ADVANCED PATTERN ANALYSIS

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Version 2.1/June 18, 2015

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Introduction.

This text is an advanced one, meant to follow the SAT (Subpattern Analysis Textbook), so the reader is urged to acquire an understanding of the material in the earlier text first. The information in this introduction is little more than a commentary and list of observations, intended to add to and reinforce that earlier text. It is assumed the reader will already have read the earlier text and grasped the essence of it prior to reading this.

The pattern of candidates for a particular digit, 1-9, is derived from a completely annotated sudoku in the following manner:

A separate blank sudoku form, called the pattern form (a copy of which is made available to the reader in the appendix) is used to construct the pattern, and in which:

1) For every square of the sudoku in which the solved digit appears, a large X is placed in the center of the corresponding square of the pattern form.
2) For every square of the sudoku in which the candidate digit appears, a large version of the digit, of the same size as an established value, is placed in the corresponding square of the pattern form.
3) All other squares of the pattern form are left blank.

For a more complete description of the pattern form, as well as the use of it, see the section on pages 16-17 in the SAT.

The sudokus which are solved are always partially solved, the degree to which is shown by the squares containing the givens, the original clues. The average sudoku puzzle generally has a minimum of 27 givens, the least number of which can be as few as 17-18, else not be solvable.

The nomenclature used in this text will be an extension of that defined in the SAT, Chapter 1, Initial Information, pages 1-14.

Every subpattern is a possible completion of the partial pattern of already existing established values. The correct subpattern is the one which solves the particular sudoku puzzle you are working on. The same, already established pattern, might be coupled with a different subpattern in another sudoku puzzle. It is conceivable that zillions of potentil sudoku puzzles are solved by every subpattern. This text does not concern itself with finding ***the*** correct subpattern for a sudoku. It concerns itself with finding ***all*** the correct subpatterns. Then they may be tested, one by one, until the one that works is found, ***but*** we cannot count on success unless the one that works is discovered by our analysis. Success relies on ***completion***. Pattern analysis has to do with formally identifying and subscripting ***all*** the members of ***every*** subpattern of a particular digit pattern.

I have made one small change to that advocated in SAT. Insstead of assigning a zero subscript to a pending square, I use a small p. When more than one pending square occurs, the second one geta a q subscript, the next an r, and so forth.

When a preceding subpattern has led to a pending situation. amd then come to a conclusion without creating a further pending situation, then a new subpattern must be started in the same square of the starting box, and then proceed, box by box, sharing the

same squares, until the pending box is reached. Then it takes possession of the pending square, after which the fledgling subpattern takes off on its own.

Some comments on the amount of territory being amassed by the developing subpattern – it is impressive how quickly it takes possession of the sudoku. Together with the boxes already under the domination of the established subpattern (the ones with large X's in them), the sudoku eventially becoming blanketed by their control.(See the pictorial displays of subpattern development in chapters 1 and 3.) Every subpattern must behave in this manner, else it fails as a subpattern.

This is what happens at Blind Alleys, which occur when there is no extension of a developing subpattern in the next box, no square which is not already possiesed by the subpattern. At such a point, one must backtrack, box by box, upstream, and on arriving at each previous box, have its membership revoked by the removal of the abandoned subpattern number, until the starting box is reached, where the subpattern number is retired from the starting box, and its starting square disallowed as the starting square of any future subpattern. The discontinued subpattern number is now available for use with any remaining unclaimed squares in the starting box.

If you chose a starting box, and then chose any random sequence of boxes, there would be no problem, but if you ran into a pending box, it would be vital for you to remember how you got there, because you will need to follow that same box order for the next subpattern. This is one of the rules of pattern evaluation, in addition to the rule about choosing the starting box and returning to it whenever a subpattern has been completed, in order to begin the next subpattern there as well. You may never, under any circumstance, change the starting box. If you want to try another starting box, you must begin the pattern analysis anew.

If you started at the starting box and didn't decide on the box order in advance, there wouldn't be any problem. You simply need to travel backwards through time to the starting box and specify the arbitrary box order you actually followed. You need to know that box order however, whenever you run into a pending box. Then you must follow the procedure outlined in the paragraph above. Time travel doesn't help when you have a bad memory.

As long as a pending box has not been encountered, you may change the box order for every subpattern, but you must make such a change at the starting box. As soon as a pending situation has occurred, you ***must*** follow the same order of boxes up to the pending box over and over, until the pending situation no longer exists, with subpattern after subpattern, until no pending squares remain. A pending box will spawn a new pattern for every pending square in the pending box. Normally, there is only one pending square, but multiple pending squares will occur from time to time, and you must be ready for them.

When more than one pending situation occurs, it is vital that you always resolve the highest pending box first. This means that you must slavishly return to the starting box and begin a new subpattern for every pending square in the highest pending box, and keep returning until the pending squares have all given rise to a new subpattern for every

one of them, until a return to the starting box determines that the pending situation in that highest pending box no longer exists, which is signalled by the pending P in the pending box being removed when the last pending square is assigned to a subpattern. Once the highest pending box has been resolved, the next highest pending box becomes the highest pending box. This is always the pending box most immediately upstream.

As soon as the analysis is beyond the highest pending box, the box order is allowed to be changed before the present subpattern is completed, but must be resumed again at the starting box until all pending situations are resolved.. Note that just being beyond the highest pending box does not mean that it is no longer pending. Sister subpatterns must share the same squares with their sisters until they reach the common pending box, and then they are allowed to leave the family breeding bground (the pending box) and set out on their own. Just because one of them has reached the jumping off place does not mean that the next one has yet arrived at that point.

Let us call the subpattern which creates the pending situation the "pender," and the subpattern which follows it the "pendee."

A) If the pending box <u>immediately follows</u> the starting box, then the pendee <u>need not</u> share any further squares with the pender.

B) If there are boxes <u>between</u> the starting box and the pending box, then in all these boxes the pendee <u>must</u> share the same pattern squares with the pender.

C) If the pending square is last, then the pender and pendee share a square in every box except the last. (The last box is the one immediately preceding the starting box.)

Philosophy of Patterns

It is necessary to limit the neighborhood of a square to not include itself.

The subpattern and the neighborhood of the subpattern are developing in tandem. when the subpattern is complete, the neighborhood of the subpattern includes the entire sudoku, except for the members of the subpattern and the members of the established pattern.

Members of a subpattern are not in the neighborhoods of each other, but the neighborhood of the entire subpattern includes every square of the sudoku, except for the squares of the subpattern members and the established pattern members

After testing all the subpatterns, the winning subpattern becomes merged with the established pattern members to create a completed set of pattern members. The combined neighborhood of all the members of the completed set of pattern members includes every square of the sudoku except for the members of the completed set themselves.

The neighborhood of a subpattern, at any stage of its development, is the collection of the members of all the neighborhoods of all of its members.

In the solved sudoku, every square is a member of the neighborhood of the pattern of the unique value of every other square.

In the beginning, the only knowns are the givens. The complete list of the unknowns for each square are the ungivens. They are the candidates. The collection of givens is a complete set of clues as to the identity of every blank square in the sudoku. Even when a particular value does not appear as a given, its exact locations are known in advance, in the form of the solution to the sudoku, and encoded by the identity and location of the givens.

Sudoku puzzles are as difficult or easy as the puzzlemasters choose for them to be. There is a certain art to the creation of sudokus which cannot be fully explained by the puzzlemaster, but there is certainly a great deal of intention which can. We are at the mercy of the puzzlemasters. We do not outwit them. They guide us through the very design of their puzzles. They frequently intend the direction our thoughts must go in order to arrive at a solution. They boast about such matters in language carefully chosen so as to mask their egotism and exalt their creativity, but pride must be there, lurking behind the scenes. It is difficult not to be proud of the difficulties of one's creations, and sudokus are not easy to create, even poor ones. The poverty or richness of a sudoku is the relationship between the givens and the solution, the kind of thinking which is promoted. Ultimately it is the expression of a philosophical attitude towards the solving of sudokus, even as to the proper frame of mind for the puzzler to foster, which are the domain of the puzzlemaster. The "wraparound" nature of sudokus themselves becomes the basis for their solution. But it is important for the solver not to be too preening of his abilities, since it is only because the puzzlemaster has chosen to offer a puzzle capable of being solved by the majority of solvers, or even by a select few. It has always been possible to create close to unsolvable puzzles, if not downright unsolvable ones. But it takes art to make them challenging, while solveable and enjoyable as well.

I call candidates the *ungivens*, because it is so critical that every conceivable value be assigned to them from the very start, if only to avoid that one really fatal mistake of omitting the correct value from a candidate list. If I think I've wrongfully omitted the inclusion of a possible value for a candidate, I add it immediately, even if unnecessarily. With candidates, it is the act of omission, rather than that of commission, which is the fatal error.

What are these strange creatures, the ones we are allowed to delete on the basis of n-wing evidence, or by their being "killer" candidates? In either case, they can only be called "geometric" deletions, provided, of course, that the evidence is accurate. Geometry, interestingly enough, with both n-wings and subpatterns, overrides the excesses of annotation.

Outside of the error of including a digit as a candidate when its established value is already possessed by a square in its neighborhood, there is the lack of knowledge about "non-inclusion," which is responsible for including all the candidates whose "real values" haven't yet been "realized" in their neighborhoods. I wonder how many pattern digits I later deleted shouldn't have been there in the first place. But that can't possibly be responsible for the large numbers of candidates I've been able to erase en masse on occasion with n-wings. I remember how many of these innocents proved to have the characteristics of killer candidates, in their capability, on being hypothetically realized, of destroying parts of the subpattern to the point of rendering it meaningless, while, at other

times, they simply fell to the wayside, others seem to be incredibly un-sudoku-social. Perhaps it's the method of finding them. Perhaps it's finding the right subpattern. If it's really the right one, it'll cut to the quick.

The most solid characteristic of a winning subpattern is that it arises from the dregs of a successful n-wing deletion. I have found no comparable wisdom, no clue with such a winning record.

My personal passport to solving sudokus was using a "blank" sudoku form for testing for n-wings and subpatterns. Had I not, I would've continued "drawing a blank." I originally started copying newspaper sudokus onto blank forms on normal 8 ½ by 11 sheets with room for two on each side, and then the left-side copy started getting used to test hypotheses, and I never went back to saving paper, except when it was one of those puzzles that solves itself while you sit back and watch while you rapidly scribble out the answer, realizing disappointedly that there wasn't going to be an endgame after all that work. Just another fill-in puzzle.

Killer Candidates

Let us suppose you had just completed the analysis of a pattern, and one of the squares didn't get included in a subpattern. You know that such a square is supposed to be a killer, but maybe you made a mistake. How can you verify that a square harbors a killer? Simple. Just write out the pattern on a blank sudoku form and promote that candidate to an established value. Remember that an established value cancels all the candidates in its neighborhood. If the candidate is valid, all the pattern boxes will end up having at least one candidate at the end.

If one or more of the pattern boxes ends up with no candidates, or if two boxes have a single candidate each, and those two boxes end up in a standoff (i.e. one candidate in each box with the two candidates opposing one another in the same row or column, so if one of them is eliminated, its box is then devoid of candidates), then you know that the candidate which was promoted is the culprit. An easy test you can always count on. It is also the reason I chose for calling it a killer, as it always kills all the candidates in at least one of the pattern boxes.

Killers were never known as such until pattern analysis came on the scene. They seem to be similar to the pattern squares eliminated by n-wings. When you encounter one, it is important to keep it in the pattern, but given the subscript K, for "killer." The reason for keeping in in the pattern, even though it isn't a valid candidate, it is important when you go to test the pattern to know that the candidate in the sudoku corresponding to the killer position should not be a member of the pattern and must be removed. In this case, the K stands for "kaput," so it is a reminder to get rid of that candidate before proceeding further with the solving process, but don't get rid of it until the pattern is put into use.

Let's promote the killer 2 in square (48) of the example below, the underlined 2-candidate. It eliminates all the candidates in its row, column, and box, leaving box C without a candidate, and resulting in a standoff between the 2's in column 5.

	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	<u>2</u>	
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1					2				
2									
3				2					
4								<u>2</u>	
5									
6					2				
7									
8									
9									

A Simple Subpattern Analysis

An interesting analysis can be made using the same method as above, but for a different purpose. Let's look again at the same subpattern:

	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	2	
5									
6					2		2		
7									
8									
9									

Instead of using this diagram for proving that the 2 in (48) is a killer, let's use that same diagram to analyze the subpatterns.

Promote the 2 in square (18), and see what happens to the sudoku pattern. We first eliminate all the 2's in its row, column, and box:

	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	2	
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1								2	
2									
3				2					
4				2	2		2		
5									
6					2		2		
7									
8									
9									

We have already isolated two of the 2's. Next, we'll eliminate all the 2's in the vicinity of the second isolated 2, the one in (34).

	1	2	3	4	5	6	7	8	9
1								2	
2									
3				2					
4				2	2		2		
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1								2	
2									
3				2					
4					2		2		
5									
6					2		2		
7									
8									
9									

We have now run into the equivalent of a pending situation in boxes E and F, so we'll choose square (45) as the next 2 to isolate, by eliminating all the squares in its neighborhood.

	1	2	3	4	5	6	7	8	9
1								2	
2									
3				2					
4					2		2		
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1								2	
2									
3				2					
4					2				
5									
6							2		
7									
8									
9									

This action isolates the fourth member. We have now isolated our first subpattern, the 2's in the diagram on the upper right, in squares **(18), (34),(45), and (67)**.

On the next page, we'll do the same for the candidate in square (38), the remaining square of our starting box C.

This action isolates the two in square (15), the first member of subpattern-2, which isolates the second member of subpattern-2, square (15).

	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	2	
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	2	
5									
6					2		2		
7									
8									
9									

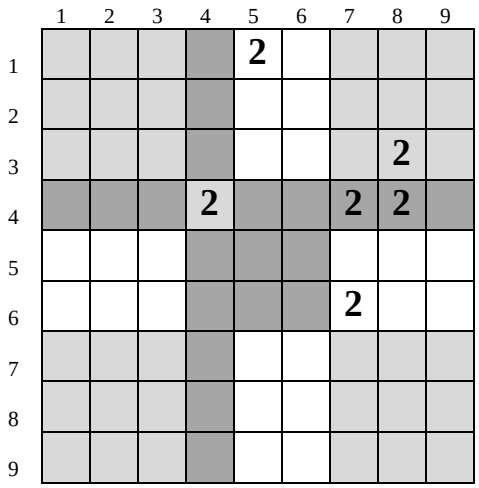
Next, we eliminate all the 2's in the neighborhood of square (15), which isolates the third member of subpattern-2, namely (44):

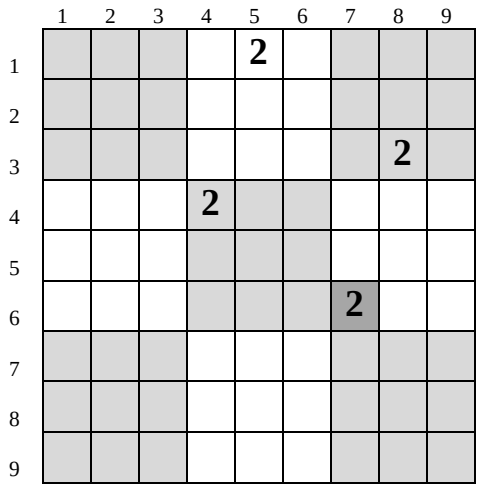
	1	2	3	4	5	6	7	8	9
1					2			2	
2									
3				2				2	
4				2	2		2	2	
5									
6					2		2		
7									
8									
9									

	1	2	3	4	5	6	7	8	9
1					2				
2									
3								2	
4				2			2	2	
5									
6							2		
7									
8									
9									

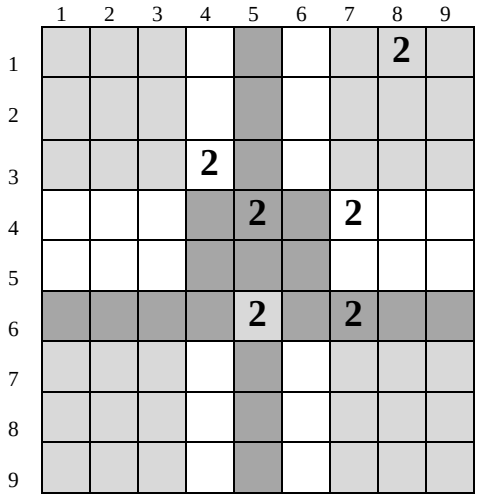
The last action for this second subpattern is to eliminate all the 2's in the neighborhood of square (44).

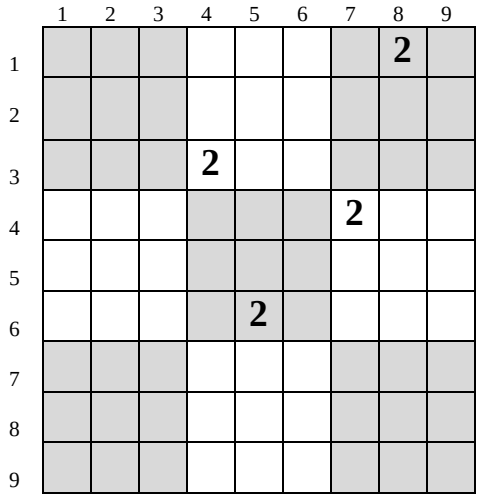
Eliminating the 2's in the neighborhood of this third square, (67), isolates the fourth and final member of subpattern-2, which consists of the set of squares (38), (15), (44) and (67).





To isolate the last subpattern, we return to the "pending" situation two pages back, and this time we isolate the square (65), below, revealing the third subpattern below:





Subpattern-3 = (18), (34), (47), and (65). We can encapsulate these subpatterns by giving their squares the subscripts 1, 2, and 3. See the next page.

The three subpatterns are:
Subpattern-1: (18), (34), (45), and (67)
Subpattern-2: (38), (15), (44), and (67).
Subpattern-3: (18), (34), (47), and (65)

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					$2_{\mathbf{2}}$			$2_{\mathbf{13}}$	
row2									
row3				$2_{\mathbf{13}}$				$2_{\mathbf{2}}$	
row4				$2_{\mathbf{2}}$	$2_{\mathbf{1}}$		$2_{\mathbf{3}}$	$2_{\mathbf{K}}$	
row5									
row6					$2_{\mathbf{3}}$		$2_{\mathbf{12}}$		
row7									
row8									
row9									

The Pattern Project

I began collecting successful subpatterns five or six years ago, with the vague notion of doing a study on them. It was clear that every pattern had a high probability of occurring in another sudoku, but unlikely that the same subpattern would be successful in solving it, but a pattern study reserved to be done, and on what better group?

An attempt has been made to preserve the large X's in the patterns even though they play no role in the study or use of them. It does seem likely that if two sudokus were identical except for the positions of the established values, a successful subpattern in one would be successful in the other. But the X's remind the reader that the situation arose in the context of a real problem involving a real sudoku, so I have kept them.

The only records I had saved for this study were the successful subpatterns and the patterns which had spawned them, the original sudokus lost under the graphiti of scribblings and erasures.

Because I had accumulated such a treasure trove, I was then faced with the daunting project of solving all of them. After all, I had intended this to be a complete pattern analysis. This focussed my attention on the raw data, the hope being to find a meaningful grouping,

Before I even considered abstract reasons for groupings, I had early on realized the futility of breaking up sudokus into sizeable hunks and then just doing a survey on hunks. Sudokus are too wraparound, too holographic. The relationship itself had to be relational, and the relationship had to be the addition of something new. Once it was incorporated, it was part of the new whole, the new new, and this growing monster had a passion for all, until all became one, when every square in the part that didn't have members to represent it was gone. Then all the subpatterns were complete, which really means recognized, and there were nine of them; one member in every box, one box for every member, which was what the puzzlemaker, in all his sudoku-wisdom, had intended.

The strange kind of ***relational*** that this idea of a subpattern of equals depends upon is the relationship of non-membership. The new cannot become a member of the old unless it is not one of them. The pattern square which survives is the next king of the hill, where hill means box, and it cannot even share a square in its own neighborhood with its neighboring reigning candidate. The set of squares of the subpattern is a set of sociopaths, each with its separate domain, one for each of the nine boxes, one of the up-to-nine unclaimed, that is.

With this idea in mind, I set out to divvy up what I had into six groups, one for each digit, which referred to subscripts rather than candidate digits. This lent some orderliness to the groups, that order generally implying simplicity. It also arranged the orderliness to the comparisons of sudokus of the same size, size referring to the largeness of squares due to so many candidates at their tops, as well as being of sufficient size to clearly display the subscripts of their candidates.

All in all, it proved to be a wise choice. The number of subscripts roughly related to the number of candidates, as well as to the complexity of patterns. So there are six groups of

patterns, separated by the maximum number of subscripts. A little cheating goes on at the borders of these groups, where only one candidate has three subscript, and all the rest have one or two, and they are together as a 2-group.

It didn't take long to discover the uncomfortable truth that the box code wasn't going to cut it. As long as the number of subscripts was three or less, all almost went well. With just nine squares in a box, there aren't many arrangements of three, especially when two arrangements are the same when a nine-perfect transformation turns one into the other. With three, for example, there are only three arrangements of three squares within a box: three in a row, two in a row with the third sharing a column with one of the other two, and two in a row with the third not sharing a column with either of the other two.

So up to three candidates in a box could be catalogued. I called them horizontal (including vertical and diagonal), small ells, and large ells. The three subgroups couldn't be transformed into one another 9-perfectly, but there were exactly three kinds of candidate arrangement, and two kinds of relationships between two boxes, so there were equivalence classes, which is what I wanted.

But it all fell apart with four squares in a box, because the number of interactions was so great that analysis was unhelpful. But the picture codes at least afforded a means of doing it. At least it was that. Do-able. So I stuck with the box codes and lumped patterns together according to the box codes. In most cases I am willing to argue that the situations in the analysis are analogous, like alleles in organic chemistry.

This is the irrational rationale to my selection of patterns to solve.

We'll proceed on to a short discussion of 9-perfect transformations of patterns, followed by a brief foray into the files of the Pattern System, their contents and interconnections

Pattern Codes

Permutations of rows, columns, bands and stacks:

Any permutation of the 3 rows of a band results in a sudoku. The proof is intuitively clear, since the rows maintain their integrity as rows, the columns undergo only a reordering of the values within them, and the boxes undergo only a shuffling of the rows within them. Hence every row, column, and box which is affected by the permutation does not have its elements altered, only rearranged, so that 9-perfection is maintained.

Any permutation of the 3 columns of a stack results in a sudoku. The proof is similar to that above.

Any permutation of the bands of a sudoku results in a sudoku. The proof is obvious, since the integrity of rows is unaffected, the boxes are not altered, and the columns suffer no more than an alteration in the sequence of their values.

Any permutation of the stacks of a sudoku results in a sudoku. The proof is similar to the argument above.

Any combination of the above permutations results in a sudoku. The proof is an iteration of what has already been said.

Rotations and reflections:

Any rotation of a sudoku by an angle which is any multiple of ninety degrees results in a sudoku. The proof is visually clear. The digits will still be recognizable, and their relationships are not changed.

Any reflection of a sudoku about a vertical, horizontal, or diagonal axis results in a sudoku. Again, the proof is visually clear.

What is the point of all these transformations? That any pattern of boxes within a sudoku is essentially unaltered by them. Rows and columns retain their status, or are converted into columns and rows. Squares in the same row either end up in a different row together, or the row they are in is converted into a column in which those boxes end up being together. Rows maintain their integrity, as do columns. Even the intersections of rows and columns are still the intersections of the rows and columns or columns and rows into which they have been converted. Boxes sharing rows remain boxes sharing rows, or are converted into boxes sharing columns. Relationships between specific squares are transformed into similar relationships between the transformations of those squares.

The important conclusion is that patterns of boxes, including the patterns of candidates within them, are not altered by such transformations. Moreover, except for orientation, they remain the same patterns. Upside down or backwards, the relationships of boxes and their candidates remain unaltered.

This was my reason for choosing patterns of boxes as a code for classifying sudoku patterns. These codes, since they don't take into consideration the orientation of the squares within the boxes, are not precise. It was one of my initial intentions to make it precise, but but I discovered that to take classification to the level of exactness required too much claim on my time.

I needed a way, however, of reducing the sheer number of sudoku candidate patterns I had collected, because to present solutions of all of them would be sheer insanity. I was hoping that if I could make the pattern codes precise, then I could group the codes by the pattern code, in which case the solution to one would be the solution to a whole bunch of them. That would cut down on the job I had undertaken, to write a text on sudoku pattern analysis. I needed a classification system, and it had to be abstract rather than visual, and it had to do with candidates. The squares they were in and their own individual digits

The elements of these ***box codes*** are the boxes in which the pattern exist, and the identification of those boxes by the number of pattern squares inside them. The digit "3" represents a box with 3 candidate squares. 3-4-2 represents three boxes in the same row or column with a 3-pattern-square box followed by a 4-pattern-square box, followed by a 2-pattern-square box. Two boxes are related if they possess pattern squares in their shared rows or columns. The fact of that relationship is shown by a short vertical or horizontal line segment connecting the two. They resemble a flow chart, except that there is no flow, and therefore no arrows, the line segments joining them showing

organizational relationship rather than causal. The order of boxes (the box order used in analysing subpatterns) is closely related to the box code, except that the order of boxes is allowed to connect two boxes not physically adjacent. The box code reminds me a little of organic chemistry, in its architectural look.

The major distinction between the box code I employ and a simple diagram of the boxes is that unrelated boxes in the box codes are never placed in the same row or column, even when there is no line segment joining them, just to avoid seeing relationships when they are not there.

I did discover a way to compare patterns on the level of squares within boxes, by means of what I call a ***picture pattern*** derived from the sudoku pattern. All that needs to be done is to remove all the blank rows and columns from the pattern, which is easy to do on a computer. The size of these picture patterns depends on the extensiveness of the sudokus from which they are derived. They are most useful when they are small, and one must still perform all the mental gymnastic associated with rotations and reflections. The major problem is that the identity of boxes is destroyed, which is partly alleviated by my practice of shading alternate boxes, but that too is not entirely helpful when boxes of the same shade are merged due to the blank rows or columns between them having been deleted. When boxes so merge, I slightly alter their shades in the picture pattern in order to preserve distinction.

When two patterns have precisely the same picture pattern, there can be no doubt that they are identical. It takes time to make these comparisons, so I have only used them so far in conjunction with sudoku patterns with two subscripts, which I have spent the most time analyzing. Patterns with a limit of two subscripts are easier to compare, and they fall into groups more readily than patterns with a larger number of subscripts, where pattern variation is much more widespread.

A page from the Pattern File follows, showing the ***picture pattern*** beneath the pattern.

2 051 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{3}			1_{1}	1_{2}				
row2	1_{12}					1_{3}			
row3									X
row4							X		
row5		X							
row6				1_{23}	1_{1}				
row7			X						
row8								X	
row9					1_{3}	1_{12}			

2 051 A4 L

	col 1	col 4	col 5	col 6
row1	1_{3}	1_{1}	1_{2}	
row2	1_{12}			1_{3}
row6		1_{23}	1_{1}	
row9			1_{3}	1_{12}

(For more examples, go to the Pattern File.)

The solved problems in the two-subscript category have specified for each the transformations necessary to orient the pattern in the sudoku to the pattern of its box code. I had to perform these transformations for all of the patterns in order to arrive at the box codes, but it was mainly done in my head, and, except for more complicated ones, seldom written down, except in the case of the two-subscript group (of which I made a special study).

I divided the patterns up into six groups, according to the number of subscripts, on the basis that larger sudoku patterns tend to be more difficult, and more digits generally mean more complexity, and I wanted to present the sudoku patterns by difficulty of solution. Still, I didn't know quite how to go about it. I had been collecting these patterns for several years with the intent to use them for a study of patterns, but the occasion never seemed to arrive.

Conceivably, almost every subpattern might be used to solve a particular sudoku, or even a large number of sudokus, but I seldom tried to use the subpattern method until all other methods had failed, so it was always my ace in the hole, and I gained little expertise on how one might use them as the principal solving technique.

Still, the fact that they had always worked in clutch situations might have tipped me off as to their general solving efficacy. For the last year and a half I have tried them on almost every difficult puzzle, and have discovered in many instances that not just one subpattern, but often three or four, can be used to solve a particular sudoku. The one measure I follow faithfully, however, is to check first for what I call ***n-wings*** (my terminology for ***xwings)***. I have come to believe that the best pattern for subpattern solving is the remains of one which has been pared down by n-wing operations. Even when they don't lead to candidate reduction, patterns are the first thing I look at after the normal reduction which follows annotation.

The 5-subscript patterns & 6-subscript patterns have not yet been included in this study. They are, unsurprisingly, fewer in number, since rational sudoku solvers, as I like to think of myself, do not willingly make use of overlarge patterns, not primarily because they take time to analyze, which is certainly true, but because they have too many subpatterns, and each one must be laboriously tested with yet another temporary update. The only instance in which I settle for a large pattern is that rare one where the smaller ones don't free up enough digits to work

Since I had such a massive project on my hands, I started out by dividing the patterns into the six groups I have described, and I decided to deal with each one in its own section of the text. I did this partly because the box codes varied quite a bit from one group to the next. As a result, I dealt independently with each of the groups, creating them one at a time, even setting up a differet set of alpha codes for each. The ***alpha code*** is a two-character alphanumberic code which relates the ***box code*** to the ***pattern number*** via the ***Pattern Description File***, which, besides the alpha code, by which it is organized, contains the box code and the list of the pattern numbers which possess that same box code.

Two types of files follow this text:

1) The **Pattern File**, organized by **pattern number**, in which each pattern is shown on a sudoku form bearing the **pattern number** and **alpha code.** It is also accompanied by its **picture code**, which, for the smaller patterns, is a useful way to determine the precise structure, down to the squares within the boxes. An example of one of its entries has already been shown two pages back.

2) the **Pattern Description File**, organized by **alpha code**,
showing the **alpha code**, the **box code** and all the **equivalent pattern numbers**, which relates it to the Pattern File. An example of the first few entries in it are:

Pattern Description Codes 2:

A1	**3 – 2** **|** **2**	**S 023, 038, 047, 048, 056, 066, 068, 091, 092, 093, 094, 096, 105, 145.**
A3	**3 – 2 – 2**	**030, 102. (Straight three)**
A4	**3 – 2 – 2** **|** **2**	**S 110, 114.** **L 039, 051, 070, 072, 079, 095, 107, 110, 120, 123.**
A6	**3 – 2 – 2** **|** **2**	**X 104**
A5	**3 – 2 – 2** **|** **2 – 2**	**L 097**
D	**2** **|** **3 – 2** **|** **2**	**S 002, 003, 006, 010, 011, 020, 050, 078, 080, 089, 098, 099, 103, 106, 113, 115, 118, 122, 124, 127, 152, 154**

* * *

In the main text, every solved pattern is preceded by a header giving the following information:

Pattern 2.023 L	Box Orientation	Patterns with the same box code:
3 – 2	**E – D**	**023, 038, 047, 048, 056, 066, 068, 091,**
|	**|**	**092, 093, 094, 096, 103, 105, 126, 145.**
2	**H**	
(box orientation for 023 – interchange stacks 1 & 2)		

The diagram on the extreme left is the box code, indicating, in this instance, which boxes have three pattern squares and which have two, and how they're arranged. If you compare it with the box orientation immediately to its right, you can see by the comparison how many pattern squares are in each of the pattern boxes E, D, and H.

There are six sets of files, one for each subscript range, from 1 to 6. Each set consists of a Pattern File and a Pattern Description File. It will be a future project to merge the six Pattern Description Files together, as well as to amalgamate the alpha codes for all of them into a single grand scheme. The alpha codes themselves need to be completely revamped for this scheme, in order to connote the level of the patterns, from simple to complex. The present alpha codes were adopted in a hurry, in order to get this project off the ground, and lack entirely in esthetics. The six Pattern Files will remain the same, however, as well as the six sections of this text, arranged, obviously, in order of the number of subscripts in the patterns themselves.

The initial study included an in-depth analysis of the 2-subscript patterns, which are the most extensive of the six sections. It surprised me considerably, when I analyzed the results, just how many of these patterns had nearly identical box codes, especially among the 2-subscript patterns (the largest category). Here is the summary:

1-subscript patterns
- 9 box codes with one example each
- 3 box code with 2 examples each
- 1 box code with 3 examples
- 1 box code with 8 examples
- 1 box code with 13 examples

2-subscript patterns
- 20 box codes with 1 example each
- 9 box codes with 2 examples each
- 2 box codes with 3 examples each
- 1 box code with 5 examples
- 1 box code with 6 examples
- 1 box code with 7 examples
- 1 box code with 8 examples
- 1 box code with 14 examples
- 1 box code with 16 examples
- 1 box code with 19 examples
- 1 box code with 20 examples
- 1 box code with 22 examples

3-subscript patterns
- 24 box codes with one example each
- 9 box codes with 2 examples each
- 2 box codes with 3 examples each
- 2 box codes with 4 examples each
- 1 box code with 6 examples
- 1 box code with 11 examples

4-subscript patterns
- 17 box codes with 1 example each
- 5 box codes with 2 examples each
- 3 box codes with 3 examples each

The in-depth study included comparison of the members of the first and third codes in the Pattern Description Codes, A1 and A2. This comparison was necessary to shed light on the degree to which box codes reflect the intricacy of the patterns.

The page below is a comparison of the picture codes for the A1 alpha code group. No effort was made to convert them into identity comparisons, via 9-perfect transformations, as the equalities between the picture codes are fairly evident.

If *all* the box codes reflected this kind of one-to-one comparison with the picture codes, my original dream would have been realized, because the box codes groups would be ones of equality, rather than groups of closely related patterns.

The following is a summary of the picture codes for the first alpha code, A1, for which all the members have exactly the same pattern, which simple rotations, axial reflections, and subscript rearrangements would suffice to show.

023 A1

	col 3	col 4	col 5
row4	3_{3}	3_{1}	3_{2}
row5	3_{12}	3_{3}	
row9		3_{2}	3_{13}

038 A1

	col 5	col 6	col 7
row3	8_{13}	8_{2}	
row5		8_{1}	8_{23}
row6	8_{2}	8_{3}	8_{1}

047 A1

	col 5	col 6	col 9
row1	1_{1}	1_{2}	1_{3}
row3	1_{3}		1_{12}
row5	1_{2}	1_{13}	

048 A1

	col 4	col 5	col 7
row1	2_{1}	2_{2}	2_{3}
row2		2_{3}	2_{12}
row7	2_{23}	2_{1}	

056 A1

	col 1	col 2	col 5
row1	3_{1}	3_{2}	3_{3}
row2		3_{3}	3_{12}
row4	3_{23}	3_{1}	

066 A1

	col 1	col 5	col 6
row1	4_{23}	4_{1}	
row2	4_{1}	4_{2}	4_{3}
row7		4_{3}	4_{12}

068 A1

	col 1	col 3	col 5
row2	4_{1}	4_{2}	4_{3}
row3		4_{3}	4_{12}
row5	4_{23}	4_{1}	

091 A1

	col 6	col 7	col 9
row2	2_{1}	2_{2}	2_{3}
row3	2_{23}		2_{1}
row4		2_{13}	2_{2}

092 A1

	col 4	col 6	col 9
row5	6_{2}	6_{13}	
row7	6_{1}	6_{2}	6_{3}
row9	6_{3}		6_{12}

093 A1

	col 1	col 5	col 6
row4		8_{1}	8_{23}
row8	8_{3}	8_{2}	8_{1}
row9	8_{12}	8_{3}	

094 A1

	col 2	col 4	col 6
row5	5_{1}	5_{2}	5_{3}
row6	5_{23}	5_{1}	
row9		5_{3}	5_{12}

096 A1

	col 5	col 8	col 9
row1	2_{23}		2_{1}
row2	2_{1}	2_{2}	2_{3}
row8		2_{13}	2_{2}

105 A1

	col 5	col 8	col 9
row2	2_{3}	2_{1}	2_{2}
row3	2_{12}	2_{3}	
row8		2_{2}	2_{13}

145 A1

	col 3	col 7	col 9
row1	1_{23}	1_{1}	
row3	1_{1}	1_{2}	1_{3}
row7		1_{3}	1_{12}

The second large box code group, for code A2, is first calculated for pattern 051, and is shown in its entirety:

This is the pattern snapshot:

051 A4 L

	col 1	col 4	col 5	col 6
row1	1_{3}	1_{1}	1_{2}	
row2	1_{12}			1_{3}
row6		1_{23}	1_{1}	
row9			1_{3}	1_{12}

Step 1: put cols in order 4651:

051 A4 L

	col 4	col 6	col 5	col 1
row1	1_{1}		1_{2}	1_{3}
row2		1_{3}		1_{12}
row6	1_{23}		1_{1}	
row9		1_{12}	1_{3}	

Step 2. Interchange rows 6 & 9:

051 A4 L

	col 4	col 6	col 5	col 1
row1	1_{1}		1_{2}	1_{3}
row2		1_{3}		1_{12}
row9		1_{12}	1_{3}	
row6	1_{23}		1_{1}	

Comparison with pattern 039:

039 A4 L

	col 1	col 2	col 3	col 9
row1	7_{1}		7_{2}	7_{3}
row3		7_{3}		7_{12}
row5		7_{12}	7_{3}	
row9	7_{23}		7_{1}	

All of the subscripts exactly agree.

It must be pointed out that the operations leading to the comparison above are 9-imperfect. They cross stack and band boundaries, destroying the integrity of the boxes.. But, and this is the critical "but" – All of the rows and columns have been preserved, even though the boxes haven't. The sums expressed by the rows and columns are exactly the same on both sides, as well as the complete match on subscripts. The Law of Total Subscripts is upheld on every row and column. Therefore the solutions must be identical.

The remainder of the group 2 members run into no snags. The methods of conversion are provided, and they are all 9-perfect.

Group 1:

2 070 A4 L

	col 3	col 4	col 5	col 9
row4		4_{2}	4_{13}	
row7		4_{1}		4_{23}
row8	4_{3}		4_{2}	4_{1}
row9	4_{12}	4_{3}		

2 072 A4 L

	row7	row4	row6	row2
col 5		3_{2}	3_{13}	
col 4		3_{1}		3_{23}
col 6	3_{3}		3_{2}	3_{1}
col 2	3_{12}	3_{3}		

072: change col order from 2456 into 2645, swap rows 4&6, rotate 90 degrees clockwise, then change digits from 123 into 312.

Group 2:

051: interchange digits 1 & 2, put cols in order 4561, and swap rows 6 & 9.
095: no changes.
107: rotate 90 deg counterclockwise, change digits 123 into 231.

2 039 A4 L

	col 1	col 2	col 3	col 9
row1	7_{1}		7_{2}	7_{3}
row3		7_{3}		7_{12}
row5		7_{12}	7_{3}	
row9	7_{23}		7_{1}	

2 051 A4 L

	col 4	col 6	col 5	col 1
row1	1_{1}		1_{2}	1_{3}
row2		1_{3}		1_{12}
row9		1_{12}	1_{3}	
row6	1_{23}		1_{1}	

2 095 A4 L

	col 4	col 5	col 6	col 7
row2	7_{1}		7_{2}	7_{3}
row3		7_{3}		7_{12}
row6		7_{12}	7_{3}	
row9	7_{23}		7_{1}	

2 107 A4 L

	row4	row5	row6	row7
col 8	9_{1}		9_{2}	9_{3}
col 7		9_{3}		9_{12}
col 5		9_{12}	9_{3}	
col 2	9_{23}		9_{1}	

All subsequent conversions are 9-perfect, patter 095 agreeing, by accident, on pattern digit as well.

D1 **3 – 3** **006, 019, 021, 023, 028, 036**
| |
3 – 2

subgroup 1 (24 possibilities): 006, 021, 023, 028 generated from model A (below)

abcd = 2134 for 006

3	006	col 4	col 6	col 7	col 8
	row5	1_{12}	1_{3}	1_{4}	
	row6	1_{4}		1_{13}	1_{2}
	row8	1_{3}	1_{14}	1_{2}	
	row9		1_{2}		1_{134}

abcd = 2314 for 021

3	021	col 1	col 3	col 7	col 8
	row4	1_{2}	1_{34}	1_{1}	
	row5		1_{1}	1_{23}	1_{4}
	row7	1_{134}			1_{2}
	row9		1_{2}	1_{4}	1_{13}

abcd = 4213 for 023

3	023	col 2	col 3	col 5	col 6
	row1	4_{1}		4_{24}	4_{3}
	row3	4_{23}	4_{4}	4_{1}	
	row7	4_{4}		4_{3}	4_{12}
	row8		4_{123}		4_{4}

abcd = 2314 for 028

3	028	col 1	col 3	col 7	col 8
	row4	1_{2}	1_{34}	1_{1}	
	row5		1_{1}	1_{23}	1_{4}
	row7	1_{134}			1_{2}
	row9		1_{2}	1_{4}	1_{13}

M O D E L A (abcd = perm(1234))

3	xxx	col ?	col ?	col ?	col ?
	row?	9_{ab}	9_{c}	9_{d}	
	row?	9_{d}		9_{ac}	9_{b}
	row?	9_{c}	9_{ad}	9_{b}	
	row?		9_{b}		9_{acd}

subgroup 2 (24 possibilities): 019, 036. generated from model B (below)

abcd = 1234 for 019

3	019	col 5	col 6	col 7	col 9
	row5		3_{12}		3_{34}
	row6	3_{3}	3_{4}	3_{1}	3_{2}
	row8	3_{1}		3_{234}	
	row9	3_{24}	3_{3}		3_{1}

abcd = 4213 for 036

3	036	col 4	col 6	col 8	col 9
	row5	2_{12}	2_{3}	2_{4}	
	row6	2_{4}			2_{123}
	row7		2_{24}	2_{13}	
	row9	2_{3}	2_{1}	2_{2}	2_{4}

M O D E L B (abcd = perm(1234))

3	xxx	col ?	col ?	col ?	col ?
	row?		9_{ab}		9_{cd}
	row?	9_{c}	9_{d}	9_{b}	9_{a}
	row?	9_{b}		9_{acd}	
	row?	9_{ad}	9_{c}		9_{b}

Note: to see agreement between picture code derived from a particular pattern and that generated by the model, some permutation of rows and columns will be necessary. It is standard practice to allow 9's to be used in the abstract to represent all possible digits.

The powers of Zap:

Zap is a power possessed by the squares of a sudoku in the process of being solved. It is used to create subpatterns, and its power is only available to certain squares called ***zap squares,*** which are under your command and guidance, in your role as ***Zapmaster***. Subpatterns are collections of zap squares, and may only be created one at a time. Until a subpattern is complete, it exercises, through its members, the power of Zap. Once a subpattern has been completed, it becomes inactive, as far as the solver is concerned, and zap power is passed on to the next subpattern to be developed.

Zap squares are antisocial entities which cannot abide the presence of other members of the same subpattern. For a particular pattern digit, there must be exactly one member, one zap square in each box, and each zap square must be labeled with a subscript identifying it as a member of the particular subpattern which is under process of completion. When a subpattern has been completed, it ceases its aggression, at which time the power of zap is conferred upon the members of the next subpattern to be developed.

At the beginning of sudoku time, there exist already, <u>for each subpattern</u>, a number of already solved squares, which could be called ***established zap freelancers***, which, while a subpattern is under development, exercise that same power of zap, but do not belong to that subpattern. They are the squares with single digits at their centers. Some of these freelancers were specified as ***givens***, clues to the solution of the sudoku. Others were discovered by you, during the initial stages of solution prior to the process of annotation, and sometimes even a few during annotation. Each freelancer exercises zap power for one particular pattern digit, and it exercises that power over its entire domain, which is the neighborhood of the freelancer . (The neighborhood of any square is the collection of all other squares which are in the row, column, and box of that square.)

On the other hand, there are the blank squares with lists of candidates at their tops. We could call them ***non-freelancers,*** because, due to the candidates at their tops, they are associated with a number of ***different*** subpatterns, which are like different clubs to which they may belong. There are exactly nine of these clubs, one for each of the nine digits. Subpatterns are created from these non-freelancers, and subpatterns are oblivious to one another. They coexist, just as human organizations coexist, in that an individual square may belong to a number of them, independently.

Just after the beginning of sudoku time, the established zap freelancers exercised their zap power to confer upon all non-freelancers membership in these nine clubs. This initial period is called the ***process of annotation***. It is the intention of all non-freelancers to gradually divest themselves of membership in all but one of these clubs, and, under the guidance of you, the Zapmaster, their multiple memberships are eventually whittled down to exactly one specific club each, at which point they themselves become established freelancers. At the end of sudoku time, when the sudoku has become completely solved, every one of the 81 squares has become an ***established*** zap freelancer**,** which is just another way of saying ***solved square***.

The exercise of zap power is called ***zapping*****.** Zapping is always directed at the members of a particular box until a single unzapped square remains (called a ***zap square*** or ***zapper***), which becomes the next member of the growing subpattern. Zappers can only zap squares which are in the same row or column of the box whose squares are being zapped, the zap power passing invisibly through any squares in the way until that particular box is reached, at which point all squares of that box which are in the same row or column as the zapper become zapped, which renders them ineligible for membership in the subpattern being developed.

The most important powers that you, as Zapmaster, have, in the development of a subpattern, are threefold: the ***choice of the starting box*** of that subpattern, the ***choice of the starting square*** for that subpattern, and in the ***choice of the order of boxes*** which is to be followed during that development. Any choices you make for these three items will succeed, but some choices would result in much more labor for you than others, in your job as Zapmaster, directing the development of that subpattern.

The purpose of this Zap language is the facilitation of the process of subpattern evaluation by you. Without this language, the description of that process is laborious, lengthy and overwordy. The sheer number of words involved can become cumbersome. Lengthy description requires more concentration, as the salient points often become buried in the process of explanation, and the eye, as well as the mind, becomes easily fatigued by the discipline necessary.

The downside to this approach is the necessity of understanding the **Zap** language to the point of being able to think in terms of it. But once the language has been mastered, the understanding of the process becomes greatly simplified. If you have an aversion to abstraction, you are in trouble. If you prefer a volume of words to the simple terms of zapping, this is not a method you will easily embrace, but if you are willing to submit to the process of understanding it, you will find yourself carried along by it, and you will be able to calculate sudoku patterns with ease..

Once that understanding has been achieved, there is litttle more to learn about the calculation of subpatterns. Using zap language, the amount of description is greatly simplified, and you, as sudoku solver, will find that it focuses your solving on the specific information to be calculated – the determination of the squares of the set of subpatterns you have chosen to use in solving the sudoku. The payoff is the ease with which you will be able to solve some of the most difficult sudoku problems, in some instances, cutting two hours down to a half hour, and in most instances, being able to solve some of the most difficult problems without having to learn anything more in the way of technique.

The areas which will not be simplified are the initial ones of trapping, annotation and group separation.. The actual solving is where the power of Zap manifests itself, by making possible the determination of subpatterns, and it is the use of subpatterns which speeds up and simplifies that solving. This volume does not show you how to use subpatterns to solve sudokus; it merely shows you how to calculate those subpatterns in the first place. There are other texts on this website which thoroughly go into the use of subpatterns for solving.

There is one last point that should be made. The Zap language is meant only to assist you in learning how to solve patterns. It is not a language you will use personally (except in your mind while you are calculating a subpattern). You will never write down an instruction or action in it. The only items you will be using a pencil for are filling out the blank sudoku form with the digit pattern to be analyzed, the subpattern subscripts as you deduce them, the pending P's in the pending boxes, along with the p subscripts you append to the pending squares, and perhaps also the order of boxes, so you won't forget it, and, finally, the list of subpattern members that you calculate for each subpattern

* * *

In the calculation of a subpattern, one needs to prime the pump by choosing the starting box and the starting square of that subpattern. These are the choices that you, as Zapmaster, must make. There are other choices down the line, once you have begun the process of determining the squares of a subpattern. One of them is how to handle the situations in which several squares in a particular box are made available by the zapping process. We'll deal with these details in the comments which follow.

A subpattern is begun by choosing the starting box and the starting square within that box. The boxes of a pattern are all those in which the pattern digit appears as a candidate in <u>two or more squares</u>. (If the pattern digit is a candidate in only one square of a box, it must be promoted to the established value for that box.) Once a starting box is chosen for analyzing the subpatterns of a sudoku, it may never be changed. But it ceases to be important, or even meaningful, once the subpatterns have been calculated, since any box could have been chosen as the starting box. The same is true of the order of boxes. When you go to use the subpatterns to solve a sudoku, the subpattern members do not have to be looked at in any order, because they are equal in importance.

For the discussion which follows, we'll assume a situation in which you are determining the subpatterns for a particular digit, and in which you have chosen the pattern to analyze, and have arbitrarily chosen the starting box and the initial square within it to begin the first subpattern, which will be called ***subpattern-1***.

The initial square is able to ***zap*** all the squares in the sudoku which are in the <u>same row or column</u> of that initial square, but they must lie outside its box. You, as Zapmaster, have chosen the order of boxes, so the zapping power is directed only at the squares of the next box in the order of boxes. When a square zaps a square in another box which contains the pattern digit, it makes that other square ***ineligible*** for the subpattern being calculated. Let us suppose that all the squares but one in that other box are made ineligible by having been zapped by the zapping square. Let's consider an example. We'll restrict our attention to the middle three rows of a sudoku:

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			1
row5		1					1		
row6	1					1			

Let's suppose that the middle box, as well as the starting square **(46)** within it, has been chosen by you as the beginning of subpattern-1, with the box order **E →F →D**.. Then you perform the following action

square **(46)** zaps square **(49)**

Since square **(49**) has been zapped, it is no longer eligible for inclusion in subpattern-1. This leaves one square only as a possible member in box F, namely square **(57)**, which then becomes the second member of subpattern-1.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			1
row5		1					$1_{\mathbf{1}}$		
row6	1					1			

If, subsequently, square **(57)** zaps square **(52)**, the result is**:**

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			1
row5		1					$1_{\mathbf{1}}$		
row6	$1_{\mathbf{1}}$					1			

When we have completed subpattern-1, we must choose a beginning for subpattern-2. There isn't much choice in this case, as there's only one square left in starting box E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			1
row5		1					$1_{\mathbf{1}}$		
row6	$1_{\mathbf{1}}$					$1_{\mathbf{2}}$			

In this case, it would be much better if we could switch the box order and put box D next, because if E were next, box F would become a phony pending box, ending up by creating a contradiction up the line, necessitating a return to this point, erasing the digit 2 in every square along the way and selecting whichever of the two candidates caused all the trouble (by having created a false subpattern). At any rate, we travel back through time and change the box order to **E→D→F** before continuing subpattern-2.

Square **(66)** zaps square **(61)**, adding square **(52)**

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			1
row5		$1_{\mathbf{2}}$					$1_{\mathbf{1}}$		
row6	$1_{\mathbf{1}}$					$1_{\mathbf{2}}$			

Our last step is: Square **(52)** zaps square **(57)** adding **(49)**

which then results in

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4						$1_{\mathbf{1}}$			$1_{\mathbf{2}}$
row5		$1_{\mathbf{2}}$					$1_{\mathbf{1}}$		
row6	$1_{\mathbf{1}}$					$1_{\mathbf{2}}$			

In the next example, we have a four-box problem. Box G has three candidate squares, while the other three boxes, A, D and I, have two candidate squares each. We'll see why it is easiest to always make the box with the most candidate squares the starting box. We'll try two different box orders

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1		1
row3				X					
row4						X			
row5								X	
row6	1	1							
row7	1	1					1		
row8					X				
row9		1							1

We'll first try this problem using the box order **C→I→G→D**

		C
D		
G		**I**

We'll begin with box C, choosing square (27) as the starting square of the first subpattern, subpattern-1, We'll mark it with the subscript 1. We'll use it to find the second member of subpattern-1 in box I, by performing the action:

Square (27) zaps square (77), adding square (99) to subpattern-1

Remember that squares can only zap squares in other boxes, when those other squares are either in the same row, or the same column of the square that is doing the zapping.

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1_1		1
row3				X					
row4						X			
row5								X	
row6	1	1							
row7	1	1					1		
row8					X				
row9		1							1_1

The rest of this page is illustrated by the diagram on the next page

We'll go on to update box G with box I, with the action:

Square (99) zaps square (92) adding square (71) and pending square (72)

This time, two squares were left after the zapping. We arbitrarily chose square (71), which meant that square (72) had be be placed on hold, for later addition to the next subpattern. We could just as easily added (72) and pended (71). The same results would be achieved, except that subscripts 1 & 2 would be swapped for all boxes following box G. The results of this last action will be shown on the next page.

We not only subscript the 1 in square (72) with a P. We also pencil in a large P in the box itself. We do this because we don't want to forget that box G is a pending box. Later, when we include square (72) in the next subpattern, we'll erase the pending P, and the small subscript P will be replaced by the digit 2, because it will be a member of the next subpattern, subpattern-2.

Note the pending P as well as the subscript p in box G.

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							$1_{\mathbf{1}}$		1
row3				X					
row4						X			
row5								X	
row6	1	1							
row7	$1_{\mathbf{1}}$	$1_{\mathbf{P}}$					1		
row8					X				
row9		1	*P*						$1_{\mathbf{1}}$

Now we shall update box D with the action

Square (71) zaps square (61) adding square (62) to subpattern-1.

This completes subpattern-1, since there is now a member of subpattern-1 in every pattern box. Notice that there are no members of subpattern-1 in boxes A, B, E, F, and H. That's because there are established 1's (in the form of large X's) in those boxes, which do not tolerate 1-candidates.

(You, as Zapmaster, always return to the starting box after finishing a subpattern, to ensure that every candidate square in the starting box, or any of the other boxes, has either been made a member of a subpattern, or disqualified as a candidate.)

Back at the starting box, there is a pending condition in box G, so you, as Zapmaster, must begin a ***sister*** subpattern to subpattern-1, one which begins in the same starting square in the starting box, and which shares squares all the way to the pending box, in the same sequence of boxes followed by subpattern-1, at which point this sister subpattern will part ways with subpattern-1 by taking possession of the pending square as its own member in the pending box.

The sudoku below is the picture you, as Zapmaster, are presented with when you return to the starting box C, with the box order **C→I→G→D.**

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							$1_{\mathbf{1}}$		1
row3				X					
row4						X			
row5								X	
row6	1	$1_{\mathbf{1}}$							
row7	$1_{\mathbf{1}}$	$1_{\mathbf{P}}$					1		
row8					X				
row9		1	*P*						$1_{\mathbf{1}}$

The pending condition requires that you give equal opportunity to the pending square as a rightful inheritor of the sequence of squares, (27) and (99), as members of a new ***sister*** subpattern. Consequently, you begin subpattern-2 in the same starting square (27) as subpattern-1, and then you dutifully continue it in square (99). When you get to box G in the box order, you see the pending P and remember that subpattern-2 must be continued in the pending square (72). So you replace the subscript p with a 2 and erase the pending P. You then perform the next action

Square (72) zaps square (62) adding square (61) to subpattern-2

Notice that this action really goes on in your head, and is carried out with your pencil as you add subscripts and pencil in pending P's. Clearly, none of this get written down, except for the new subscripts and the penciling in and erasing of the pending P's.

Now when you return your attention to the starting box, C, you are aware that there is no pending situation at the moment, so your next item of business is to check for any unassigned squares in box C, and you note that square (29) has no subscripts, and therefore no membership yet in a subpattern. Your duty is to fill this void, and begin a new subpattern-3 in square (39) and update box I, next in the box order, with the action:

Square (29) zaps square (99) adding square (77) to subpattern-3

The result of this action is below:

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1_{12}		1_{3}
row3				X					
row4						X			
row5								X	
row6	1_{2}	1_{1}							
row7	1_{1}	1_{2}					1_{3}		
row8					X				
row9		1							1_{12}

On the next action, we'll see some new notation. In this action, square (77) will zap **both** squares (71) and (72), leaving square (92) as the sole survivor.

Square (77) zaps <u>square (71) & square (72)</u> adding square (92)

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7	1_{1}	1_{2}					1_{3}		
row8					X				
row9		1_{3}							1_{12}

The final action wil be to update box D with box G:

Square (92) zaps square (62) adding square (61)

Back at the starting box C, all squares are members of subpatterns, and there are no squares in other boxes which are unclaimed. This completes the pattern analysis.

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1_{12}		1_{3}
row3				X					
row4						X			
row5								X	
row6	1_{23}	1_{1}							
row7	1_{1}	1_{2}					1_{3}		
row8					X				
row9		1_{3}							1_{12}

This time you choose G as the starting box. Even though you know the solution, it won't help, because you've got to follow the rules and proceed step by step. You choose square (72), with the box order **G→D→I→C**. Then you upate box D with the action:

Square (72) zaps square (62) adding square (61)

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1		1
row3				X					
row4						X			
row5								X	
row6	1_{1}	1							
row7	1	1_{1}					1		
row8					X				
row9		1							1

Notice that boxes D and I in the box order **G→D→I→C** are not adjacent to one another, and share no rows or columns. But box G can take care of box I. **It isn't obligatory that each box in the box order has to be responsible for the next box.** Previous boxes with members of the same subpattern are always ready to contribute their zapping powers..

So in this case, the action to take is:

Square (72) zaps square (77) adding square (99)

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1		1
row3				X					
row4						X			
row5								X	
row6	$1_{\mathbf{1}}$	1							
row7	1	$1_{\mathbf{1}}$					1		
row8					X				
row9		1							$1_{\mathbf{1}}$

The final action is:

Square (99) zaps square (29) adding square (27)

This completes subpattern-1 Next, you choose square (92) as the starting square of subpattern-2, and perform the action

Square (92) zaps square (99) adding square (77)

<u>Notice that we no longer bother with the subpattern name after</u> ***adding***. That is because we can only work on one subpattern at a time, so there should never be a doubt about what the present subpattern is. ***Adding*** means adding to the current subpattern. It is important that we have a way of making it official that square (77) is now a member of the current subpattern, giving it the rights of zapping power. The keyword ***adding*** fills that need. It is also useful in that it makes the point that the subpattern itself is growing as we add pattern members, and therefore has more zapping power.

The final action in calculating subpattern-2 is

Square (77) zaps square (27) adding square (29)

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1		$1_{\mathbf{2}}$
row3				X					
row4						X			
row5								X	
row6	$1_{\mathbf{1}}$	1							
row7	1	$1_{\mathbf{1}}$					$1_{\mathbf{2}}$		
row8					X				
row9		$1_{\mathbf{2}}$							$1_{\mathbf{1}}$

This completes subpattern-2, and when a return is made to the starting box G, a final subpattern-3 is begun in the remaining square (71). Our next action is to update box D, the next box in the box order **G→D→I→C**

Square (92) zaps square (62) adding (61)

Then, the zappers turn their zap guns around and aim them in the direction of box I, the third box in the sequence of boxes, and perform the action

Square (71) zaps square (77) adding (99)

The final action

Square (99) zaps square (29) adding square (27)

completes the update. See the diagram on the next page.

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1_{3}		1_{2}
row3				X					
row4						X			
row5								X	
row6	1_{12}	1_{3}							
row7	1_{3}	1_{1}					1_{2}		
row8					X				
row9		1_{2}							1_{13}

Notice that the subscripts are different in the two solutions (the previous solution is at the top of page 10, three pages back). This difference was caused by the difference in choice of beginning squares for the three subpatterns, and amounts to nothing more than a simple transposition of digits,

$$\mathbf{1 \rightarrow 2}$$
$$\mathbf{2 \rightarrow 3}$$
$$\mathbf{3 \rightarrow 1}$$

The importance of the two updates is that using the box with the greatest number of squares results in there being no pending situation. This will not always be the case. Pending situations are not always avoidable, but it is always best to avoid them when possible. The next example has a pending condition in either of two boxes, box D and box F. Whichever is chosen as the starting box, the other becomes a pending box.

2 016 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4			5					5	
row5	5			5			5		
row6	5			5			5		

If we make box D the starting box, then when a subpattern is begun in square (43),

Square (43) zaps square (48) adding square (57) and pending square (67)

On the other hand, if we make box F the starting box, then when a subpattern is begun in square (48)

Square (48) zaps square (43) adding square (51) and pending square (61)

Every time a zapping is made of a square in a box with three squares, two squares are left unzapped. One of them may be chosen as a member of the subpattern being developed, but the other must always be a pending square.

Some additional language:

3 009

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7				1_1			1		1
row8			X						
row9				1	1		1_1		

Zapping can take out more than one square at a time. In the situation above, square (74) can zap both squares (77) and (79).

Square (74) zaps <u>square (77) & square (79)</u> adding square (97)

Notice the use of the underline. It's used in place of a pair of enclosing parentheses because parentheses are used to enclose the coordinates of a square. It keeps the zap language from looking too cluttered.

Another instance in which an underline is used is when two actions have a collective effect, as with: **square (82) zaps square (88)** and **square (94) zaps square (97)**:

2 012 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7					2				2
row8		2_1						2	
row9			2	2_1			2		

<u>Square (82) zaps square (88) & square (94) zaps square (97)</u> adding square (79)

Notice the length of the last zap statement. See how cluttered it is, like not being able to see the trees because of the surrounding forest. It is not the intent of zap language to be so dense. Its purpose is to communicate quickly and understandably. We shall therefore make a further inroad on the readability of zap language, although its purpose is to attain greater clarity, as well as the ability to understand the action at a glance.

Therefore, except on the occasion of clarity, the word ***square*** shall no longer be used to specify a square. Instead, we shall rely solely on the pair of parentheses and the enclosed coordinate pair of row and column numbers.

The statement on the bottom of the previous page then becomes simplified:

(82) zaps (88) & (94) zaps (97) adding (79)

A second consideration is that when the entire line is in bold, it doesn't cause anything in particular to stand out. We choose therefore to reserve the bold typeface for information which changes, like the coordinates of squares, as well as showing active agents as opposed to passive ones. The statement above now looks like:

(82) zaps (88) & **(94)** zaps (97) adding **(79)**

Now the active agents, the squares **(82)** and **(94)**, as well as the result, **(79)**, can be clearly seen. The underline avoids clutter, the keywords ***zap*** and ***adding***, since they are the two main underpinnings of the zap language, are expected, and therefore do not need to stand out. Since there is little else to the zap language, its sometimes apparent complexity is really little else than the multiple usage of statements like the one above.

There is one remaining wrinkle in the use of the zap language. It is used to reduce the repetitive and cumulative nature of zap actions, and is what is popularly called a ***run-on sentence***. An example in English would be:

The teenager struck the child who yelled to the mother who called the policeman

There are three actions here, ***struck, yelled, and called***, and the guiding principle of the sentence structure is that the passive object of one action becomes the active agent of the next action. Although run-on sentences are disliked by most, when the parts of the sentence are all related, as in the above example, the overall sense, and in particular the interconnectedness of the individual events, is better understood at a glance than from looking at the sequence of statements:

The teenager struck the child.
The child yelled to the mother.
The mother called the policeman.

It also uses the lines on the page more frugally, and, when used properly, creates less of a feeling of clutter. Short descriptions sometimes bring out the immediacy of cause and effect.

For these reasons and others, the zap language allows (and is frequently used in) run-on zap statements like the following:

(87) zaps (37) adding **(19)** zaps (14) adding **(34)**

This means the same as:

(87) zaps (37) adding **(19)**
(19) zaps (14) adding **(34)**

The adoption of the philosophy of zapping stemmed from a passion for direct and succinct connections, making it easier to know why something was being done, and what it led to. Our sprawling English language often seems to turn into a morass of unintended implication, compared to which formulaic language is a godsend. The run-on treatment hooks up together a string of seemingly disparate actions into a fathomable sequence of events. It makes it clear why anyone would go to the bother of zapping (37) above, when it is seen as a stepping stone to identify (34) as a bona fide extension of the subpattern being analyzed.

The zap language, albeit perhaps too formulaic, enables you to see at a glance when reading this text, to see whether, for example, all the members of a subpattern have been discovered. It is intended as a convenience for you in thinking about, using, and learning the underlying (simple) theory. Once you are solidly into using zap language, you need only realize its implications, so that it can assist you in deciphering the sudoku, and planning your next action.

The next item of importance is care and precision in following the box order. It might be of use to jot it down. Whenever you encounter a pending box with a false candidate, you are obliged to backtrack along the path that got you there, erasing the false candidate. You are obliged to be a **box accountant** when using this method, what the order is, when you can change it, how to know when you've finished analyzing a subpattern, whether to add a new subscript to all the squares leading from the starting box to the pending box, and what to do when you discover a square which somehow cannot be made a member of any subpattern.

Another way of showing the simultaneity and coordination of two actions is with the use of the keyword ***while***. It is used when each of the actions zaps a different square or set of squares, but the result of both actions is that a single square is isolated, becoming the next member of the subpattern.

4 019

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7	$3_{\mathbf{1}}$				3			3	
row8	3			3				$3_{\mathbf{1}}$	
row9	3				$3_{\mathbf{1}}$				

(88) zaps (81) while **(95)** zaps (91) adding **(71)**

The alternative method would be:

<u>**(88)** zaps (81) and **(95)** zaps (91)</u> adding **(71)**

When a run-on zap statement runs out of room on a line, it can be simply continued on the next, always indenting the next line. Such continuations are seldom used.

(17) zaps (97) adding **(98)** zaps (58) adding **(69)** zaps (65) adding **(69)** zaps (66) adding **(54)** zaps (14) adding **(25)** zaps (21) adding **(31)**

When you read a statement like this, you are also keeping an eye on the sudoku being updated, and you see each action separately. You first see how (98) is added as a result of (17) zapping (97). Then you see how (69) is added as a result of zapping (59), and so on. When you have become adept with the concept of zapping as well as with the use of the zap language, you begin to see

"**(17)** zaps (97) adding **(98)**"

as a <u>single</u> action, linking (17) to (98)

and your scanning of the entire run-on zap statement becomes a linking of consecutive pattern members, seven in a row, all in bold. You see only the bold squares, and demote the unbold squares to nothing but cannon fodder for the zapping process, seeing them only as obstructions to be dismissed, being little more than part of the geometry of the box

There is one further simplification, but it does not occur in a zap statement. It is the designation of a box, with will, most of the time, consist of nothing but the capital letters A, B, C, D, E, F, G, H, and I for the nine boxes. Instead of "**box A**' we will just use "**A**"

Now we get to the second most important part of a zap statement. When one or more squares in the same box are zapped, and more than one square remains unzapped, then a choice must be made as to which one is to be added to the subpattern, and which one(s)

is/are to be placed in a pending status, awaiting its/their assignment(s) to a future subpattern.

An explanatory situation is the following sudoku segment:

4 006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 7			5		$5_{\mathbf{1}}$	5			5
row 8	5					5			5
row 9			5		5				

Remember that although zapping only operates within rows or columns, the purpose of zapping is to reduce the box whose rows and/or columns are being zapped, so the consequences of zapping are those squares in the box which escape being zapped, and it is from the ranks of those escapees, the ***unzapped*** squares, that you, the zapmaster, must make the selections for squares to be added and squares to be pended.

Let us first consider the action of (75) zapping (79):

(75) zaps (79) adding **(89)**

4 006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 7			5		$5_{\mathbf{1}}$	5			5
row 8	5					5			$5_{\mathbf{1}}$
row 9			5		5				

Here, there is no choice. Square (89) is forced. But imagine instead the action

(75) zaps (73) adding **(??)**

What square shall **(??)** be chosen to be? It's easy, when we introduce the next new piece of zap language, the ***pending*** keyword.

Let us return to the bottom three rows again, and this time point the zap guns in the opposite direction:

(75) zaps (73) adding **(81)** and pending ***(93)***

4 006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 7	*P*		5		$5_{\mathbf{1}}$	5			5
row 8	$5_{\mathbf{1}}$					5			5
row 9			$5_{\mathbf{P}}$		5				

The reason that the ***pending square*** *(93)* is in ***italics*** as well as bold is to remind us that it is ***not*** going to be a member of the subpattern under analysis. It will become a member of the ***next*** subpattern, subpattern-2. The "p" will be replaced by a "2" when the time comes for subpattern-2. (One must always remember to pencil a P in the box, just for good measure. It must be erased when the pending square is given a real subscript).

In the next situation, still using the bottom three rows, the update is from the box with less pattern squares to the one with more, G to H.

(81) zaps (86) adding **(75)** and pending ***(76)&(95)***

4 006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 7	*P*		5		$5_{\mathbf{1}}$	$5_{\mathbf{p}}$			5
row 8	$5_{\mathbf{1}}$					5			5
row 9			$5_{\mathbf{P}}$		$5_{\mathbf{q}}$				

In this case, both (76) and (95) are placed on hold. The choice is still open as to the order in which they are to be chosen, which is entirely up to you.

Pending situations.

The single most complicated feature of the calculation of subpatterns is the pending situation, so it is important that we spend some time discussing it, as well as the zap language associated with it.

When subpatterns are analyzed, it is a ***one-at-a-time*** process. A subpattern is always completely determined before the calculation of the next subpattern is undertaken. Pending situations are those in which more than one candidate within a particular box is available to a subpattern. Only one candidate may be chose for the subpattern, and the rest must be placed on hold for the next subpattern(s). We accomplish this by giving the pending squares the false subscripts p, q, r, and so forth (you will probably never encounter a situation in which there are more than two pending squares, or in which more than two pending situations exist at the same time).

When, in the course of analyzing (calculating) a subpattern, two or more squares in the same box remain unzapped, only one of them can be chosen for the present subpattern, an the other one (or two) must be given pending subscripts (p, q, etc.), and a pending P must be penciled in the box as a reminder of the pending situation. Then the analysis of the subpattern must pass to the next box in the box order.

When the subpattern is complete, and you are back at the starting box, and a pending condition exists, you must begin a new subpattern in the same starting square as the preceding subpattern, adding the new subscipt to all the squares containing the previous subscript, and when the pending box is arrived at, one of the pending squares in that box must become the next member of the new subpattern. If it is the only pending square in the pending box, then the pending P in the box must be erased, the pending square must be selected as the next member, and its pending subscript replaced by the subscript of the new, present subpattern. If there is yet another pending square in that same pending box, the pending P must not be erased, and that second pending square will become a member of yet another new subpattern, not to be started until the present subpattern is complete.

Note that the starting box never becomes a pending box, although it has many similarities to one.

Once the pending square has been assigned to a subpattern, control always continues on with the next box in the box order. If the pending box is the last one in the box order, then, the next box is the starting box, where there are either no more subpatterns to be started, or where the next subpattern will begin.

The order of boxes is the order in which boxes are evaluated in calculating a subpattern. The direction of the box order is considered to be ***downstream***. A box which is ***upstream*** from another is one which is earlier in the box order.

While a box is pending, it is possible for another box to become pending. This new pending box is <u>always</u> ***downstream*** from the first pending box, and is called a ***higher pending box***.

Higher pending boxes are ***always*** resolved before ***lower pending boxes.*** No new squares are allowed to be developed in any box ***upstream*** from the highest pending box. As boxes upstream from the highest pending box are encountered, no ***new squares can be added***, the new subscript always being ***slavishly*** placed in the ***same*** square as the preceding, old subscript, ***until*** the highest pending box is no longer pending. At that point the ***next highest*** pending box becomes the highest.

It is vitally important to always label ***new pending P's*** with subscripts ***higher*** than any of the ***present pending P's***, so that ***higher*** pending P's will always have a ***higher*** subscript than lower ones. When there is no pending P and a new pending P is being added, the numbering can, but need not, be started all over again.

Note that it is not logically possible, if you follow the rules, for a new pending condition to occur in a box which is upstream from an existing pending condition. ***New*** pending conditions ***always*** occur ***downstream*** from existing pending conditions. A pending condition ***cannot be resolved*** when there exists a pending condition ***downstream*** from it.

Thus if a pending box has three pending squares, it will take three additional subpatterns to be started before the pending condition in that box can be resolved.

In this fashion, it is guaranteed that all possible subpatterns will be discovered.

Blind Alleys and Killer Candidates

Situations occur when a subpattern cannot proceed any further because there is no square left unzapped in the next box in the box order. This can only occur when every square in that box has been zapped by the members of the subpattern being developed. These are cases in which the would-be subpattern has no continuation. They are called ***blind alleys***, and must be ***abandoned***. This is accomplished by ***backtracking***, box by box, in the sequence of assignments made for that subpattern number, until the starting box is reached, removing the subscripts from every square along the way, including from the starting square itself, and no further subpatterns may be begun in that square in the starting box. If there are other squares in the starting box which have not yet been included in a subpattern, then the subpattern number, which has been painstakingly removed from all of its squares as a result of this blind alley, must be reassigned to a ***new subpattern*** beginning in one of those other squares, so that a gap in subpattern digits does not occur.

Blind alleys can occur as a result of pending situations, but they can also occur normally. They are the only way in which a square can end up not being assigned to a subpattern, but for that to be so, such a square will have been tried out as a possible member of every subpattern, and will have led to a blind alley in every instance. Such a square is labeled as a ***killer candidate***, a terminology which will be explained later. It cannot be a real candidate, but is left in the pattern analysis with the ***subscript k***.

Blind alleys do not occur frequently, but one must be prepared for their occasional manifestation.

Killer candidates are tested by every candidate duting the subpattern analysis, but that testing is not always evident to the solver, as they simply are always among the zapped squares. The solver is often not aware of them until the analysis is complete, and they are the squares which have received no subscripts. It is at such a time that they are generally given the k subsript.

Example of the solution of a sudoku being expressed in zap language:

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2			X						
row3						X			
row4	2				2				2
row5	2				2				
row6	2				2				2
row7				X					
row8		X							
row9								X	

Since the top and bottom bands have no candidates, we'll leave them out till the end.

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	2				2				2
row5	2				2				
row6	2				2				2

Subpattern-1 is started in **(41)** with box order **D→F→E**

(41) zaps (49) adding **(69).**
(41) zaps (45) while **(69)** zaps (65) adding **(55)**

Subpattern-1 = **(41),(69),(55)**
D F E

There are three actions above which give values to the subscripts in the middle three boxes. The first action is: Subpattern-1 is started in **(41)** with box order **D→F→E**
This causes the subscript "1" to be appended to the 2 in square (41):

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				2				2
row5	2				2				
row6	2				2				2

The second action is: **(41)** zaps (49) adding **(69).**

This causes the subscript "1" to be appended to the 2 in square (69):
It does this by limiting the adding statement to apply only to square (69),
the only eligible pattern square left in box F (righmost box) after the zapping action.

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				2				2
row5	2				2				
row6	2				2				$2_{\mathbf{1}}$

The third action is: **(41)** zaps (45) while **(69)** zaps (65) adding **(55)**

It causes the subscript "1" to be appended to the 2 in square (55), the only pattern square remaining in box E (middle box) after the zapping action.

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				2				2
row5	2				$2_{\mathbf{1}}$				
row6	2				2				$2_{\mathbf{1}}$

The final zap statement is a summary of the three members of subpattern-1. Beneath each of the three members is the name of the box in which the member is found. Those boxes are D, F, and E. The three boxes are listed in the same order as in the box order statement. That order has no further meaning after the three members have been identified. It was simply used to discover the three members, and another order could have been used. The members themselves may be placed in any order, the important

piece of information being the box each is located in, which could easily be deduced from the coordinates of the square.

The zap language showing the calculation of subpattern-2 is the following:

Subpattern-2 is started in **(51)** with box order **D→F→E**

(51) zaps (55) adding **(45)** and pending ***(65)*.**
(45) zaps (49) adding **(69)**

Subpattern-2 = **(45),(69),(54)**
D F E

The first action is: Subpattern-2 is started in **(51)** with box order **D→F→E**
The result is below:

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				2				2
row5	$2_{\mathbf{2}}$				$2_{\mathbf{1}}$				
row6	2				2				$2_{\mathbf{1}}$

The second action is: **(51)** zaps (55) adding **(45)** and pending ***(65)*.**
The result is below:

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$			***P***	$2_{\mathbf{2}}$				2
row5	$2_{\mathbf{2}}$				$2_{\mathbf{1}}$				
row6	2				$2_{\mathbf{p}}$				$2_{\mathbf{1}}$

The third action is: **(45)** zaps (49) adding **(69)**
The result is below:

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$			***P***	$2_{\mathbf{2}}$				2
row5	$2_{\mathbf{2}}$				$2_{\mathbf{1}}$				
row6	2				$2_{\mathbf{p}}$				$2_{\mathbf{12}}$

The zap language showing the calculation of subpattern-2 is the following:

Subpattern-3 is started in **(51)** (same as subpattern-2) with box order **D→F→E**

due to the pending action in box **E**, subpattern-3 must
begin in the same starting square **(51)** as subpattern-2
include the pending square **(55)**

(65) zaps (69) adding **(49)**

Subpattern-3 = **(51),(65),(49)**
D F E

Note the addition of a new keyword in the zap language, the **due to** statement. This is a reminder for you, to remember that the subpattern which follows the subpattern which created a pending box and pending square must start in the same starting square, and share every square of subpattern-2 until the pending box, E is reached, at which time the pending square must be the member in subpattern-3. In this example, there are no squares between the starting and pending boxes, so this second warning does not appear.

In the general situation, the **due to** statement has the form:

due to the pending action in box X, subpattern-N+1 must
begin in the same starting square **(ab)** as subpattern-N
share squares **(ab), (cd)**, . . . with subpattern-N
include the pending square **(yz)**

where (ab), (cd), . . . is the list of squares between, (but not including) the starting and pending squares. Note that only the square designations above are in bold.

This statement is a reminder to you, as zapmaster, to add the shared squares to the subpattern which follows the pending action. In the example **which precedes the general statement above**, the pending box immediately follows the starting box, and there are no squares in between, so you don't need to be reminded.

Since two of the squares of subpattern-3 are forced (the starting and pending squares), so only one square needs to be calculated, which is accomplished by the sole action:

(65) zaps (69) adding **(49)**

The final pair of lines

Subpattern-3 = **(51),(65),(49)**
D F E

summarizes the findings. Note the list of boxes underneath the subpattern members, showing the boxes they are located in. This isn't necessary, since you could locate them from their coordinates. It simply makes it easier for you to understand the result, since

you can now compare them to the box order at the beginning. Sometimes, when there is insufficient room on the page, the line of box names (D F E) is incorporated with the list of subpattern members (*this is done rarely*):

Subpattern-3: **D(51), (F(65), E(49)**

After the update, we move the updated middle section back into the sudoku:

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2			X						
row3						X			
row4	$2_{\mathbf{1}}$				$2_{\mathbf{2}}$				$2_{\mathbf{34}}$
row5	$2_{\mathbf{23}}$				$2_{\mathbf{14}}$				
row6	$2_{\mathbf{4}}$				$2_{\mathbf{3}}$				$2_{\mathbf{12}}$
row7				X					
row8		X							
row9								X	

The one question which might still linger in your mind is why we updated the boxes in the order **D→F→E,** rather than **D→E→F.** That's because two squares must be used to zap the three squares of the middle box, in order to leave only one, and updating F first works because F has only two squares, so one square in box D can eliminate one square in box F, and then that one square in D and that one square in F can team up to eliminate two of the squares in E, leaving only one to become the result in E. Simple.

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	2				2				2
row5	2				2				
row6	2				2				2

Some final remarks on notation:

Pattern analysis begins with an arbitrarily chosen square, and an arbitrarily chosen order of boxes, then grows square by square, and as each new square is added, so is the total zapping power of the growing subpattern. Its zapping power grows by addition.

Consider the following paragraph, taken from the previous pattern analysis:

We choose **(83)** as the first member in **G**, which zaps (53) in D, making **(51)** the member in **D**. **(83)** also zaps (23), making **(32)** the member in **A**, which zaps (39) in C, making **(19)** the member in **C**, which zaps (16) in B, making **(26)** the member in **B**, completing subpattern-3.

This language can be more simply and directly expressed in the following manner:

(83) zaps (53) adding **(51)**.
(83) zaps (23) adding **(32)** zaps (39) adding **(19)** zaps (16) adding **(26)**

Subpattern-3 = **(83),(51),(32),(19),(26)**
G D A C B

Here, the term "adding" is taken to mean that the square following the term is <u>added to the subpattern</u> being developed. The sequence of keywords "zaps" and "adding" explains the zapping of unwanted squares and subsequent adding of desired squares to the subpattern, which then are used to zap another unwanted square.

Note the list of subpattern boxes beneath the list of subpattern members, showing which boxes those members are in.

Another device is the use of an underline to show inclusion:

<u>**(88)** zaps (82) **&** **(75)** zaps (72)</u> adding **(93)**

(57) zaps <u>(51) **&** (53)</u> adding **(43)**

It is hoped that this new language will simplify and enhance the process of explanation.

General Remarks

The pattern examples used in this text all came from real sudokus. Except for bipatterns, none has been invented for the sake of example. The pattern digit has also not been altered, although there is no advantage to this, and the large X's showing the position of the established pattern digits have been retained, although, again, there is no advantage.

The one area which has not been properly represented is that of the simplest bipatterns, which have not been kept count of, and therefore not tallied with the other patterns to show their numbers. More sudokus were solved by bipatterns than by any other pattern, on a better than two-to-one basis.

It is intended to eventually include sections on the 5-subscript and 6-subscript patterns, and more material will be developed on box codes, picture codes, and their interrelationships, as well as a single box code system for all six pattern groups, and a more meaningful and useful alpha code.

In addition to all of this, I am still collecting successful patterns, adding at least one new pattern every day from the two or three sudokus that I solve, and intend to incorporate these as well into this study, which will therefore grow at a rate of at least 300 a year.

My search for an organizing principle in reducing the number of sudokus to be solved in this study turned out in the end to be the method of solving itself, with the introduction of the Zap language for its simplification in description of that solving process, and the internal similarity of solving examples. I hope the Zap language proves successful. It certainly reduced the sheer amount of verbiage previously necessary, and made this project a manageable one.

Chapter 1. Patterns with 1 subscript.

Simple bipatterns

A simple bipattern is defined as two candidate pairs in opposing boxes. Each pair must share a box. If the two pairs face each other vertically, it means that each pair consists of two candidates in the same row and same box, and that the corresponding members share columns. If they face each other horizontally, each pair consists of two candidates in the same column and box, and each pair of corresponding members share a row.

Below is a pattern composed of a bipattern. Let us solve it. The pattern exists in two boxes, A and D.

Subpattern-1 begins in square **(11)** with the order of boxes **A→D**.

(11) zaps (41) adding **(43)**

Subpattern-1 = **(11),(43)**
A D

Subpattern-2 begins in square **(13)** with the order of boxes **A→D**
(13) zaps (43) adding **(41)**

Subpattern-2 = **(13),(41)**
A D

Back at the starting box, there is no pending situation anywhere and no square in the starting box lacking a subpattern. The completed pattern analysis is below.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_1		1_2						
row2					X				
row3							X		
row4	1_2		1_1						X
row5				X					
row6									
row7						X			
row8		X							
row9								X	

The next two pages show a few examples of simple bipatterns.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9_1		9_2			
row2		X							
row3									X
row4	X								
row5				9_2		9_1			
row6								X	
row7			X						
row8							X		
row9					X				

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2			1_1					1_2	
row3			1_2					1_1	
row4							X		
row5				X					
row6	X								
row7									X
row8									
row9									

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2			X						
row3								X	
row4	X						X		
row5				X					
row6									
row7									X
row8		2_1			2_2				
row9		2_2			2_1				

For horizontal pairs,
there are 27 columnar arrangements of two pairs
and 9 row arrangements for a single pair,
making 27 x 9 = 243 vertically facing pairs.

By a similar argument,
there are 243 horizontally facing pairs,
making altogether 243 + 243 = <u>486 possible simple bipatterns</u>.

Despite their simplicity, simple bipatterns solve more sudokus than any other kind of pattern. There are many instances in which the venerated sudoku masters would cringe at the ease with which bipatterns solve their otherwise complicated sudokus.

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 – 2	G – H – I	033

G	**H**	**I**

Subpattern-1 begins in **(73)** with the box order **G→H→I**

(73) zaps (74) adding **(94)** zaps (98) adding **(88)**
(94) zaps (98) adding **(88)**

Subpattern-1 = **(73),(94),(88)**
G H I

Subpattern-2 begins in **(83)** with box order **G→I→H**

(83) zaps (88) adding **(98)** zaps ((94) adding **(74)**

Subpattern-2 = **(83),(98),(74)**
G I H

Back at the starting box, nothing is pending, and no squares remain unclaimed. We are done.

1 017 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3					X				
row4						X			
row5		X							
row6									X
row7			5_1	5_2					
row8			5_2					5_1	
row9				5_1				5_2	

Example 1.033

Although this pattern is related to the **2 – 2 – 2** group (preceding page), it must be derived from it by a 90 degree rotation, so we shall examine it separately.

A		
D		
G		

Subpattern-1 begins in **(11)** with box order **A→G→D.**

(11) zaps (81) adding **(82)** zaps (62) adding **(63)**

Subpattern-1 = **(11),(82),(63)**
A G D

Subpattern-2 begins in **(13)** with box order **A→D→G**

(13) zaps (63) adding **(62)** zaps (82) adding **(81)**

Subpattern-2 = **(13),(62),(81)**
A D G

---

1 033

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_1		3_2						
row2				X					
row3							X		
row4					X				
row5									X
row6		3_2	3_1						
row7						X			
row8	3_2	3_1							
row9								X	

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 | 2	I – F | G	032

		F
G		**I**

Box order**: F→I→G**

Subpattern-1 is begun in **(48)** zaps (78) adding **(89)** zaps (89) adding **(71)**

Subpattern-1 = **(48),(89),(71)**
F I G

Subpatttern-2 in begun in **(49)** zaps (99) adding **(78))** zaps (71) adding **(81)**

Subpattern-2 = **(49),(78),(81)**
F I G

Back at the starting box, nothing is pending and no squares remain unclaimed. We are done.

1 006 A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3							X		
row4								3_1	3_2
row5		X							
row6						X			
row7	3_1							3_2	
row8	3_2								3_1
row9				X					

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2	B – A	035
|	|	
2 – 2	G – H	

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: A→B→H→G

Subpattern-1 starts in **(23)** zaps (36) adding **(34)** zaps (94) adding **(76)**
(76) zaps (72) adding **(92)**

Subpattern-1 = **(23),(34),(76),(92)**
A B H G

Subpattern-2 starts in **(33)** zaps (34) adding **(26)** zaps (76) adding **(94)**
(94) zaps (92) adding **(72)**

Subpattern-2 = **(33),(26),(94),(72)**
A B H G

Back at the starting box, there is no pending condition and no unclaimed squares. We are done.

1 020 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2			3_1			3_2			
row3			3_2	3_1					
row4	X								
row5					X				
row6							X		
row7		3_2				3_1			
row8								X	
row9		3_1		3_2					

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 – 2 | 2 – 2	G – H – I | E – D	none

D	**E**	
G	**H**	**I**

Box order**: E→D→G→H→I**

Subpattern-1 begins in **(44)** zaps (43) adding **(51)** zaps (91) adding **(73)** **(73)** zaps (77) adding **(87)** zaps (85) adding **(95)**

Subpattern-1 = **(44),(51),(73),(87),(95)**
E D G H I

Subpattern-2 begins in **(54)** zaps (51) adding **(43)** zaps (73) adding **(91)** **(91)** zaps (95) adding **(85)** zaps (97) adding **(77)**

Subpattern-2 = **(54),(43),(91),(85),(77)**
E D G H I

Back at the starting box E, no pattern square remains unclaimed, and there is no pending situation. We are done.

1 034 A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2		X							
row3						X			
row4			7_2	7_1					
row5	7_1			7_2					
row6									X
row7			7_1				7_2		
row8					7_2		7_1		
row9	7_2				7_1				

Pattern Code	Box Orientation	Patterns with the same box code
2 | 2 – 2 | 2	F | B – C | H	none

	B	**C**
		F
	H	

Box H connects only to box B, and box F only connects to box C. Therefore one should be the starting box and the other the ending box. We'll choose H for the starting box, making the **box order H→B→C→F**.

Subpattern-1 begins in **(85)** zaps (35) adding **(26)** zaps (27) adding **(38)**
(38) zaps (68) adding **(67)**

Subpattern-1 = **(85),(26),(38),(67)**
H B C F.

Subpattern-2 begins in **(86)** zaps (26) adding **(35)** zaps (38) adding **(27)**
(27) zaps (67) adding **(68)**

Subpattern-2 = **(86),(35),(27),(68)**
H B C F.

Back at the starting box, nothing is pending and no square unclaimed. We are done.

1 024 A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2						4_1	4_2		
row3					4_2			4_1	
row4				X					
row5			X						
row6							4_1	4_2	
row7	X								
row8					4_1	4_2			
row9									X

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 | 2 – 2 | 2	A – B | I – G | F	none

A	**B**	
		F
G		**I**

Box order: A→B→G→H→F

Subpattern-1 begins in **(13)** zaps (14) adding **(24)**
(13) zaps (93) adding **(71)** zaps (79) adding **(98)** zaps (68) adding **(69)**

Subpattern-1 = **(13),(24),(71),(98),(69)**
A B G H F

Subpattern-2 begins in **(21)** zaps (24) adding **(14)**
(21) zaps (71) adding **(93)** zaps (98) adding **(79)**
(79) zaps (69) adding **(68)**

Subpattern-2 = **(21),(14),(71),(98),(69)**
A B G H F

At the starting box A, nothing is pending & no squares unclaimed. We are done.

1 009

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			6_1	6_2					
row2	6_2			6_1					
row3							X		
row4						X			
row5		X							
row6								6_2	6_1
row7	6_1								6_2
row8					X				
row9			6_2					6_1	

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 | | 2 – 2	A – B | | D – E	005, 013, 015, 019, 021, 022, 031, 039.

A	**B**	
D	**E**	

Box order A→B→E→D

Subpattern-1 begins in **(22)** zaps (26) adding **(35)** zaps (55) adding **(66)** (66) zaps (62) adding **(53)**

Subpattern-1 = **(22),(35),(66),(53)**
A B E D

Subpattern-2 begins in **(33)** zaps (35) adding **(26)** zaps (66) adding **(55)** **(55)** zaps (53) adding **(62)**

Subpattern-2 = **(33),(26),(55),(53)**
A B E D

At the starting box A, nothing is pending & no squares unclaimed. Done.

1 002 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2		1_1				1_2			
row3			1_2		1_1				
row4								X	
row5			1_1		1_2				
row6		1_2				1_1			
row7							X		
row8				X					
row9	X								

Pattern Code	Box Orientation	Patterns with the same box code
2--------2 **| |** **2 – 2 |** **| |** **2 – 2**	**A -------C** **| |** **D – E |** **| |** **H – I**	**003, 007, 010, 011, 012,** **014, 016, 025, 026, 028,** **031, 039.**

A		**C**
D	**E**	
	H	**I**

Box order A→C→I→H→E→D

Subpattern-1 begins in **(12)** zaps (18) adding **(27)** zaps (87) adding **(98)**
(98) zaps (95) adding **(86)** zaps (56) adding **(45)** zaps (42) adding **(51)**

Subpattern-1 = **(12),(27),(98),(86),(45),(51)**
A C I H E D

1 001 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1						2	
row2	2						2_1		
row3				X					
row4		2			2_1				
row5	2_1					2			
row6									X
row7			X						
row8						2_1	2		
row9					2			2_1	

Pattern 1.001 continued.

A		**C**
D	**E**	
	H	**I**

Box order A→C→I→H→E→D

Subpattern-2 begins in **(21)** zaps (27) adding **(18)** zaps (98) adding **(87)** **(87)** zaps (86) adding **(95)** zaps (45) adding **(56)** zaps (51) adding **(42)**

Subpattern-2 = **(21),(18),(87),(95),(56),(42)**

Back at the starting box A, nothing is pending and no squares remain unclaimed. The pattern analysis is complete.

1 001 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1						2_2	
row2	2_2						2_1		
row3				X					
row4		2_2			2_1				
row5	2_1					2_2			
row6									X
row7			X						
row8						2_1	2_2		
row9					2_2			2_1	

Pictorial demonstration of Pattern 1 001.

We'll first show it for subpattern-1:

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

Arbitrary choice of first member of subpattern-1 in box A..

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by first member, showing zapped area in dark. Forced choice of second member of subpattern-1 in box C.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by second member of subpattern-1 in box C, showing zapped area in dark. Forced choice of third member of subpattern-1 in in box I

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by third member of subpattern-1 in box I, showing zapped area in dark. Forced choice of fourth member of subpattern-1 in box H.

continued on next page

Pictorial demonstration of example 1 001, continued.

End of pictorial view of zapping by subpattern-1.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by fourth member, showing zapped area in dark. Forced choice of 5th member of subpattern-1 in box E.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by fifth member, showing zapped area in dark. Forced choice of 6th and final member of subpattern-1 in box D.

Pictorial view of zapping by subpattern-2:

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

First member of subpattern-2 is the only remaining choice in box A,

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping of surrounding sudoku by first member, showing zapped area in dark. Forced choice of second member in box C. (Note that this action also reveals last member of subpattern-2 in box D.)

continued on next page

Pictorial demonstration of example 1 001, continued.

Continuation of pictorial view of zapping by subpattern-2.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by second member of subpattern-2, the third choice in box I reveals forced choice of subpattern-2.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by third member, fourth member is revealed, again a forced choice.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

After zapping by fourth member of subpattern-2, the fifth choice in box D is forced.

	1	2	3	4	5	6	7	8	9
1		2						2	
2	2						2		
3				x					
4		2			2				
5	2					2			
6									x
7			x						
8						2	2		
9					2			2	

Finally, after zapping by fifth member, sixth member in box C is forced. The subpattern is finished, but if we zapped what remained by the last member, the only squares not zapped would be the X's, revealing the positions of the established 2's.

Pattern Code	Box Orientation	Patterns with the same box code
2 – 2 – 2 | | 2 – 2	D – F – E | | A – C	023, 030

A		**C**
D	**E**	**F**

The box order below is chosen so as to simplify the determination of subpattern-1. If we chose a counterclockwise order starting at box A, we would have to go from box F to D and then to E, instead of going directly from F to E to D.

Subpattern-1 begins in **(22)** with box order **A→D→E→F→C**

(22) zaps (52) adding **(61)** zaps (66) adding **(46)**
(46) zaps (49) adding **(57)** zaps (27) adding **(39)**

Subpattern-1 = **(22),(61),(46),(57),(39)**
A D E F C

1 008

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		$1_{\mathbf{1}}$					1		
row3	1								$1_{\mathbf{1}}$
row4						$1_{\mathbf{1}}$			1
row5		1					$1_{\mathbf{1}}$		
row6	$1_{\mathbf{1}}$					1			
row7			X						
row8				X					
row9								X	

Example 1.008, continued.

A		**C**
D	**E**	**F**

Back at the starting box, there is no pending condition, so we begin subpattern-2 in (31), the only remaining square in box A. Looking ahead, we see a problem in progressing from box E to box F, so we change the box order and choose a counterclockwise route, going from **A to C to F to E to D**.

Subpattern-2 begins in **(31)** with box order **A→C→F→E→D**

(31) zaps (39) adding **(27)** zaps (57) adding **(49)** zaps (46) adding **(66)**
(66) zaps (61) adding **(52)**

Subpattern-2 = **(31),(27),(49),(66),(52)**
A C F E D

Back at the starting box A, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

1 008

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		1_1					1_2		
row3	1_2								1_1
row4						1_1			1_2
row5		1_2					1_1		
row6	1_1					1_2			
row7			X						
row8				X					
row9								X	

Pattern Code	Box Orientation	Patterns with the same box code
2 | **2 – 2 – 2** | | **2 – 2**	**B** | **G – I – H** | | **D – F**	**none**

(box orientation for 038 – interchange columns 2 & 3, then interchange rows 2 & 3)

	B	
D		**F**
G	**H**	**I**

Subpattern-1 begins in **(35)** with box order **B→H→G→I→F→D**

(35) zaps (95) adding **(86)** zaps (83) adding **(72)** zaps (78) adding **(97)**
(97) zaps (57) adding **(48)** zaps (42) adding **(53)**

Subpattern-1 = **(35),(86),(72),(97),(48),(53)**
B H G I F D

1 038 B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2									X
row3					3_1	3			
row4		3						3_1	
row5			3_1				3		
row6				X					
row7		3_1						3	
row8			3			3_1			
row9					3		3_1		

Pattern 1,038 continued.

	B	
D		**F**
G	**H**	**I**

Subpattern-2 begins in **(36)** with box order **B→H→I→G→D→F.**

(36) zaps (86) adding **(95)** zaps (97) adding **(78)** zaps (72) adding **(83)**
(83) zaps (53) adding **(42)** zaps (48) adding **(57)**

Subpattern-2 = **(36),(95),(78),(57),(42),(57)**
B H I G D F

Back at the starting box B, there are no unclaimed squares nor pending situations. We are done.

1 038 B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2									X
row3					3_1	3_2			
row4		3_2						3_1	
row5			3_1				3_2		
row6				X					
row7		3_1						3_2	
row8			3_2			3_1			
row9					3_2		3_1		

Pattern Code	Box Orientation	Patterns with the same box code
3 – 2 | | **2 – 2**	**B – C** | | **E – F**	**none**

	B	**C**
	E	**F**

Box order**: B(→C)→E→F**

Subpattern-1 begins in **(14)** zaps (17) adding **(37)**
(14) zaps (44) adding **(55)** zaps (59) adding **(49)**

Subpattern-1 = **(14),(37),(55),(49)**
B C E F

Subpattern-2 begins in **(15)** zaps (17) adding **(37)**
(15) zaps (55) adding **(44)** zaps (49) adding **(59)**

Subpattern-2 = **(15),(37),(44),(59)**
B C E F

---

1 037 C0

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				7_{1}	7_{2}		7		
row2		X							
row3				7			7_{12}		
row4				7_{2}					7_{1}
row5					7_{1}				7_{2}
row6			X						
row7						X			
row8	X								
row9								X	

Pattern 1.037, continued.

	B	**C**
	E	**F**

Box order**: B(→C)→E→F**

Subpattern-3 begins in **(34)** zaps (37) adding **(17)**
(34) zaps (44) adding **(55)** zaps (59) adding **(49)**

Subpattern-3 = **(34),(17),(55),(49)**
B C E F

Back at the starting box, there are no unclaimed squares and nothing pending, so the pattern analysis is complete.

1 037 C0

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$7_{\mathbf{1}}$	$7_{\mathbf{2}}$		$7_{\mathbf{3}}$		
row2		X							
row3				$7_{\mathbf{3}}$			$7_{\mathbf{12}}$		
row4				$7_{\mathbf{2}}$					$7_{\mathbf{13}}$
row5					$7_{\mathbf{13}}$				$7_{\mathbf{2}}$
row6			X						
row7						X			
row8	X								
row9								X	

Pattern Code	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | | **2 – 2**	**G2** | **C3 – B3 - A2** | | **E2 – F2**	**none**

(box orientation for 027: swap rows 1 & 3, then columns 1 & 3)

A	**B**	**C**
	E	**F**
G		

Subpattern-1 begins in **(14)** with box order **B→E→F→C→A→G**

(14) zaps (64) adding **(55)** zaps (58) adding **(67)** zaps (37) & (17) adding **(28)**
(28) zaps (21) adding **(33)** zaps (73) adding **(71)**

Subpattern-1 = **(14),(55),(67),(28),(33),(71)**
B E F C A G

---

1 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_1			2		
row2	2				2			2_1	
row3			2_1	2			2		
row4		X							
row5					2_1			2	
row6				2			2_1		
row7	2_1		2						
row8						X			
row9									X

Example 1.027, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-2 begins in **(25)** with box order **B→A→G→C→F→E.**

(25) zaps (21) adding **(33)** zaps (73) adding **(71)**
(25) zaps (55) adding **(64)** zaps (67) adding **(58)**
(58) zaps (28) while **(33)** zaps (37) adding **(17)**

Subpattern-2 = **(25),(33),(71),(64),(58),(17)**
B A G C F E

Subpattern-3 begins in **(34)** with box order **B→E→F→C→A→G**
(34) zaps (64) adding **(55)** zaps (58) adding **(67)** zaps (37) & (17) adding **(28)**
(34) zaps (33) adding **(21)**

But now, there are two members of subpattern-3 in the same row, namely squares (28) and (21). Every action was forced, except for the choice of (34). This means that (34) cannot be the start of any subpattern, and we must remove all the 3 subscripts from the other squares in the aborted subpattern-3. The result of all these actions is that there is no pending situation, and no *claimable* unclaimed squares remaining in the starting box B. Therefore we are done! On the next page, we'll consider the meaning of all this.

---

1 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{1}			2_{2}		
row2	2_{3}				2_{2}			2_{13}	
row3			2_{12}	2_{3}			2		
row4		X							
row5					2_{13}			2_{2}	
row6				2_{2}			2_{13}		
row7	2_{12}		2						
row8						X			
row9									X

Pattern 1.027, continued.

We first attach the killer subscript to the 2's not included in either of the subpatterns. And what meaning can we give to the two 2's with both subscripts 1 and 2? Clearly, there are not three subpatterns, so the 2's in squares (33) and (71) must be established 2's, and should be replaced by large X's. See the treatment of killers in the introduction .

1 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{1}			2_{2}		
row2	2_{K}				2_{2}			2_{1}	
row3			2_{12}	2_{K}			2_{K}		
row4		X							
row5					2_{1}			2_{2}	
row6				2_{2}			2_{1}		
row7	2_{12}		2_{K}						
row8						X			
row9									X

1 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{1}			2_{2}		
row2	2_{K}				2_{2}			2_{1}	
row3			X	2_{K}			2_{K}		
row4		X							
row5					2_{1}			2_{2}	
row6				2_{2}			2_{1}		
row7	X		2_{K}						
row8						X			
row9									X

Pattern Code	Box Orientation	Patterns with same box code
3------- 3 **| |** **2 – 2 |** **| |** **2 – 2**	**B--------C** **| |** **E – D |** **| |** **G---I**	**none**

(box orientation for 004: swap columns 1 & 2)

	B	C
D	E	
G		I

Box order B→E→D→G→I→C

Note the importance of a good box order for a particular beginning square. If we had begun in square (15) of box B and progressed to box C, we would have encountered a false pending situation.

Subpattern-1 begins in **(15)** zaps (65) adding **(54)** zaps (55) adding **(62)**
(62) zaps (72) adding **(83)** zaps (87) & (89) adding **(77)** zaps (27) & (17) adding **(29)**

Subpattern-1 = **(15),(54),(62),(83),(77),(29)**
B E D G I C

1 004

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1		3		
row2				3			3		3_1
row3	X								
row4								X	
row5			3	3_1					
row6		3_1			3				
row7		3					3_1		
row8			3_1				3		3
row9						X			

Pattern 1.004, continued.

	B	**C**
D	**E**	
G		**I**

Subpattern-2 begins in **(24)** with box order **B→C→I→G→D→E**

(24) zaps (27) & (29) adding **(17)** zaps (77) & (87) adding **(89)**
(89) zaps (83) adding **(72)** zaps (62) adding **(53)** zaps (54) adding **(65)**

Subpattern-2 = **(24),(17),(89),(72),(53),(65)**
B C I G D E

Back at the starting box B, nothing is pending, and no square is unclaimed in the starting box. The pattern analysis is complete, but what about the two unclaimed squares (27) and (87)? They must be killers. See the next page for further information.

---

1 004

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1		3_2		
row2				3_2			3		3_1
row3	X								
row4								X	
row5			3_2	3_1					
row6		3_1			3_2				
row7		3_2					3_1		
row8			3_1				3		3_2
row9						X			

Pattern 1.004, continued.

	B	**C**
D	**E**	
G		**I**

This is the sudoku after completion of the two subpatterns: What about the two unsubscripted 3's in squares (27) and (87)? They are killers, candidates which do not have viable continuations to become subpatterns. One way to test them is by seeing what would happen if they were promoted to established 3's. See the introduction for an example of such testing.

1 004

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1		3_2		
row2				3_2			3_K		3_1
row3	X								
row4								X	
row5			3_2	3_1					
row6		3_1			3_2				
row7		3_2					3_1		
row8			3_1				3_K		3_2
row9						X			

Pattern Code	Box Orientation	Patterns with the same box code
3-------2 **| |** **2 – 3 |** **| |** **3 – 2**	**A3--------B2** **| |** **D2 – F3 |** **| |** **I3 –H2**	**none** **(box orientation for 014: swap columns 2 & 3)**

A	**B**	
D		**F**
	H	**I**

A→D→F→I→H→B

Subpattern-1 starts in **(21)** zaps (51) adding **(42)** zaps (47) & (48) adding **(57)**
(57) zaps (87) & (97) adding **(98)** zaps (95) adding **(86)** zaps (26) adding **(35)**

Subpattern-1 = **(21),(42),(57),(98),(86),(35)**
A D F I H B

---

1 014

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_1					5			
row3	5	5			5_1				
row4		5_1					5	5	
row5	5						5_1		
row6				X					
row7			X						
row8						5_1	5		
row9					5		5	5_1	

Pattern 1.014, continued.

A	**B**	
D		**F**
	H	**I**

A→D→F→I→H→B

Subpattern-2 begins in **(31)** zaps (51) adding **(42)** zaps (47) & (48) adding **(57)**
(57) zaps (87) & (97) adding **(98)** zaps (95) adding **(86)** zaps (26) adding **(35)**
Subpattern-2 = **(31),(42),(57),(98),(86),(35)**

But there are two members of the same subpattern-2 in row 3, **(31)** & **(35)**, based on the choice of square (31) as the beginning of subpattern-2. Moreover, every choice in the development of subpattern-2 is forced, based only on the choice of (31). Therefore the choice of (31) as the beginning of a subpattern leads to a contradiction. Therefore square (31) cannot be a member of a subpattern, so it must be a killer. We backtrack through all the squares of subpattern-2, removing the subscript 2 from all of them, until we get back to square (31), where, after we remove the subscript 2, we place the subscript K, for killer. On the next page, we'll begin a new subpattern-2 in a different square of box A.

1 014

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_{1}					5			
row3	5_{2}	5			5_{12}				
row4		5_{12}					5	5	
row5	5						5_{12}		
row6				X					
row7			X						
row8						5_{12}	5		
row9					5		5	5_{12}	

Pattern 1.014, continued.

A	**B**	
D		**F**
	H	**I**

A→D→F→I→H→B

This time we choose square (32) as the beginning square of subpattern-2. This choice is forced, as there is no other.

(32) zaps (42) adding **(51)** zaps (57) adding **(47)** and pending ***(48)***
(47) zaps (87) & (97) adding **(98)** zaps (95) adding **(86)** zaps (96) adding **(35)**

But then there are two squares in subpattern-2 – (32) and (35), and the choice back in the pending box F which led to this was square (57). We must backtrack to this point in the development of subpattern-2 and make the choice in the pending square instead. We'll accomplish this on the next page.

1 014

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_{1}					5			
row3	5_{K}	5_{2}			5_{12}				
row4		5_{1}					5_{2}	5_{p}	
row5	5_{2}						5_{1}		
row6				X					*P*
row7			X						
row8						5_{12}	5		
row9					5		5	5_{12}	

Pattern 1.014, continued.

A	**B**	
D		**F**
	H	**I**

A→D→F→I→H→B

After backtracking subpattern-2 back to the pending box F, we remove the pending P and choose the pending square (48) as the extension of subpattern-2.

(48) zaps ((98) adding **(97)** and pending **(87)**
(97) zaps (95) adding **(86)** zaps (26) adding **(35)**

But now there are two members of subpattern-2 in the same row 3 – namely (32) and (35). The source of this contradiction goes back to the choice of pending square (87), so we must backtrack to the pending box I, cancel the choice of (97) for subpattern-2, and choose the pending square instead. We'll accomplish this on the next page.

1 014

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	$5_{\mathbf{1}}$					5			
row3	$5_{\mathbf{K}}$	$5_{\mathbf{2}}$			$5_{\mathbf{12}}$				
row4		$5_{\mathbf{1}}$					5	$5_{\mathbf{2}}$	
row5	$5_{\mathbf{2}}$						$5_{\mathbf{1}}$		
row6				X					
row7			X						*P*
row8						$5_{\mathbf{12}}$	$5_{\mathbf{p}}$		
row9					5		$5_{\mathbf{2}}$	$5_{\mathbf{1}}$	

Pattern 1.014, continued.

A	**B**	
D		**F**
	H	**I**

A→D→F→I→H→B

Backtracking back to the pending box B, we remove the pending P and assign subpattern-2 to the pending square (87) instead.

(87) zaps (86) adding **(95)** zaps (35) adding **(26)**

Back at the starting box A, there are no unclaimed squares and no pending condition. Therefore we are done. There are still two unclaimed squares, (47) and (97), which must both be killers, and we must subscript them as such.

1 014

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_1					5_2			
row3	5_K	5_2			5_1				
row4		5_1					5_K	5_2	
row5	5_2						5_1		
row6				X					
row7			X						
row8						5_1	5_2		
row9					5_2		5_K	5_1	

Pattern Code	Box Orientation	Patterns with the same box code
3-------3 **| |** **2 – 2 |** **|** **3 2**	**C3---------B2** **| |** **F3 – D2 |** **| |** **G2 –H3**	**none**

(box orientation for 018: interchange columns 2 & 3, then columns 1 & 2)

	B	**C**
D		**F**
G	**H**	

B→C→F→D→G→H for subpattern-1
B→H→G→D→F→C for subpattern-2

Using B as the starting box, and these two box orders, we can avoid all pending boxes.

Subpattern-1 begins in **(24)** with box order **B→C→F→D→G→H**

(24) zaps (27) & (29) adding **(17)** zaps (57) & (67) adding **(59)** zaps (53) adding **(61)**
(61) zaps (71) adding **(93)** zaps (94) & (95) adding **(75)**

Subpattern-1 = **(24),(17),(59),(61),(93),(75)**
B C F D G H

---

1 018

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8		8_1		
row2				8_1			8		8
row3		X							
row4						X			
row5			8				8		8_1
row6	8_1						8		
row7	8				8_1				
row8								X	
row9			8_1	8	8				

Pattern 1.018, continued.

	B	**C**
D		**F**
G	**H**	

Subpattern-2 begins in **(15)** with box order **B→H→G→D→F→C**

(15) zaps (75) & (95) adding **(94)** zaps (93) adding **(71)** zaps (61) adding **(53)**
(53) zaps (57) & (59) adding **(67)** zaps (27) & (17) adding **(29)**

Subpattern-2 = **(15),(94),(71),(53),(67),(29)**
B H G D F C

Back at the starting box B, there are no unclaimed squares in the starting box, and no pending conditions anywhere, so we are done. The unclaimed squares (27), (57), and (95) must all be killers, and we shall assign them all the subscript K.

---

1 018

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8_2		8_1		
row2				8_1			8_K		8_2
row3		X							
row4						X			
row5			8_2				8_K		8_1
row6	8_1						8_2		
row7	8_2				8_1				
row8								X	
row9			8_1	8_2	8_K				

Chapter 2. Patterns with 2 subscripts.

Pattern 2.023 L	Box Orientation	Patterns with the same box code
3 – 2 **|** **2**	**E – D** **|** **H**	**023, 038, 047, 048, 056, 066, 068, 091, 092, 093, 094, 096, 103, 105, 126, 145.**
(box orientation for 023 – interchange stacks 1 & 2)		

D	**E**	
	H	

Order of boxes: E→D→H

Subpattern-1 begins in **(44)** zaps (43) adding **(53)**
(44) zaps (94) adding **(95)**

Subpattern-1**: (44),(53),(95)**
E D H

2 023 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3						X			
row4			3	3_1	3				
row5			3_1	3					
row6									X
row7							X		
row8		X							
row9				3	3_1				

Pattern 2.023, continued.

D	**E**	
	H	

Order of boxes: E→D→H

Subpattern-2 begins in **(45)** zaps (43) adding **(53)**
(45) zaps (95) adding **(94)**

Subpattern-2**: (45),(53),(94)**
E D H

2 023 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3						X			
row4			3	3_1	3_2				
row5			3_{12}	3					
row6									X
row7							X		
row8		X							
row9				3_2	3_1				

Pattern 2.023, continued.

D	**E**	
	H	

Order of boxes: E→D→H

Subpattern-3 begins in **(54)** zaps (53) adding **(43)**
(54) zaps (94) adding **(95)**

Subpattern-3**: (54),(43),(95)**
E D H

Back at the starting box, nothing is pending and no squares are unclaimed. Done.

2 023 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3						X			
row4			3_{3}	3_{1}	3_{2}				
row5			3_{12}	3_{3}					
row6									X
row7							X		
row8		X							
row9				3_{2}	3_{13}				

Pattern 2.030	Box Orientation	Patterns with the same box code
3 – 2 – 2	A – D – G	102

A		
D		
G		

Box order:A→D→G

Subpattern-1 begins in **(31)** zaps (41) adding **(42)**
(31) zaps (81) adding **(83)**

Subpattern-1**: (31),(42),(83)**
A D G

Subpattern-2 begins in **(32)** zaps (42) adding **(41)** zaps (81) adding **(83)**

Subpattern-2**: (32),(41),(83)**
A D G

2 030 A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2							X		
row3	3_{1}	3_{2}	3						
row4	3_{2}	3_{1}							
row5								X	
row6					X				
row7						X			
row8	3		3_{12}						
row9									

Pattern 2.030, continued.

A		
D		
G		

Box order:A→D→G

Subpattern-3 begins in **(33)** zaps (83) adding **(81)** zaps (41) adding **(42)**

Subpattern-3**: (33),(81),(42)**
A G D

Back at the starting box A, nothing is pending and no squares are unclaimed. The analysis is complete.

2 030 A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2							X		
row3	3_{1}	3_{2}	3_{3}						
row4	3_{2}	3_{13}							
row5								X	
row6					X				
row7						X			
row8	3_{3}		3_{12}						
row9									

Pattern 2.110	Box Orientation	Patterns with the same box code
3 – 2 – 2	**H – I – G**	**113, 114.**
|	**|**	
2	**E**	

(box orientation for 110: switch bands 1 & 3, then stacks 1 & 2, then stacks 2 & 3)

	E	
G	**H**	**I**

Box order: H→E→G→I

Subpattern-1 begins in **(84)** zaps (64) adding **(65)**
(84) zaps (82) adding **(92)** zaps (98) adding **(78)**

Subpattern-1: (84),(65),(92),(78)
H E G I

2 110 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3						X			
row4									X
row5			X						
row6				4	4_1				
row7					4			4_1	
row8		4		4_1	4				
row9		4_1						4	

Pattern 2.110, continued.

	E	
G	**H**	**I**

Subpattern-2 begins in **(75)** with box order **H→E→I→G**

(75) zaps (65) adding **(64)**
(75) zaps (78) adding **(98)** zaps (92) adding **(62)**

Subpattern-2 = **(75),(64),(98),(62)**
H E I G

2 110 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3						X			
row4									X
row5			X						
row6				4_2	4_1				
row7					4_2			4_2	
row8		4_2		4_1	4				
row9		4_1						4_2	

Pattern 2.110, continued.

	E	
G	**H**	**I**

Subpattern-3 is begun in **(85)** with box order **H→E→G→I**

(85) zaps (65) adding **(64)**
(85) zaps (82) adding **(92)** zaps (98) adding **(78)**

Subpattern-3 = **(85),(64),(92),(78)**
H E G I

Back at the starting box H, nothing is pending, no squares are unclaimed, so the analysis is complete.

2 110 A4s

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3						X			
row4									X
row5			X						
row6				4_{23}	4_{1}				
row7					4_{2}			4_{13}	
row8		4_{2}		4_{1}	4_{3}				
row9		4_{13}						4_{2}	

Pattern 2.039 L	Box Orientation	Patterns with the same box code
3 – 2 – 2 **|** **2**	**A – D– G** **|** **C**	**051, 070, 072, 079, 095, 107, 110, 120, 123.**

(box orientation for 039: rotate sudoku 90 degrees counterclockwise, then swap bands 2 & 3, then swap bands 1 & 2)

A		**C**
D		
G		

Subpattern-1 will begin in **(11)** with box order **A→C→G→D**

(11) zaps (19) adding **(39)**
(11) zaps (91) adding **(93)** zaps (53) adding **(52)**

Subpattern-1 = **(11),(39),(93),(52)**
A C G D

2 039 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$7_{\mathbf{1}}$		7						7
row2					X				
row3		7							$7_{\mathbf{1}}$
row4							X		
row5		$7_{\mathbf{1}}$	7						
row6				X					
row7						X			
row8								X	
row9	7		$7_{\mathbf{1}}$						

Pattern 2.039, continued.

A		**C**
D		
G		

Subpattern-2 will begin in **(13)** with box order **A→C→D→G**

(13) zaps (19) adding **(39)**
(13) zaps (53) adding **(52)**
(13) zaps (93) adding **(91)**

Subpattern-2 = **(13),(39),(52),(91)**

A C D G

2 039

A4 L	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$7_{\mathbf{1}}$		$7_{\mathbf{2}}$						7
row2					X				
row3		7							$7_{\mathbf{12}}$
row4							X		
row5		$7_{\mathbf{12}}$	7						
row6				X					
row7						X			
row8								X	
row9	$7_{\mathbf{2}}$		$7_{\mathbf{1}}$						

Pattern **2.039, continued.**

A		**C**
D		
G		

Subpattern-3 will begin in **(32)** with box order **A→C→D→G**

(32) zaps (39) adding **(19)**
(32) zaps (52) adding **(53)** zaps (93) adding **(91)**

Subpattern-3 = (32),(19),((53),(91)

Back at the starting box A, nothing is pending, no squares remain unclaimed, so the pattern analysis is complete.

2 039 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$7_{\mathbf{1}}$		$7_{\mathbf{2}}$						$7_{\mathbf{3}}$
row2					X				
row3		$7_{\mathbf{3}}$							$7_{\mathbf{12}}$
row4							X		
row5		$7_{\mathbf{12}}$	$7_{\mathbf{3}}$						
row6				X					
row7						X			
row8								X	
row9	$7_{\mathbf{23}}$		$7_{\mathbf{1}}$						

Pattern 2.104	Box Orientation	Patterns with the same box code
3 – 2 – 2 | **2**	**D – A – G** | **C**	**none**

(box orientation for 039: rotate sudoku 90 degrees clockwise, then swap stacks 1 & 2, then swap stacks 2 & 3, then swap bands 2 & 3)

A		**C**
D		
G		

Box order**: D→G→A→C**

Subpattern-1 begins in **(52)** zaps (82) adding **(81)**
(52) zaps (22) adding **(13)** zaps (19) adding **(29)**

Subpattern-1 = (52),(81),(13),(29)

2 104 A6 X

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			9_1						9
row2		9							9_1
row3						X			
row4				X					
row5	9	9_1	9						
row6								X	
row7					X				
row8	9_1	9							
row9							X		

Pattern 2.104, continued.

A		**C**
D		
G		

Subpattern-2 starts in **(51)** with box order **D→G→A→C**

(51) zaps (81) adding **(82)** zaps (22) adding **(13)**
(13) zaps (19) adding **(29)**

Subpattern-2 = **(51),(82),(13),(29)**
D G A C

Subpattern-3 starts in **(53)** with box order **D→A→G→C**

(53) zaps (13) adding **(22)** zaps (82) adding **(81)**
(22) zaps (29) adding **(19)**

Subpattern-3 = **(53),(22),(81),(19)**
D A G C

Back at the starting box, nothing is pending, no boxes unclaimed, Done.

2 104 A6 X

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			9_{12}						9_{3}
row2		9_{3}							9_{12}
row3						X			
row4				X					
row5	9_{2}	9_{1}	9_{3}						
row6								X	
row7					X				
row8	9_{13}	9_{2}							
row9							X		

Pattern 2.097 L	Box Orientation	Patterns with the same box code
3 – 2 – 2	**F – E – D**	**none**
|	**|**	
2 – 2	**H – I**	
(box orientation for 097: swap bands 1 & 2, then stacks 1 & 3)		

D	**E**	**F**
	H	**I**

We'll omit boxes A, B & C from the calculcations, since they have no candidates, and restrict our calculations to boxes D, E and F, then use derivative squares to complete boxes H and I.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							

2 097 A5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4			2	2			2		
row5				2				2	
row6			2				2		

row7						$2_{\mathbf{C}}$	$2_{\mathbf{A}}$		
row8	X								
row9						$2_{\mathbf{D}}$		$2_{\mathbf{B}}$	

Pattern 2.097, continued.

D	**E**	**F**

Subpattern-1 begins in **(67)** with box order **F→D→E**

(67) zaps (63) adding **(43)** zaps (44) adding **(54)**

Subpattern-1 = **(67),(43),(54)**
F D E

Subpattern-2 begins in **(58)** with box order **F→E→D**

(58) zaps (54) adding **(44)** zaps (45) adding **(54)**

Subpattern-2 = **(58),(44),(54)**
F E D

Subpattern-3 begins in **(47)** with box order **F→E→D**

(47) zaps (44) adding **(54)**
(47) zaps (43) adding **(63)**

Subpattern-3 = **(47),(54),(63)**
F E D

Back at the starting box F, nothing is pending, no square unclaimed. Done.

2 097 A5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4			$2_{\mathbf{1}}$	$2_{\mathbf{2}}$			$2_{\mathbf{3}}$		
row5				$2_{\mathbf{13}}$				$2_{\mathbf{2}}$	
row6			$2_{\mathbf{23}}$				$2_{\mathbf{1}}$		

A and 3 and 1 = 123, so **A = 2**
A and B = 123, so **B = 13**
C and A add up to 123, so **C = 13**
C and D add up to 123, so **D = 2**

row7						$2_{\mathbf{C}}$	$2_{\mathbf{A}}$		
row8	X								
row9						$2_{\mathbf{D}}$		$2_{\mathbf{B}}$	

Pattern 2.097, continued.

D	**E**	**F**
	H	**I**

Putting the three bands back together, we have the final solution:

2 097 A5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4			2_{1}	2_{2}			2_{3}		
row5				2_{13}				2_{2}	
row6			2_{23}				2_{1}		
row7						2_{13}	2_{2}		
row8	X								
row9						2_{2}		2_{13}	

Pattern 2.002	Box Orientation	Patterns with the same box code
2 | **3 – 2** | **2**	**F** | **B – C** | **H**	**003, 006, 010, 011, 050, 078, 080, 089, 098, 099, 103, 106, 115, 118, 122, 124, 152, 154.**

(box orientation for 002: swap stacks 1 & 2, then 2 & 3, then swap bands 1 & 2.)

	B	**C**
		F
	H	

Box order: B→H→C→F

Subpattern-1 begins in **(24)** zaps (94) adding **(95)**
(24) zaps (27) adding **(38)** zaps (68) adding **(67)**

Subpattern-1 = **(24),(95),(38),(67)**
B H C F

Subpattern-2 begins in **(34)** zaps (94) adding **(95)**
(34) zaps (38) adding **(27)** zaps (67) adding **(68)**

Subpattern-2 = **(34),(95),(27),(68)**
B H C F

2 002 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				1_1			1_2		
row3				1_2	1			1_1	
row4									
row5									
row6							1_1	1_2	
row7									
row8									
row9				1	1_{12}				

Pattern 2.002, continued.

	B	**C**
		F
	H	

Box order: B→H→C→F

Subpattern-3 begins in **(35)** zaps (95) adding **(94)**
(35) zaps (38) adding **(27)** zaps (67) adding **(68)**

Subpattern-3 = **(35),(94),(27),(68)**
B H C F

Back at the starting box B, nothing is pending and no boxes are unclaimed. The pattern is complete.

2 002 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				1_{1}			1_{23}		
row3				1_{2}	1_{3}			1_{1}	
row4									
row5									
row6							1_{1}	1_{23}	
row7									
row8									
row9				1_{3}	1_{12}				

Pattern 2.004	Box Orientation	Patterns with the same box code
2 | **3 – 2** | **2 – 2**	**C** | **E – F** | **G – H**	**026, 073, 111, 119, 146.**

		C
	E	**F**
G	**H**	

Box order: E→F→C→H→G

Subpattern-1 begins in **(45)** zaps (47) adding **(58)** zaps (18) adding **(17)**
(45) zaps (85) adding **(76)** zaps (71) adding **(61)**

Subpattern-1 = **(45),(58),(17),(76),(61)**
E F C H G

Subpattern-2 begins in **(55)** zaps (58) adding **(47)** zaps (17) adding **(18)**
(55) zaps (85) adding **(76)** zaps (71) adding **(81)**

Subpattern-2 = **(55),(47),(18),(76),(81)**
E F C H G

2 004 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							9_1	9_2	
row2				X					
row3			X						
row4					9_1		9_2		
row5					9_2	9		9_1	
row6		X							
row7	9					9_{12}			
row8	9_{12}				9				
row9									X

Pattern 2.004, continued.

		C
	E	**F**
G	**H**	

Box order**: E→F→C→H→G**

Subpattern-3 begins in **(56)** zaps (58) adding **(47)** zaps (17) adding **(18)**
(56) zaps (76) adding **(85)** zaps (81) adding **(71)**

Subpattern-3 = **(56),(47),(18),(85),(71)**
E F C H G

Back at the starting box E, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

2 004 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							9_{1}	9_{23}	
row2				X					
row3			X						
row4					9_{1}		9_{23}		
row5					9_{2}	9_{3}		9_{1}	
row6		X							
row7	9_{3}					9_{12}			
row8	9_{12}				9_{3}				
row9									X

Pattern 2.008	Box Orientation	Patterns with the same box code
2 – 2 | **3 – 2** | **2**	**I – C** | **B – H** | **A**	**044, 071, 117, 151.**

A	**B**	**C**
	H	**I**

Box order: B→A→H→I→C

Subpattern-1 begins in **(15)** zaps (11) adding **(21)**
(15) zaps (95) adding **(86)** zaps (88) adding **(99)** zaps (39) adding **(38)**

Subpattern-1 = **(15),(21),(86),(99),(38)**
B A H I C

Subpattern-2 begins in **(16)** zaps (11) adding **(21)**
(16) zaps (86) adding **(95)** zaps (99) adding **(88)** zaps 938) adding **(39)**

Subpattern-2 = **(16),(21),(95),(88),(39)**
B A H I C

2 008 F

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5				5_1	5_2			
row2	5_{12}					5			
row3								5_1	5_2
row4									
row5		X					X		
row6				X					
row7			X						
row8						5_1		5_2	
row9					5_2				5_1

Pattern 2.008

A	**B**	**C**
	H	**I**

Box order: B→A→H→I→C

Subpattern-3 begins in **(26)** zaps (21) adding **(11)**
(26) zaps (86) adding **(95)** zaps (99) adding **(88)** zaps (38) adding **(39)**

Subpattern-3 = **(26),(11),(95),(88),(39)**
B A H I C

Back at the starting box, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

2 008 F

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5_{3}				5_{1}	5_{2}			
row2	5_{12}					5_{3}			
row3								5_{1}	5_{23}
row4									
row5		X					X		
row6				X					
row7			X						
row8						5_{1}		5_{23}	
row9					5_{23}				5_{1}

Pattern 2.007	Box Orientation	Patterns with the same box code
3 – 2 – 2 L **│ │** **2 – 2**	**G – I – H** **│ │** **D – F**	**015, 017, 019, 021, 027, 029, 031, 046, 049, 059, 062, 063, 067, 074, 075, 077, 082, 083, 088, 108,150.**

D		**F**
G	**H**	**I**

Box order: G→H→I→F→D

Subpattern-1 begins in **(72)** zaps (76) adding **(96)**
(72) zaps (78) adding **(87)** zaps (47) adding **(58)** zaps (52) adding **(41)**

Subpattern-1 = **(72),(96),(87),(58),(41)**
G H I F D

Subpattern-2 begins in **(92)** zaps (96) adding **(76)** zaps (78) adding **(87)**
(87) zaps (47) adding **(58)** zaps (52) adding **(41)**

Subpattern-2 = **(92),(76),(87),(58),(41)**
G H I F D

2 007 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2									X
row3				X					
row4	6_{12}						6		
row5		6						6_{12}	
row6					X				
row7		6_1				6_2		6	
row8	6						6_{12}		
row9		6_2				6_1			

Pattern 2.007, continued.

D		**F**
G	**H**	**I**

Box order changed to**: G→I→H→F→D**

Subpattern-3 begins in **(81)** zaps (87) adding **(78)** zaps (76) adding **(96)**
(78) zaps (58) adding **(47)** zaps (41) adding **(52)**

Subpattern-3 = **(81),(78),(96),(47),(52)**
G I H F D

Back at the starting box, nothing is pending, and no boxes are unclaimed.
The pattern analysis is complete.

2 007 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2									X
row3				X					
row4	6_{12}						6_{3}		
row5		6_{3}						6_{12}	
row6					X				
row7		6_{1}				6_{2}		6_{3}	
row8	6_{3}						6_{12}		
row9		6_{2}				6_{13}			

Pattern **2.036**	Box Orientation	Patterns with the same box code
3 – 2 – 2 **│ │** **2 – 2** **│** **2**	**G – H – I** **│ │** **D – E** **│** **A**	**none** **(box orientation for 036: swap bands 1 & 3)**

A		
D	**E**	
G	**H**	**I**

Box order: G→D→A→E→H→I

Subpattern-1 is begun in **(71)** zaps (61) adding **(52)** zaps (12) adding **(13)**
(52) zaps (54) adding **(65)** zaps (85) adding **(94)**
(71) zaps (79) adding **(89)**

Subpattern-1 = **(71),(52),(13),(65),(94),(89)**
G D A E H I

Subpattern-2 is begun in **(81)** zaps (61) adding **(52)** zaps (12) adding **(13)**
(52) zaps (54) adding **(65)** zaps (85) adding **(94)**
(81) zaps (89) adding **(79)**

Subpattern-2 = **(81),(52),(13),(65)(94),(79)**
G D A E H I

2 036 G4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9	9_{12}						
row2						X			
row3							X		
row4								X	
row5		9_{12}		9					
row6	9				9_{12}				
row7	9_1								9_2
row8	9_2				9				9_1
row9			9	9_{12}					

Example 2.036, continued.

A		
D	**E**	
G	**H**	**I**

New box order:G→A→D→E→H→I.

Subpattern-3 begins in **(93)** zaps (13) adding **(12)** zaps (52) adding **(61)**
(61) zaps (65) adding **(54)** zaps (94) adding **(85)** zaps (89) adding **(79)**

Subpattern-3 = **(93),(12),(61),(54),(85),(79)**

Back at the starting box G, nothing is pending and no boxes are unclaimed, so we are done.

2 036 G4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9_{3}	9_{12}						
row2						X			
row3							X		
row4								X	
row5		9_{12}		9_{3}					
row6	9_{3}				9_{12}				
row7	9_{1}								9_{23}
row8	9_{2}				9_{3}				9_{1}
row9			9_{3}	9_{12}					

Pattern **2.045**	Box Orientation	Patterns with the same box code
3----2 **| |** **2 – 2 – 2** **|** **2**	**C----I** **| |** **B – H – E** **|** **A**	**none** **(Box orientation for 045 –** **rotate 90 degrees counterclockwise,** **then swap stacks 2 & 3)**

A	**B**	**C**
	E	
	H	**I**

Subpattern-1 begins in **(18)** with box order **C→A→B→E→G→H**

(18) zaps (12) adding **(32)** zaps (35) adding **(24)** zaps (44) adding **(46)**
(46) zaps (86) adding **(75)** zaps (78) adding **(89)**

Subpattern-1 = **(18),(32),(24),(46),(75),(89)**
C A B E G H

Subpattern-2 begins in **(29)** with box order **C→B→A→G→E→H**

(29) zaps (24) adding **(35)** zaps (32) adding **(12)**
(35) zaps (75) adding **(86)** zaps (46) adding **(44)**
(86) zaps (89) adding **(78)**

Subpattern-2 = **(29),(35),(12),(86),(44),(78)**
C B A G E H

2 045 G5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_2						1_1	
row2				1_1					1_2
row3		1_1			1_2			1	
row4				1_2		1_1			
row5			X						
row6							X		
row7					1_1			1_2	
row8						1_2			1_1
row9	X								

Example 2.045, continued.

A	**B**	**C**
	E	
	H	**I**

Subpattern-3 begins in **(38)** with box order **C→B→A→E→H→I**
(38) zaps (35) adding **(24)**
(38) zaps (32) adding **(12)**
(24) zaps (44) adding **(46)** zaps (86) adding **(75)** zaps (78) adding **(89)**

Subpattern-3 = **(38),(24),(12),(46),(75),(89)**
C B A E H I

Back at the starting box C, nothing is pending, and no squares are unclaimed, so we are done.

2 045 G5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{23}						1_{1}	
row2				1_{13}					1_{2}
row3		1_{1}			1_{2}			1_{3}	
row4				1_{2}		1_{13}			
row5			X						
row6							X		
row7					1_{13}			1_{2}	
row8						1_{2}			1_{13}
row9	X								

Pattern 2.156	Box Orientation	Patterns with the same box code
3 – 2 – 2 **│ │** **2 – 2** **│** **2**	**B – A** **│ │** **E – D – F** **│** **H**	**none** **(Box orientation for 156 – swap stacks 1 & 3)**

A	**B**	
D	**E**	**F**
	H	

Subpattern-1 begins in **(15)** with box order **B→A→D→F→E→H**
(15) zaps (12) adding **(23)** zaps (53) adding **(42)** zaps (48) adding **(68)**
(68) zaps (65) adding **(56)** zaps (86) adding **(84)**

Subpattern-1 = **(15),(23),(42),(68),(56),(84)**
B A D F E H

2 156 G7 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1			$1_{\mathbf{1}}$				
row2			$1_{\mathbf{1}}$	1		1			
row3							X		
row4		$1_{\mathbf{1}}$						1	
row5			1			$1_{\mathbf{1}}$			
row6					1			$1_{\mathbf{1}}$	
row7									X
row8				$1_{\mathbf{1}}$		1			
row9	X								

Example 2.156. continued.

A	**B**	
D	**E**	**F**
	H	

Subpattern-2 begins in **(24)** with box order **B→A→D→E→F→H**

(24) zaps (23) adding **(12)** zaps (42) adding **(53)** zaps (56) adding **(65)**
(65) zaps (68) adding **(48)**
(24) zaps (84) adding **(86)**

Subpattern-2 = **(24),(12),(53),(65),(48),(86)**
B A D E F H

Subpattern-3 begins in **(26)** with box order **B→A→D→E→F→H**

(26) zaps (23) adding **(12)** zaps (42) adding **(53)** zaps (56) adding **(65)**
(65) zaps (68) adding **(48)**
(26) zaps (86) adding **(84)**

Subpattern-3 = **(26),(12),(53),(65),(48),(84)**
B A D E F H

Back at the starting box B, nothing is pending, and no squares are unclaimed, so the pattern analysis is complete.

2 156 G7 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{23}			1_{1}				
row2			1_{1}	1_{2}		1_{3}			
row3							X		
row4		1_{1}						1_{23}	
row5			1_{23}			1_{1}			
row6					1_{23}			1_{1}	
row7									X
row8				1_{13}		1_{2}			
row9	X								

Pattern **2.143**	Box Orientation	Patterns with the same box code
2 – 2 | **3 – 2 – 2** | | | **2** **2**	**C – A** | **D – E – F** | | | **H** **G**	**none**

A		**C**
D	**E**	**F**
G	**H**	

Subpattern-1 begins in **(52)** with box order **D(→G)→F→E(→H)→C→A**

(52) zaps (82) adding **(83)**
(52) zaps (57) adding **(49)**
(49) zaps (44) adding **(66)** zaps (76) adding **(74)**
(49) zaps (39) adding **(27)** zaps (21) adding **(31)**

Subpattern-1 = **(52),(83),(49),(66),(74),(27),(31)**
D G F E H C A

2 143 G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	5						5_1		
row3	5_1								5
row4				5					5_1
row5		5_1	5				5		
row6		5				5_1			
row7				5_1		*5*			
row8		*5*	5_1						
row9								X	

Example 2.143, continued.

A		**C**
D	**E**	**F**
G	**H**	

Subpattern-1 begins in **(52)** with box order **D(→G)→F→E(→H)→C→A**

(52) zaps (83) adding **(82)**
(52) zaps (57) adding **(49)** zaps (44) adding **(66)** zaps (76) adding **(74)**
(49) zaps (39) adding **(27)** zaps (21) adding **(31)**

Subpattern-1 = **(53),(82),(49),(66),(74),(27),(31)**
D G F E H C A

Subpattern-2 begins in **(53)** with box order **D(→G)→F→E(→H)→C→A**

(53) zaps (83) adding **(82)**
(53) zaps (57) adding **(49)** zaps (44) adding **(66)** zaps (76) adding **(74)**
(49) zaps (39) adding **(27)** zaps (21) adding **(31)**

Subpattern-2 = **(53),(82),(49),(66),(74),(27),(41)**
D G F E H C A

2 143 G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	5						5_{12}		
row3	5_{12}								5
row4				5_{3}					5_{12}
row5		5_{1}	5_{2}				5		
row6		5				5_{12}			
row7				5_{2}		5			
row8		5_{2}	5						
row9								X	

Example 2.143, continued.

A		**C**
D	**E**	**F**
G	**H**	

Subpattern-3 begins in **(62)** with **<u>new box order</u> D(→G)→E(→H)→F→C→A**

(62) zaps (83) adding **(82)**
(62) zaps (66) adding **(44)** zaps (74) adding **(76)**
(62) zaps (49) adding **(57)** zaps (27) adding **(39)** zaps (31) adding **(21)**

Subpattern-3 = **(62),(82),(44),(76),(57),(39),(21)**
D G E H F C A

Back at the starting box, nothing is pending, and no squares are unclaimed, The pattern analysis is complete.

2 143 G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	5_{3}						5_{12}		
row3	5_{12}								5_{3}
row4				5_{3}					5_{12}
row5		5_{1}	5_{2}				5_{3}		
row6		5_{3}				5_{12}			
row7				5_{2}		5_{3}			
row8		5_{2}	5_{3}						
row9								X	

Pattern **2.053**	Box Orientation	Patterns with the same box code
3 – 3	**H – B**	**109**
| |	**| |**	**(Box orientation for 053: rotate 90 degrees clockwise,**
2 – 2	**I – C**	**then swap bands 1 & 2, then swap bands 2 & 3)**

	B	**C**
	H	**I**

Subpattern-1 begins in **(25)** with box order **B→C→I→H**

(25) zaps (28) adding **(39)** zaps (99) adding **(78)** zaps (74) & (75) adding **(94)**

Subpattern-1 = **(25),(39),(78),(94)**
B C I H

Subpattern-2 begins in **(34)** with box order **B→C→I→H**

(34) zaps (39) adding **(28)** zaps (78) adding **(99)**
(34) zaps (34) & (35) adding **(75)**

Subpattern-2 = **(34),(28),(99),(75)**
B C I H

2 053 L2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2					3_1			3_2	
row3				3_2	3				3_1
row4			X						
row5						X			
row6							X		
row7				3	3_2			3_1	
row8	X								
row9				3_1					3_2

Pattern 2.053, continued.

	B	**C**
	H	**I**

Subpattern-3 begins in **(35)** with box order **B→C→I→H**

(35) zaps (39) adding **(28)** zaps (78) adding **(99)**
(35) zaps (75) while **(99)** zaps (94) adding **(74)**
Subpattern-3 = **(35),(28),(99),(74)**
B C I H

Back at the starting box B, there is nothing pending and no boxes left unclaimed. The analysis is complete.

2 053 L2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2					3_{1}			3_{23}	
row3				3_{2}	3_{3}				3_{1}
row4			X						
row5						X			
row6							X		
row7				3_{3}	3_{2}			3_{1}	
row8	X								
row9				3_{1}					3_{23}

Pattern 2.138	Box Orientation	Patterns with the same box code
3 – 3 – 2	**E – F – D**	**none**
|	**|**	**(Box orientation for 138: swap bands 1 & 2,**
2	**B**	**then swap stacks 1 & 2, then stacks 2 & 3)**

	B	
D	**E**	**F**

Subpattern-1 begins in **(46)** with box order **E→D→F→B**

(46) zaps (43) adding **(63)**
(46) zaps (48) while **(63)** zaps (68) adding **(58)**
(46) zaps (16) adding **(15)**

Subpattern-1 = **(46),(63),(58),(15)**
E D F B

Subpattern-2 begins in **(66)** with box order **E→D→F→B**

(66) zaps (63) adding **(43)**
(66) zaps (68) while **(43)** zaps (48) adding **(58)**
(66) zaps (16) adding **(15)**

Subpattern-2 = **(66),(43),(58),(15)**
E D F B

2 138 L3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_{12}	7			
row2	X								
row3							X		
row4			7_{2}			7_{1}		7	
row5					7			7_{12}	
row6			7_{1}			7_{2}		7	
row7		X							
row8				X					
row9									X

Pattern 2.138, continued.

	B	
D	**E**	**F**

Subpattern-3 begins in **(55)** with box order **E→D→F→B**

(55) zaps **(nothing)** adding **(43)** and pending ***(63)***
(55) zaps (58) while **(43)** zaps (48) adding **(68)**
(55) zaps (15) adding **(16)**

Subpattern-3 = **(55),(43),(68),(16)**
E D F B

Due to the pending situation in **D**, subpattern-4 must
begin in the same starting square **(55)** as subpattern-3
include the pending square **(63)**
The box order is chosen to be **E→D→F→B**

(55) zaps (58) while **(63)** zaps (68) adding **(48)**
(55) zaps (15) adding **(16)**

Subpattern-4 = **(55),(63),(48),(16)**

Back at the starting box E, there is no longer a pending situation, and no boxes remain unclaimed, so the pattern analysis is complete.

2 138 L3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_{12}	7_{34}			
row2	X								
row3							X		
row4			7_{23}			7_{1}		7_{4}	
row5	~~P~~				7_{34}			7_{12}	
row6			7_{13}			7_{2}		7_{3}	
row7		X							
row8				X					
row9									X

Pattern 2.001	Box Orientation	Patterns with the same box code
3 – 3 – 2 **│ │** **2 – 2**	**B – H – E** **│ │** **C – I**	**005, 016, 022, 024, 034, 035, 040, 042, 043, 054, 055, 060, 069, 084, 086, 139, 144, 147, 153.**

(Box orientation for 001: rotate 90 degrees clockwise, then swap bands 1 & 2, then swap bands 2 & 3, then swap stacks 2 & 3, then swap stacks 1 & 2)

	B	**C**
	E	
	H	**I**

Subpattern-1 starts in **(24)** with box order **B→C→I→H→E**

(24) zaps (27) adding **(38)** zaps (78) adding **(87)** zaps (84) & (86) adding **(75)**
(24) zaps (54) adding **(56)**

Subpattern-1 = **(24),(38),(87),(75),(56)**
B C I H E

Subpattern-2 starts in **(26)** with box order **B→C→I→H→E**

(26) zaps (27) adding **(38)** zaps (78) adding **(87)** zaps (84) & (86) adding **(75)**
(26) zaps (56) adding **(54)**

Subpattern-2 = **(26),(38),(87),(75),(54)**
B C I H E

2 001 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				6_1		6_2	6		
row3					6			6_{12}	
row4		X							
row5				6_2		6_1			
row6									X
row7					6_{12}			6	
row8				6		6	6_{12}		
row9			X						

Pattern 2.001, continued.

	B	**C**
	E	
	H	**I**

Subpattern-3 begins in **(35)** with box order **B→C→I→H→E**

(35) zaps (38) adding **(27)** zaps (87) adding **(78)** zaps (75) adding **(84)** and pending ***(86)***
(84) zaps (54) adding **(56)**

Subpattern-3 = **(35),(27),(78),(84),(56)**
B C I H E

Due to the pending situation in **H**, subpattern-4 must
begin in the same starting square **(35)** of subpattern-3
share squares **(27) & (78)** with subpattern-3
include pending square **(86)**
The box order is chosen to be **B→C→I→H→E**

(86) zaps (56) adding **(54)**
Subpattern-4 = **(35),(27),(78),(86),(54)**
B C I H E

Back at the starting box B, nothing is pending, and no squares are unclaimed, so the pattern analysis is complete.

2 001 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				6_{1}		6_{2}	6_{34}		
row3					6_{34}			6_{12}	
row4		X							
row5				6_{24}		6_{13}			
row6									X
row7					6_{12}			6_{34}	
row8				6_{3}		6_{4}	6_{12}		
row9			X		~~P~~				

Pattern **2.085**	Box Orientation	Patterns with the same box code
3 – 3	**I – H**	**087**
| |	**| |**	
3 – 2	**F – E**	
(Box orientation for 085: swap bands 1 & 3, then swap stacks 1 & 3)		

	E	**F**
	H	**I**

Subpattern-1 begins in **(78)** with box order **I→F→E→H**

(78) zaps (68) & (48) adding **(49)** zaps (44) adding **(66)**
(78) zaps (74) & (76) adding **(94)**

Subpattern-1 = **(78),(49),(66),(94)**
I H E F

Subpattern-2 begins in **(98)** with box order **I→F→E→H**

(98) zaps (68) & (48) adding **(49)** zaps (44) adding **(66)**
(66) zaps (76) while **(98)** zaps (94) adding **(74)**

Subpattern-2 = **(98),(49),(66),(74)**
I F E H

2 085 N

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					X				
row3							X		
row4				8				8	8_{12}
row5		X							
row6						8_{12}		8	
row7				8_2		8		8_1	
row8			X						
row9				8_1				8_2	8

Pattern 2.085, continued.

	E	**F**
	H	**I**

Subpattern-3 begins in **(99)** with box order **I→F→E→H**

(99) zaps (49) adding **(68)** and pending ***(48)***
(68) zaps (66) adding **(44)** zaps (74) & (94) adding **(76)**

Subpattern-3 = **(99),(68),(44),(76)**
I F E H

Due to the pending condition in **F,** subpattern-4 must
begin in the same starting square **(99)** as subpattern-3
include the pending square **(48)**
Box order will be **I→F→E→H**

(48) zaps (44) adding **(66)**
(66) zaps (76) while **(99)** zaps (94) adding **(74)**

Subpattern-4 = **(99),(48),(66),(74)**

2 085 N

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					X				
row3							X		
row4				8_{3}				8_{4}	8_{12}
row5		X							~~P~~
row6						8_{124}		8_{3}	
row7				8_{24}		8_{3}		8_{1}	
row8			X						
row9				8_{1}				8_{2}	8_{34}

Pattern **2.136**	Box Orientation	Patterns with the same box code
3 – 3 | | **3 – 2 – 2**	**A – C** | | **G – I – H**	**none**

A		**C**
G	**H**	**I**

Subpattern-1 begins in **(98)** with box order **I→H→G→A→C**

(98) zaps (96) adding **(86)** zaps (81) adding **(73)** zaps (13) & (33) adding **(11)**
(98) zaps (18) & (38) adding **(37)**

Subpattern-1 = **(98),(86),(73),(11),(37)**
I H G A C

Subpattern-2 begins in **(97)** with box order **I→H→G→A→C**

(97) zaps (96) adding **(86)** zaps (81) adding **(73)** zaps (13) & (33) adding **(11)**
(11) zaps (18) while **(97)** zaps (37) adding **(38)**

Subpattern-2 = **(97),(86),(73),(11),(38)**
I H G A C

2 136 O

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}		1					1	
row2				X					
row3	*P*		1				1_1	1_2	
row4		X							
row5					X				
row6									X
row7			1_{12}				1		
row8	1					1_{12}			
row9						1	1_2	1_1	

Pattern 2.136, continued

A		**C**
G	**H**	**I**

Subpattern-3 begins in **(77)** with box order **I→G→H→A→C**

(77) zaps (73) adding **(81)** zaps (86) adding **(96)**
(81) zaps (11) adding **(13)** and pending ***(33)***
(13) zaps (18) while **(77)** zaps (37) adding **(38)**

Subpattern-3 = **(77),(81),(96),(13),(38)**
I G H A C

Due to the pending condition in **A,** subpattern-4 must
begin in the same starting square **(77)** as subpattern-3
share squares **(96), (81)** with subpattern-3
include the pending square **(33)**
(33) zaps (37) & (38) adding **(18)**

Subpattern-4 = **(77),(96),(81),(33),(18)**
I G H A C

Back at the starting box I, there is no longer a pending situation, and no squares remain unclaimed, so the analysis is complete.

2 136 O

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}		1_{3}					1_{4}	
row2				X					
row3	~~P~~		1_{4}				1_{1}	1_{23}	
row4		X							
row5					X				
row6									X
row7			1_{12}				1_{34}		
row8	1_{34}					1_{12}			
row9						1_{34}	1_{2}	1_{1}	

Pattern **2.013**	Box Orientation	Patterns with the same box code
4 – 2	**F – D**	**028, 052, 101, 130, 132.**
|	**|**	
2	**C**	

(Box orientation for 013: Swap stacks 1 & 2, then swap bands 1 & 2)

		C
D		**F**

Box order: F→D→C

Subpattern-1 begins in **(47)** zaps (41) adding **(61)**
(47) zaps (37) adding **(39)**

Subpattern-1 = **(47),(61),(39)**
F D C

Subpattern-2 begins in **(49)** zaps (41) adding **(61)**
(49) zaps (39) adding **(37)**

Subpattern-2 = **(49),(61),(37)**
F D C

---

2 013 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3							3_{2}		3_{1}
row4	3						3_{1}		3_{2}
row5					X				
row6	3_{12}						3		3
row7						X			
row8			X						
row9								X	

Pattern **2.013, continued.**

		C
D		**F**

Box order: F→D→C

Subpattern-3 begins in **(67)** zaps (61) adding **(41)**
(67) zaps (37) adding **(39)**

Subpattern-3 = **(67),(41),(39)**
F D C

Subpattern-4 begins in **(69)** zaps (61) adding **(41)**
(69) zaps (39) adding **(37)**

Subpattern-4 = **(69),(41),(37)**
F D C

At the starting box, nothing is pending and no squares are unclaimed.
The pattern analysis is complete..

2 013 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3							3_{24}		3_{13}
row4	3_{34}						3_{1}		3_{2}
row5					X				
row6	3_{12}						3_{3}		3_{4}
row7						X			
row8			X						
row9								X	

Pattern **2.018**	Box Orientation	Patterns with the same box code
2	**G**	**041, 057, 064, 112, 125, 137, 141.**
|	**|**	
4 – 2	**F – I**	**(Box orientation for 013: rotate 90 degrees**
|	**|**	**counterclockwise, then swap stacks 1 & 2,**
2	**D**	**then stacks 2 & 3, then swap bands 2 & 3)**

D		**F**
G		**I**

Box order: F→D→I→G

Subpattern-1 begins in **(47)** zaps (41) adding **(61)**
(47) zaps (97) adding **(79)** zaps (72) adding **(92)**

Subpattern-1 = **(47),(61),(79),(92)**
F D I G

Subpattern-2 begins in **(49)** zaps (41) adding **(61)**
(49) zaps (79) adding **(97)** zaps (92) adding **(72)**

Subpattern-2 = **(49),(61),(97),(72)**
F D I G

---

2 018 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3			X						
row4	6						6_1		6_2
row5					X				
row6	6_{12}						6		6
row7		6_2							6_1
row8				X					
row9		6_1					6_2		

Example 2.018, continued.

D		**F**
G		**I**

Box order: F→D→I→G

Subpattern-3 begins in **(67)** zaps (61) adding **(41)**
(67) zaps (97) adding **(79)** zaps (72) adding **(92)**

Subpattern-3 = **(67),(41),(79),(92)**
F D I G

Subpattern-4 begins in **(69)** zaps (61) adding **(41)**
(69) zaps (79) adding **(97)** zaps (92) adding **(72)**

Subpattern-4 = **(69),(41),(97),(72)**
F D I G

Back at the starting box, F, there is no pending condition, and no squares remain unclaimed, so the analysis is complete.

2 018 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3			X						
row4	6_{34}						6_{1}		6_{2}
row5					X				
row6	6_{12}						6_{3}		6_{4}
row7		6_{24}							6_{13}
row8				X					
row9		6_{13}					6_{24}		

Pattern **2.058**	Box Orientation	Patterns with the same box code
4 – 2 – 2	**D – A – G**	**none**
|	**|**	
2	**E**	**(Box orientation for 013: rotate 90 degrees clockwise, then swap stacks 1 & 2, then stacks 2 & 3)**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-1 begins in **(41)** with box order **D→A→G→E**

(41) zaps (31) adding **(32)** zaps (92) adding **(93)**
(41) zaps (45) adding **(65)**

Subpattern-1 = **(41),(32),(93),(65)**
D A G E

Subpattern-2 begins in **(43)** with box order **D→G→A→E**

(43) zaps (93) adding **(92)** zaps (32) adding **(31)**
(43) zaps (45) adding **(65)**

Subpattern-2 = **(43),(92),(31),(65)**
D G A E

---

2 058 R

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				X					
row3	2_2	2_1							
row4	2_1		2_2		2				
row5									
row6	2_3		2_4		2_{12}				
row7								X	
row8						X			
row9		2_2	2_1						

Example 2.058, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-3 begins in **(61)** with box order **D→A→G→E**
(61) zaps (31) adding **(32)** zaps (92) adding **(93)**
(61) zaps (65) adding **(45)**
Subpattern-3 = **(61),(32),(93),(45)**
D A G E
Subpattern-4 begins in **(63)** with box order **D→G→A→E**
(63) zaps (93) adding **(92)** zaps (32) adding **(31)**
(63) zaps (65) adding **(45)**
Subpattern-4 = **(63),(92),(31),(45)**
D G A E

Back at the starting box, nothing is pending and no squares unclaimed, so the analysis is complete.

2 058 R

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				X					
row3	2_{24}	2_{13}							
row4	2_{1}		2_{2}		2_{34}				
row5									
row6	2_{3}		2_{4}		2_{12}				
row7								X	
row8						X			
row9		2_{24}	2_{13}						

Pattern **2.134**	Box Orientation	Patterns with the same box code
2 – 2	**I – C**	**none**
|	**|**	
4 – 2	**E – H**	**(Box orientation for 134:**
|	**|**	**rotate 90 degrees counterclockwise,**
2	**D**	**then swap stacks 1 & 2, then swap stacks 2 & 3)**

		C
D	**E**	
	H	**I**

Box order: E→D→H→I→C

Subpattern-1 begins in **(44)** zaps (41) adding **(51)**
(44) zaps (94) adding **(86)** zaps (89) adding **(98)** zaps (28) adding **(29)**

Subpattern-1 = **(44),(51),(86),(98),(29)**
E D H I C

Subpattern-2 begins in **(46)** zaps (41) adding **(51)**
(46) zaps (86) adding **(94)** zaps (98) adding **(89)** zaps (29) adding **(28)**

Subpattern-2 **= (46),(51),(94),(89),(28)**
E D H I C

---

2 134 S

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2								5_2	5_1
row3		X							
row4	5			5_1		5_2			
row5	5_{12}			5		5			
row6							X		
row7			X						
row8						5_1			5_2
row9				5_2				5_1	

Example 2.134, continued.

		C
D	**E**	
	H	**I**

Box order: E→D→H→I→C

Subpattern-3 begins in **(54)** zaps (51) adding **(41)**
(54) zaps (94) adding **(86)** zaps (89) adding **(98)** zaps (28) adding **(29)**

Subpattern-3 = **(54),(41),(86),(98),(29)**
E D H I C

Subpattern-4 begins in **(56)** zaps (51) adding **(41)**
(56) zaps (86) adding **(94)** zaps (98) adding **(89)** zaps (29) adding **(28)**

Subpattern-4 = **(56),(41),(94),(89(,(28)**

Back at the starting box, nothing is pending and no squares unclaimed, so the analysis is complete.

2 134 S

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2								5_{24}	5_{13}
row3		X							
row4	5_{34}			5_{1}		5_{2}			
row5	5_{12}			5_{3}		5_{4}			
row6							X		
row7			X						
row8						5_{13}			5_{24}
row9				5_{24}				5_{13}	

Pattern 2.148	Box Orientation	Patterns with the same box code
4 – 2 – 2	**A – D – G**	**149 (Box orientation for 148: rotate 90 degrees counterclockwise, then swap stacks 2 & 3, then swap stacks 1 & 2)**
|	**|**	
2	**C**	

A		**C**
D		
G		

Subpattern-1 begins in **(21)** with box order **A→G→D→C**

(21) zaps (71) adding **(72)** zaps (42) adding **(43)**
(21) zaps (29) adding **(39)**

Subpattern-1 **= (21),(72),(43),(39)**
A G D C

Subpattern-2 begins in **(23)** with box order **A→D→G→C**

(23) zaps (43) adding **(42)** zaps (72) adding **(71)**
(23) zaps (29) adding **(39)**

Subpattern-2 = **(23),(42),(71),(39)**
A D G C

---

2 148 T

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2	9_1		9_2						9
row3		9	9						9_{12}
row4		9_2	9_1						
row5								X	
row6						X			
row7	9_2	9_1							
row8					X				
row9							X		

Example 2.148, continued.

A		**C**
D		
G		

Subpattern-3 begins in **(32)** with box order **A→D→G→C**

(32) zaps (42) adding **(43)**
(32) zaps (72) adding **(71)**
(32) zaps (39) adding **(29)**

Subpattern-3 = **(32),(43),(71),(29)**
A D G C

Subpattern-4 begins in **(33)** with box order **A→D→G→C**

(33) zaps (43) adding **(42)** zaps (72) adding **(71)**
(33) zaps (39) adding **(29)**

Subpattern-4 = **(33),(42),(71),(29)**
A D G C

Back at the starting box, nothing is pending and no square unclaimed.
The pattern analysis is complete.

2 148 T

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2	9_{1}		9_{2}						9_{34}
row3		9_{3}	9_{4}						9_{12}
row4		9_{24}	9_{13}						
row5								X	
row6						X			
row7	9_{234}	9_{1}							
row8					X				
row9							X		

Pattern **2.065**	Box Orientation	Patterns with the same box code
4 – 2 – 2	**B – H – E**	**none**
| |	**| |**	**(Box orientation for 065:**
3 – 2	**A – G**	**rotate 90 degrees counterclockwise,**
	then swap bands 1 & 2, then swap bands 2 & 3, then swap stacks 2 & 3)	

A	**B**	
	E	
G	**H**	

Subpattern-1 begins in **(14)** with box order **B→E→H→G→A**

(14) zaps (54) adding **(55)**
(14) zaps (94) adding **(76)** zaps (72) adding **(91)**
(91) zaps (31) while **(14)** zaps (12) adding **(32)**

Subpattern-1 = **(14),(55),(76),(91),(32)**
B E H G A

---

2 U 065

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2		2_1		2			
row2								X	
row3	2	2_1		2	2				
row4			X						
row5				2	2_1				
row6							X		
row7		2_2				2_1			
row8									X
row9	2_1			2					

Example 2.065, continued.

A	**B**	
	E	
G	**H**	

Subpattern-2 begins in **(16)** with box order **B→H→E→G→A**

(16) zaps (76) adding **(94)** zaps (91) adding **(72)** zaps (12) & (32) adding **(31)**
(31) zaps (34) & (35) while **(76)** zaps (16) adding **(14)**

Subpattern-2 = **(16),(94),(72),(31),(14)**

Subpattern-3 begins in **(34)** with box order **B→H→G→eE→A**

(34) zaps (94) adding **(76)** zaps (72) adding **(91)**
(34) zaps (54) adding **(55)**
(34) zaps (31) & (32) adding **(12)**

Subpattern-3 = **(34),(76),(91),(55),(12)**
B H G E A

---

2 065
U

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{3}		2_{1}		2_{2}			
row2								X	
row3	2_{2}	2_{1}		2_{3}	2				
row4			X						
row5				2_{4}	2_{123}				
row6							X		
row7		2_{2}				2_{13}			
row8									X
row9	2_{13}			2_{2}					

Example 2.065, continued.

A	**B**	
	E	
G	**H**	

Subpattern-4 begins in **(35)** with box order **B→E→H→G→A**
(35) zaps (55) adding **(54)** zaps (94) adding **(76)** zaps (72) adding **(91)**
(35) zaps (31) & (32) adding **(12)**
Subpattern-4 = **(35),(54),(76),(91),(12)**

Back at the starting box B, there are no boxes pending and no squares unclaimed.
The analysis is complete.

2 065
U

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{34}		2_{1}		2_{2}			
row2								X	
row3	2_{2}	2_{1}		2_{3}	2_{4}				
row4			X						
row5				2_{4}	2_{123}				
row6							X		
row7		2_{2}				2_{134}			
row8									X
row9	2_{134}			2_{2}					

Pattern **2.025**	Box Orientation	Patterns with the same box code
4 – 3 – 2 **| |** **2 – 2**	**A – B – C** **| |** **D – E**	**none**

A	**B**	**C**
D	**E**	

Box order: A→C→D→E→B

Subpattern-1 begins in **(22)** zaps (27) adding **(37)**
(22) zaps (52) adding **(43)** zaps (46) adding **(55)**
(55) zaps (15) while **(22)** zaps (27) adding **(16)**
Subpattern-1 = **(22),(37),(43),(55),(16)**
A C D E B

Subpattern-2 begins in **(23)** zaps (27) adding **(37)**
(23) zaps (43) adding **(52)** zaps (55) adding **(46)** zaps (16) & (36) adding **(15)**
Subpattern-2 = **(23),(37),(52),(46),(15)**
A C D E B

---

2 025 U2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8_{2}	8_{13}			
row2		8_{1}	8_{2}				8_{3}		
row3		8_{3}	8			8_{K}	8_{12}		
row4			8_{13}			8_{2}			
row5		8_{2}			8_{13}				
row6								X	
row7	X								
row8				X					
row9									X

Example 2.025, continued.

A	**B**	**C**
D	**E**	

Box order: A→C→D→E→B

Subpattern-3 begins in **(32)** zaps (37) adding **(27)**
(32) zaps (52 adding **(43)** zaps (46) adding **(55)**
(55) zaps (15) while **(32)** zaps (36) adding **(27)**
Subpattern-3 = **(32),(27),(43),(55),(27)**
A C D E B

Subpattern-4 begins in **(33)** zaps (37) adding **(27)**
(33) zaps (43) adding **(52)** zaps (55) adding **(46)** zaps (36) & (16) adding **(15)**
Subpattern-4 = **(33),(27),(52),(46),(15)**
A C D E B

Back at the starting box, there is no pending situation, and no square unclaimed in the starting box A, but there is an unclaimed square in box B, namely (36), which is not a member of any subpattern. Therefore it is a killer candidate, and should be subscripted with a K. The analysis is complete.

---

2 025 U2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8_{24}	8_{13}			
row2		8_{1}	8_{2}				8_{34}		
row3		8_{3}	8_{4}			8_{K}	8_{12}		
row4			8_{13}			8_{24}			
row5		8_{24}			8_{13}				
row6								X	
row7	X								
row8				X					
row9									X

Pattern **2.100**	Box Orientation	Patterns with the same box code
3 – 3 – 2	**I→H→G**	**102**

G	**H**	**I**

	1	2	3	4	5	6	7	8	9
1						X			
2								X	
3	X								
4		X							
5							X		
6					X				
7			3						3
8				3					3
9			3	3					3

Since all the drama is in the bottom six boxes, we'll dispense with the top six boxes during the analysis.

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7			~~3~~						3_1
row8				3					3
row9			3	~~3~~					3

Box order: **I→H→G**
Subpattern-1 begins in **(79)** zaps (73) adding **(93)** zaps (94) adding **(84)**
Subpattern-1 = **(79),(93),(64)**
I H G

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7			~~3~~						3_1
row8				3_1					3
row9			3_1	~~3~~					3

Pattern 2.100, continued.

Box order: **I→H→G**

Subpattern-2 begins in **(89)** zaps (84) adding **(94)** zaps (93) adding **(73)**

Subpattern-2 = **(89),(94),(73)**
I H G

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7			3_{2}						3_{1}
row8				3_{1}					3_{2}
row9			3_{1}	3_{2}					3

Box order: **I→H→G**

Subpattern-3 begins in **(99)** zaps (94) adding **(84)**
(99) zaps (73) adding **(93)**

Subpattern-3 = **(99),(84),(93)**
I H G

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row7			3_{2}						3_{1}
row8				3_{13}					3_{2}
row9			3_{1}	3_{2}					3_{3}

This middle section is reconnected with the rest of the sudoku on the next page.

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3	X								
row4		X							
row5							X		
row6					X				
row7			3_{23}						3_{1}
row8				3_{13}					3_{2}
row9			3_{1}	3_{2}					3_{3}

Pattern **2.121**	Box Orientation	Patterns with the same box code
3 – 2 – 2	**B – E – H**	**061, 116**
|	**|**	
2	**F**	

(Box orientation for 121: rotate 90 degrees clockwise, then swap stacks 1 & 3)

	B	
	E	**F**
	H	

Subpattern-1 begins in **(24)** with box order **B→E→F→H**

(24) zaps (64) adding **(46)** zaps (47) adding **(67)**
(24) zaps (24) while **(46)** zaps (26) adding **(25)**

Subpattern-1 = **(24),(46),(67),(25)**
B E F H

Subpattern-2 begins in **(25)** with box order **B→H→E→F**

(**25)** zaps (95) adding **(94)** zaps (64) adding **(46)** zaps (47) adding **(67)**

Subpattern-2 = **(25),(94),(46),(67)**
B H E F

---

2 121 W2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2				9_1	9_2	9			
row3									
row4						9_{12}	9		
row5									
row6				9			9_{12}		
row7									
row8									
row9				9_2	9_1				

Pattern 2.121, continued.

	B	
	E	**F**
	H	

Subpattern-3 begins in **(26)** with box order **B→E→F→H**

(26) zaps (46) adding **(64)** zaps (94) adding **(95)**
(64) zaps (67) adding **(47)**

Subpattern-3 = **(26),(64),(47),(95)**
B E F H

Back at the starting box B, there are no boxes pending and no squares unclaimed, so the pattern analysis is complete.

2 121 W2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2				9_{1}	9_{2}	9_{3}			
row3									
row4						9_{12}	9_{3}		
row5									
row6				9_{3}			9_{12}		
row7									
row8									
row9				9_{2}	9_{13}				

Pattern 2.129	Box Orientation	Patterns with the same box code
3 – 2 – 2 | **2** | **2**	**G – A – D** | **B** | **C**	**none**

(Box orientation for 129: rotate 90 degrees clockwise, then swap stacks 2 & 3)

A	**B**	**C**
D		
G		

Subpattern-1 begins in **(81)** with box order **G→D→A→C→B**

(81) zaps (51) adding **(53)** zaps (23) adding **(32)** zaps (39) adding **(19)**
(19) zaps (16) adding **(26)**

Subpattern-1 = **(81),(53),(32),(19),(26)**
G D A C B

Subpattern-2 begins in **(82)** with box order **G→A→B→C→D**

(82) zaps (32) adding **(23)** zaps (26) adding **(16)** zaps (19) adding **(39)**
(23) zaps (51) adding **(51)**

Subpattern-2 = **(82),(23),(16),(39),(51)**
G A B C D

---

2 129 W3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						8_2			8_1
row2			8_2			8_1			
row3		8_1							8_2
row4					X				
row5	8_2		8_1						
row6							X		
row7				X					
row8	8_1	8_2	8						
row9								X	

Example 2.129, continued.

A	B	C
D		
G		

Subpattern-1 begins in **(83)** with box order **G→D→A→C→B**

(83) zaps (53) adding **(51)**
(83) zaps (23) adding **(32)** zaps (39) adding **(19)** zaps (16) adding **(26)**

Subpattern-3 = **(83),(51),(32),(19),(26)**

Back in the starting box G, no boxes are pending and no squares are unclaimed. The analysis is complete.

2 129 W3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						8_{2}			8_{13}
row2			8_{2}			8_{13}			
row3		8_{13}							8_{2}
row4					X				
row5	8_{23}		8_{1}						
row6							X		
row7				X					
row8	8_{1}	8_{2}	8_{3}						
row9								X	

Pattern 2.090	Box Orientation	Patterns with the same box code
3 – 2 – 2	**C – B – A**	**none**
| 2------2	**| H-------G**	**(Box orientation for 090: swap stacks 1 & 3)**

A	**B**	**C**
G	**H**	

Subpattern-1 starts in **(19)** with box order **C→B→A→H→G**

(19) zaps (16) adding **(35)** zaps (31) adding **(21)**
(35) zaps (75) adding **(96)** zaps (93) adding **(73)**

Subpattern-1 = **(19),(35),(21),(96),(73)**
C B A H G

---

2 090 W5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						2			2_1
row2	2_1								2
row3	2				2_1				2
row4		X							
row5								X	
row6				X					
row7			2_1		2				
row8							X		
row9			2			2_1			

Pattern 2.090, continued.

Subpattern-2 begins in **(39)** with box order **C→B→A→H→G**

(39) zaps (35) adding **(16)**
(39) zaps (31), adding **(21)**
(16) zaps (96) adding **(75)** zaps (73) adding **(93)**

Subpattern-2 = **(39),(16),(21),(75),(93)**
C B A H G

Subpattern-3 starts in **(29)** with box order to **C→A→B→H→G**

(29) zaps (21) adding **(31)** zaps (35) adding **(16)**
(16) zaps (96) adding **(75)** zaps (73) adding **(93)**

Subpattern-3 = **(29),(31),(16),(75),(93)**
C A B H G

Back at the starting box, nothing is pending, and no boxes remain unclaimed. The pattern analysis is complete.

2 090 W5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						2_{2}			2_{1}
row2	2_{12}								2
row3	2				2_{1}				2_{2}
row4		X							
row5								X	
row6				X					
row7			2_{1}		2_{23}				
row8							X		
row9			2_{23}			2_{1}			

Pattern 2.012	Box Orientation	Patterns with the same box code
3 – 2 – 2 **| | |** **2 – 2 |** **| |** **2 ------ 2**	**I – H – G** **| | |** **C – B |** **| |** **F--------D**	**032, 033 (same structure except for one 2-box replaced by 3-box or 4-box)** **(Box orientation for 012: rotate 180 degrees clockwise, then swap bands 2 & 3)**

	B	**C**
D		**F**
G	**H**	**I**

	•	←
→		↑
↑	←	←

Subpattern-1 is started in **(79)** with box order **I→H→G→D→F→C→B**

(79) zaps (75) adding **(94)** zaps (93) adding **(82)** zaps (62) adding **(53)**
(53) zaps (57) adding **(68)**.
Then **(79)** zaps (39) adding **(27)** zaps (24) adding **(35)**.

Subpattern-1 = **(79)**,**(94)**,**(82)**,**(53**),**(68)**,**(27)**,**(35)**
I H G D F C B

2 012 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				2			2_1		
row3					2_1				2
row4						X			
row5			2_1				2		
row6		2						2_1	
row7					2				2_1
row8		2_1						2	
row9			2	2_1			2		

Pattern 2.012 continued.

	B	**C**
D		**F**
G	**H**	**I**

	↓	←
→		↑
↑	•	←

Subpattern-2 is started in **(88)** with box order **I→G→D→F→C→B→H**

(88) zaps (82) adding **(93)** zaps (53) adding **(62)** zaps (68) adding **(57)** zaps (27)
(57) zaps (27) adding **(39)** zaps (35) adding **(24)**. zaps (94) adding **(75)**.

Subpattern-2 = **(88),(93),(62),(57),(39),(24),(75)**
I G D F C B H

2 012 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				2_{2}			2_{1}		
row3					2_{1}				2_{2}
row4						X			
row5			2_{1}				2_{2}		
row6		2_{2}						2_{1}	
row7					2_{23}				2_{1}
row8		2_{1}						2_{2}	
row9			2_{2}	2_{1}			2_{3}		

Pattern 2.012 continued.

	B	**C**
D		**F**
G	**H**	**I**

	↓	←
→		↑
↑	•	←

Subpattern-3 is started in **(97)** with box order **I→H→G→D→F→C→B**

(97) zaps (94) adding **(75)**.
(97) zaps (93) adding **(82)** zaps (62) adding **(53)** zaps (57) adding **(68)**.
(97) zaps (27) adding **(39)** zaps (35) adding **(24)**.

Subpattern-3 = **(97),(75),(82),(53),(68),(39),(24)**
I H G D F C B

2 012 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				2_{23}			2_{1}		
row3					2_{1}				2_{23}
row4						X			
row5			2_{13}				2_{2}		
row6		2_{2}						2_{13}	
row7					2_{23}				2_{1}
row8		2_{13}						2_{2}	
row9			2_{2}	2_{1}			2_{3}		

Back at the starting box I, there are no outstanding pending boxes and no unclaimed squares, either in the starting box or elsewhere, so the analysis is complete.

Pattern 2.032	Box Orientation	Patterns with the same box code
3 – 2 – 3 **| | |** **3 – 2 |** **| |** **2 ------ 2**	**I – H – G** **| | |** **C – B |** **| |** **F--------D**	**none (several have same structure but with one higher-order box)** **(Box orientation for 032: rotate 180 degrees clockwise, then swap bands 2 & 3)**

	B	**C**
D		**F**
G	**H**	**I**

	•	←
→		↑
↑	←	←

Subpattern-1 is started in **(79)** with box order **I→H→G→D→F→C→B**

(79) zaps (75) adding **(94)**
(79) zaps.(72) while **(94)** zaps (93) adding **(82)** zaps (62) adding **(53)**
(53) zaps (57) adding **(68)**
(79) zaps (39) **while (68)** zaps (38) adding **(27)** zaps (24) adding **(35)**

Subpattern-1 = **(79),(94),(82),(53),(68),(27),(35)**
I H G D F C B

2 032 W7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				5			5_1		
row3					5_1			5	5
row4						X			
row5			5_1				5		
row6		5						5_1	
row7		5			5				5_1
row8		5_1						5	
row9			5	5_1			5		

Pattern 2.032, continued.

	B	**C**
D		**F**
G	**H**	**I**

	↓	←
•		↑
↑	←	↑

Subpattern-2 is started in **(88)** with box order **I→F→C→B→H→G→D**

(88) zaps (68) adding **(57).**
(88) zaps.(38) **& (57)** zaps (27) adding **(39)** zaps (35) adding **(24)** zaps (94) adding **(75)**
(88) zaps (82) **& (75)** zaps (72) adding **(93)** zaps (53) adding **(62)**

Subpattern-2 = **(88),(57),(39),(24),(75),(93),(62)**
I F C B H G D

2 032 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				5_2			5_1		
row3					5_1			5	5_2
row4						X			
row5			5_1				5_2		
row6		5_2						5_1	
row7		5			5_2				5_1
row8		5_1						5_2	
row9			5_2	5_1			5		

Pattern 2.032, continued.

	B	**C**
D		**F**
G	**H**	**I**

	•	←
→		↑
↑	←	←

Subpattern-3 is started in **(97)** with box order **I→H→G→D→F→C→B**

(97) zaps (94) adding **(75)**
(97) zaps.(93) while **(75)** zaps (72) adding **(82)** zaps (62) adding **(53)**
(53) zaps (57) adding **(68)**
(97) zaps (27) while **(68)** zaps (38) adding **(39)** zaps (35) adding **(24)**

Subpattern-3 = **(97),(75),(82),(53),(68),(39),(24)**
I H G D F C B

Back at the starting box I, nothing is pending. Squares (38) and (72) are unclaimed, so they are not members of any subpattern, and must be given killer K subscripts.

2 032 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				5_{23}			5_{1}		
row3					5_{1}			5_{K}	5_{23}
row4						X			
row5			5_{13}				5_{2}		
row6		5_{2}						5_{13}	
row7		5_{K}			5_{23}				5_{1}
row8		5_{13}						5_{2}	
row9			5_{2}	5_{1}			5_{3}		

Pattern 2.033	Box Orientation	Patterns with the same box code
4 – 2 – 2 **| | |** **3 – 2 |** **| |** **2 ------ 2**	**A – C – B** **| | |** **D – F |** **| |** **G--------H**	***016, *032.**

A	**B**	**C**
D		**F**
G	**H**	

→	→	↓
↓		←
→	•	

Subpattern-1 is started in **(12)** with box order **A→B→C→F→D→G→H**

(12) zaps (15) adding **(24)** zaps (17) adding **(38)** zaps (48) adding **(57)**
(57) zaps (51) & (53) adding **(43)**
(12) zaps.(92) adding **(81)** zaps (84) adding **(95)**

Subpattern-1 = **(12),(24),(38),(57),(43),(18),(95)**
A B C F D G H

2 033 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_1			1				
row2	1		1	1_1			1		
row3			1					1_1	
row4			1_1					1	
row5	1		1				1_1		
row6						X			
row7									X
row8	1_1			1					
row9		1			1_1				

Pattern 2.033, continued.

	B	**C**
D		**F**
G	**H**	**I**

	↓	←
•		↑
↑	←	↑

Subpattern-2 is started in **(21)** with box order **A→B→C→F→D→G→H**

(21) zaps (24) adding **(15)**
(21) zaps (27) adding **(38)** zaps (48) adding **(57)** zaps (51) & (53) adding **(43)**
(21) zaps (81) adding **(92)** zaps (95) adding **(84)**

Subpattern-2 = **(21),(15),(38),(57),(43),(91),(84)**
A B C F D G H

2 033 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}			1_{2}				
row2	1_{2}		1	1_{1}			1		
row3			1					1_{12}	
row4			1_{12}					1	
row5	1		1				1_{12}		
row6						X			
row7									X
row8	1_{1}			1_{2}					
row9		1_{2}			1_{1}				

Pattern 2.033, continued.

	B	**C**
D		**F**
G	**H**	**I**

	•	←
→		↑
↑	←	←

Subpattern-3 is started in **(23)** with box order **A→B→C→F→D→G→H**

(23) zaps (24) adding **(15)**
(23) zaps.(27) adding **(38)** zaps (48) adding **(57)** zaps (51) & (53).
(23) zaps (43)

But then (51), (53) & (53) are all zapped, leaving nothing in box D. Therefore our choice of (23) as the beginning square for subpattern-3 leads to an impossibility, so we must abandon (23) and try the other available square (33) as the beginning square for subpattern-3. We must first backtrack to box A, erasing all the subscript 3's.

Subpattern-3 is **next** started in **(33)** with box order **A→C→B→F→D→G→H**

(33) zaps (38) adding **(27)** zaps (24) making **(15)**
(27) zaps.(57) adding **(48)**.
(33) zaps (43) **&** (53) adding **(51)** zaps (81) adding **(92)** zaps (95) adding **(84)**

Subpattern-3 = **(33),(27),(15),(48),(51),(92),(84)**
A C B F D G H

Back at the starting box I, nothing is pending. Squares (38) and (72) are unclaimed, so they are not members of any subpattern, and must be given killer K subscripts.

2 033 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}			1_{23}				
row2	1_{2}		1_{K}	1_{1}			1_{3}		
row3			1_{3}					1_{12}	
row4			1_{12}					1_{3}	
row5	1_{3}		1_{K}				1_{12}		
row6						X			
row7									X
row8	1_{1}			1_{23}					
row9		1_{23}			1_{1}				

Notes on patterns 2.012, 2,032, and 2.033:

These three patterns are quite unusual. All three are slightly different from one another, yet all three have exactly the same set of subscripts. All of this is caused by the K subscripts. If it weren't for the killer candidates, the patterns would be identical. Patterns 2.012 and 1.032 are even in the same set of boxes.

Pattern 2.081	Box Orientation	Patterns with the same box code
3 – 3 – 2	**D – E – F**	**142**

Since the top and bottom bands have no candidates, we'll leave them out.

D	**E**	**F**

→	•	←

Subpattern-1 is started in **(41)** with box order **D→F→E**

(41) zaps (49) adding **(69).**
(41) zaps (45) while **(69)** zaps (65) adding **(55)**

Subpattern-1 = **(41),(69),(55)**
D F E

Subpattern-2 is started in **(51)** with box order **D→F→E**

(51) zaps (55) adding **(45)** and pending **(65)**
(45) zaps (49) adding **(69)**

Subpattern-2 = **(45),(69),(54)**
D F E

---

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				$2_{\mathbf{2}}$				2
row5	$2_{\mathbf{2}}$				$2_{\mathbf{1}}$				
row6	2				$2_{\mathbf{p}}$	*P*			$2_{\mathbf{12}}$

Pattern 2.081, continued.

Subpattern-3 is started in **(51)** (same as subpattern-2) with box order **D→F→E**

(65) no longer pending zaps (69) adding **(49)**

Subpattern-3 = **(51),(65),(49)**
D F E

---

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				$2_{\mathbf{2}}$				$2_{\mathbf{3}}$
row5	$2_{\mathbf{23}}$				$2_{\mathbf{1}}$	~~**P**~~			
row6	2				$2_{\mathbf{3}}$				$2_{\mathbf{12}}$

Back at the starting box A, there is nothing pending, but there is still an unassigned square, (61), looking for a subpattern, so

Subpattern-4 is started in **(61)** with box order **D→F→E**

(61) zaps (69) adding **(49)**
(61) zaps (65) while **(49)** zaps (45) adding **(55)**

Subpattern-4 = **(61),(49),(55)**

Back at the starting box D, nothing is pending, and no squares anywhere without subpatterns. The analysis is complete.

---

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4	$2_{\mathbf{1}}$				$2_{\mathbf{2}}$				$2_{\mathbf{34}}$
row5	$2_{\mathbf{23}}$				$2_{\mathbf{14}}$				
row6	$2_{\mathbf{4}}$				$2_{\mathbf{3}}$				$2_{\mathbf{12}}$

Pattern 2.099	Box Orientation	Patterns with the same box code
3 – 3 – 2 | **2**	**A – D – G** | **I**	**none**

A		
D		
G		**I**

↓		
↓		
→		•

Subpattern-1 is started in **(21)** with box order **A→G→I→D**

(21) zaps (81) adding **(73)** zaps (78) adding **(88)**
(21) zaps (51) while **(73)** zaps (53) adding **(52)**

Subpattern-1 = **(21),(73),(88),(52)**
A G I D

Subpattern-2 is started in **(22)** with box order **A→D→I→G**

(22) zaps (52) adding **(51)** and pending **(53)**
(51) zaps (81) adding **(73)** zaps (78) adding **(88)**

Subpattern-2 = **(22),(51),(73),(88)**

---

2 009 L1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_1	8_2							
row3				X					
row4									X
row5	8_2	8_1							
row6					X				
row7			8_{12}					8	
row8	8							8_{12}	
row9						X			

Pattern 2.099, continued.

A		
D		
G		**I**

↓		
↓		
→		•

Due to pending situation,
Subpattern-3 must have the same starting square **(22)**
and same **box order A→G→I→D** as subpattern-2,
and must claim pending square **(53)** in pending box **D** (and erase pending P).

(53) zaps (73) adding **(81)** zaps (88) adding **(89)**

Subpattern-3 = **(22),(53),(81),(89)**

Subpattern-4 is started in **(23)**.
D is no longer pending, so box order may be changed to **A→G→I→D**

(23) zaps (73) adding **(81)** zaps (88) adding **(78)**
(23) zaps (53) while **(81)** zaps (61) adding **(52)**

Subpattern-4 = **(23),(81),(78),(52)**
A G I D

Back at starting box **A**, nothing pending, no boxes unclaimed, analysis complete.
---

2 009 L1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}	8_{23}	8_{4}						
row3				X					
row4			~~P~~						X
row5	8_{2}	8_{14}	8_{3}						
row6					X				
row7			8_{12}					8_{34}	
row8	8_{34}							8_{12}	
row9						X			

Pattern 2.131	Box Orientation	Patterns with the same box code
3 – 3 – 2 | **2**	**A – C – B** | **D**	**none**

A	**B**	**C**
D		

Subpattern-1 is started in **(12)** with box order **A→B→C→D**

(12) zaps (16) adding **(26)**
(12) zaps (17) & **(26)** zaps (27) adding **(37).**
(12) zaps (42) adding **(43).**

Subpattern-1 = **(12),(26),(37),(43)**
A B C D

Subpattern-2 is started in **(22)** with box order **A→B→C→D**

(22) zaps (26) adding **(16)**
(22) zaps (27) & **(16)** zaps (17) adding **(37)**
(22) zaps (42) adding **(43)**

Subpattern-2 = **(22),(16),(37),(43)**
A B C D

---

2 131 X3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}				1_{23}	1_{4}		
row2		1_{2}				1_{14}	1_{3}		
row3			1_{34}				1_{12}		
row4		1_{34}	1_{12}						
row5				X					
row6									X
row7					X				
row8								X	
row9	X								

Pattern 2.131 continued.

A	**B**	**C**
D		

Subpattern-3 is started in **(33)** with box order **A→C→B→D**

(33) zaps (37) adding **(27)** & pending **(17)**
(27) zaps (26) adding **(16).**
(33) zaps (42) adding **(42).**

Subpattern-3 = **(33),(27),(16),(42)**
A C B D

Due to ***pending***,
subpattern-4 also started in **(33)** with same box order **A→C→B→D**
subpattern-4 continued in pending square **(17)**
(17) zaps (16) adding **(26)**
(33) zaps (43) adding **(42)**

Subpattern-4 = **(33),(17),(26),(42)**

At the starting box A, no pending situation, no unclaimed boxes, we are done.

2 131 X3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}				1_{23}	1_{4}		~~P~~
row2		1_{2}				1_{14}	1_{3}		
row3			1_{34}				1_{12}		
row4		1_{34}	1_{12}						
row5				X					
row6									X
row7					X				
row8								X	
row9	X								

Pattern 2.140	Box Orientation	Patterns with the same box code
3 – 3 – 2	**C – A – B**	**none**
|	**|**	
2	**F**	**(Box orientation for 140:**
|	**|**	**swap stacks 1 & 3, then**
2	**I**	**swap stacks 2 & 3)**

A	**B**	**C**
		F
		I

Subpattern-1 is started in **(11)** with box order **A→C→B→I→F**

(11) zaps (17) adding **(28)** & pending ***(38)***
(28) zaps (25) adding **(35)**
(28) zaps (88) adding **(89)** zaps (49) adding **(47)**

Subpattern-1 = **(11),(28),(35),(89),(47)**
A C B I F

2 140 X4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_1						2		
row2	2				2			2_1	
row3	2				2_1			2	
row4							2_1		2
row5						X			
row6			X						
row7		X							
row8								2	2_1
row9				X					

2.140, continued.

due to pending condition,

subpattern-2 started in same beginning square **(11)** as subpattern-1
subpattern-2 must have same box order **A→C→B→I→F**
subpattern-2 must claim pending square **(38)**\

(38) zaps (35) adding **(25)**
(38) zaps (88) adding **(89)** zaps (49) adding **(47)**

subpattern-2 = **(11),(38),(25),(89),(47)**
A C B I F

Subpattern-3 started in **(21)** with box order **A→B→C→F→I**

(21) zaps (25) adding **(35)**
(21) zaps (28) while (35) zaps (38) adding **(17)** zaps (47) adding **(49)**
(49) zaps (89) adding **(88)**

Subpattern-3 = **(21),(35),(17),(49),(88)**
A B C F I

2 140 X4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{12}						2_{3}		~~2_{1}~~
row2	2_{3}				2_{2}			2_{1}	
row3	2				2_{13}			2_{2}	
row4							2_{12}		2_{3}
row5						X			
row6			X						
row7		X							
row8								2_{3}	2_{12}
row9				X					

2.140, continued.

Subpattern-4 started in **(31)** with box order **A→B→C→F→I**

(31) zaps (35) adding **(25)**
(31) zaps (38) while **(25)** zaps (28) adding **(17)** zaps (47) adding **(49)**
(49) zaps (89) adding **(88)**

Subpattern-4 = **(31),(25),(17),(49),(88)**

Back at the starting box A, nothing is pending, and no squares are unclaimed, so the analysis is complete.

2 140 X4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{12}						2_{34}		
row2	2_{3}				2_{24}			2_{1}	
row3	2_{4}				2_{13}			2_{2}	
row4							2_{12}		2_{34}
row5						X			
row6			X						
row7		X							
row8								2_{34}	2_{12}
row9				X					

Pattern 2.128	Box Orientation	Patterns with the same box code
3 – 3 – 3	**B – E – H**	**none**

(Box orientation for 131: rotate 90 degrees clockwise,then swap bands 1 & 2)

	B	
	E	
	H	

Subpattern-1 started in **(14)** with box order: **B→E→H**

(14) zaps **(64)** adding **(65)** and (66) *pending*
(14) zaps (94) & **(65)** zaps (95) adding **(96)**

Subpattern-1 = **(14),(65),(96)**
B E H

Due to pending situation, subpattern-2 must
start in same square **(14)** as subpattern-1
keep same box order **B→E→H**
include pending square **(66)**
(14) zaps (64) while **(66)** zaps (96) adding **(95)**

Subpattern-2 = **(14),(66),(95)**
B E H

---

2 128 Y1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_{12}	5	5			
row2		X							
row3									X
row4	X					*P*			
row5								X	
row6				5	5_1	5_2			
row7							X		
row8			X						
row9				5	5_2	5_1			

Pattern 2.128, continued.

Subpattern-3 started in **(15)** with box order: **B→E→H**

(15) zaps (65) adding **(64)** and *(66) pending*
(15) zaps (95) while **(64)** zaps (94) adding **(96)**

Subpattern-3 = **(15),(64),(96)**
B E H

Due to pending situation, subpattern-4 must
start in same square **(15)** as subpattern-3
keep same box order **B→E→H**
include pending square **(66)**
(15) zaps (95) while **(66)** zaps (96) adding **(94)**

Subpattern-4 = **(15),(66),(94)**
B E H

---

2 128 Y1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_{12}	5_{34}	5			
row2		X							
row3									X
row4	X					*P*			
row5								X	
row6				5_{3}	5_{1}	5_{24}			
row7							X		
row8			X						
row9				5_{4}	5_{2}	5_{13}			

Pattern 2.128, continued.

Subpattern-5 starts in **(16)** with box order: **B→E→H**

(16) zaps (66) adding **(64)** and *pending (65)*
(16) zaps (96) & **(64)** zaps (94) adding **(95)**

Subpattern-5 = **(16),(64),(95)**
B E H

Due to pending situation, subpattern-6 must
start in same square **(16)** as subpattern-5
keep same box order **B→E→H**
include pending square **(65)**
(16) zaps (96) & **(65)** zaps (95) adding **(94)**

Subpattern-6 = **(16),(65),(94)**
B E H

---

2 128 Y1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_{12}	5_{34}	5_{56}			
row2		X							
row3									X
row4	X					*P*			
row5								X	
row6				5_{35}	5_{16}	5_{24}			
row7							X		
row8			X						
row9				5_{46}	5_{25}	5_{13}			

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Chapter 3. Patterns with 3 subscripts

Pattern 3.008	Box Orientation	Patterns with the same box code
2 | 3 – 2 | 2	B | I – C | G	none

	B	C
G		I

Box order: I→G→C→B

Subpattern-1 is begun in **(87)** zaps (81) adding **(91)**
(87) zaps (37) adding **(19)** zaps (14) adding **(34)**

Subpattern-1 = **(87),(91),(19),(43)**
I G C B

3 008
A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9					9_1
row2		X							
row3				9_1			9		
row4					X				
row5								X	
row6			X						
row7						X			
row8	9						9_1		9
row9	9_1								9

Pattern 3.008, continued.

	B	C
G		I

Box order: I→G→C→B

Subpattern-2 begins in **(89)** zapping (81) adding **(91)**
(89) zaps (19) adding **(37)** zaps (34) adding **(14)**
Subpattern-2 = **(89),(91),(37),(14)**
I G C B

Subpattern-3 begins in **(99)** zaps (91) adding **(81)**
(99) zaps (19) adding **(37)** zaps (34) adding **(14)**
Subpattern-3 = **(99),(81),(37),(14)**
I G C B

At the starting box, nothing pending, nothing unclaimed, analysis complete

3 008
A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9_{23}					9_{1}
row2		X							
row3				9_{1}			9_{23}		
row4					X				
row5								X	
row6			X						
row7						X			
row8	9_{3}						9_{1}		9_{2}
row9	9_{12}								9_{3}

Pattern 3.031	Box Orientation	Patterns with the same box code
3 – 3 – 2 | **2**	**D – E – F** | **G**	**none**

D	**E**	**F**
G		

Subpattern-1 starts in **(51)** with box order **D→F→E→G**

(51) zaps (59) adding **(69)**.
(51) zaps (56) & **(69)** zaps (66) adding **(46)**
(51) zaps (81) adding **(82)**

Subpattern-1 = **(51),(69),(46),(82)**
D F E G

3 031
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2				X					
row3			X						
row4	1					1_1			
row5	1_1	1				1			1
row6						1			1_1
row7					X				
row8	1	1_1							
row9								X	

Pattern 3.031, continued.

D	**E**	**F**
G		

Subpattern-2 starts in **(52)** with box order **D→F→E→G**

(52) zaps (59) adding **(69)**
(52) zaps (56) & **(69)** zaps (66) adding **(46) &**
(52) zaps (82) adding **(81)**

Subpattern-2 = **(52),(69),(46),(81)**
D F E G

3 A8	031	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1							X		
	row2				X					
	row3			X						
	row4	1					1_{12}			
	row5	1_1	1_2				1			1
	row6						1			1_{12}
	row7					X				
	row8	1_2	1_1							
	row9								X	

Pattern 3.031, continued.

D	**E**	**F**
G		

Subpattern-3 starts in **(41)** with box order **D→F→E→G**

(41) zaps (46) adding **(56)** and pending ***(66)***
(56) zaps (59) adding **(69)**
(41) zaps (81) adding **(82)**

Subpattern-3 = **(41),(56),(69),(82)**

3 031
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2				X					
row3			X						
row4	$1_{\mathbf{3}}$					$1_{\mathbf{12}}$			
row5	$1_{\mathbf{1}}$	$1_{\mathbf{2}}$				$1_{\mathbf{3}}$			1
row6				*P*		1			$1_{\mathbf{123}}$
row7					X				
row8	$1_{\mathbf{2}}$	$1_{\mathbf{13}}$							
row9								X	

Pattern 3.031, continued.

D	**E**	**F**
G		

Due to pending situation
subpattern-4 starts in same beginning square **(41)** as subpattern-2
subpattern-4 must follow same squares between starting and pending squares
subpattern-4 must include pending square **(66)**

(66) zaps (69) adding **(59)**
(41) zaps (81) adding **(82)**

Subpattern-4 = **(41),(66),(59),(82)**
D F E G

Back at the starting box **D**, nothing is left pending and no squares remain unclaimed, so the pattern analysis is complete.

3 031
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2				X					
row3			X						
row4	1_{34}					1_{12}			
row5	1_{1}	1_{2}				1_{3}			1_{4}
row6				~~P~~		1_{4}			1_{123}
row7					X				
row8	1_{2}	1_{134}							
row9								X	

Pattern 3.011	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | **2**	**C** | **G – D – A** | **E**	**020**

A		**C**
D	**E**	
G		

Subpattern-1 is started in **(91)** with box order: **G→D→E→A→C**

(91) zaps (41) & (51) adding **(43)** zaps (44) adding **(54)**
(91) zaps (11) adding **(32)** zaps (39) adding **(19)**

Subpattern-1 = **(91),(43),(54),(32),(19)**
G D E A C

3 011
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8								8_1
row2						X			
row3		8_1							8
row4	8		8_1	8					
row5	8			8_1					
row6								X	
row7					X				
row8							X		
row9	8_1	8	8						

Pattern 3.011 continued.

A		**C**
D	**E**	
G		

Subpattern-2 is started in **(92)** with box order **G→A→C→D→E**

(92) zaps (32) adding **(11)** zaps (19) adding **(39)**
(11) zaps (41) & (51) adding **(43)** zaps (44) adding **(54)**

Subpattern-2 = **(92),(11),(39),(43),(54)**
G A C D E

3 011
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{2}								8_{1}
row2						X			
row3		8_{1}							8_{2}
row4	8		8_{12}	8					
row5	8			8_{12}					
row6								X	
row7					X				
row8							X		
row9	8_{1}	8_{2}	8						

Pattern 3.011 continued.

A		**C**
D	**E**	
G		

Subpattern-3 is started in **(93)** with box order **G→D→E→A→C**

(93) zaps (43) adding **(41)** and pending ***(51)***
(41) zaps (44) adding **(54)**
(41) zaps (11) adding **(32)** zaps (39) adding **(19)**

Subpattern-3 = **(93),(41),(54),(32),(19)**
G D E A C

3 A4	011	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	8_{2}								8_{13}
	row2						X			
	row3		8_{13}							8_{2}
	row4	8_{3}		8_{12}	8					
	row5	8			8_{123}					
	row6		*P*						X	
	row7					X				
	row8							X		
	row9	8_{1}	8_{2}	8_{3}						

Pattern 3.011 continued.

A		**C**
D	**E**	
G		

Due to pending situation, subpattern-4 must
be started in same square **(93)** as subpattern-3
follow same squares between starting & pending
include pending square **(51)**

(51) zaps (54) adding **(44)**
(51) zaps (11) adding **(32)** zaps (39) adding **(19)**

Subpattern-4 = **(93),(51),(44),(32),(19)**
G D E A C

Back at the starting box G, no pending situation exists, and no squares are unclaimed, so the analysis is complete.

3 A4 011

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{2}								8_{134}
row2						X			
row3		8_{134}							8_{2}
row4	8_{3}		8_{12}	8_{4}					
row5	8_{4}			8_{123}					
row6		*P*						X	
row7					X				
row8							X		
row9	8_{1}	8_{2}	8_{34}						

Pattern 3.033	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | **2**	**E** | **C – F – I** | **A**	**none**

A		**C**
	E	**F**
		I

Subpattern-1 is started in **(27)** with box order **C→A→I→F→E**

(27) zaps (22) adding **(32)**
(27) zaps (97) adding **(98)**
(27) zaps (67) and **(98)** zaps (48) adding **(69)** zaps (65) adding **(45)**

Subpattern-1 = **(27),(32),(98),(69),(45)**

3 G3	033	**C** col 1	**A** col 2	**I** col 3	**F** col 4	**E** col 5	col 6	col 7	col 8	col 9
	row1				X					
	row2		8					8_1		8
	row3		8_1						8	
	row4					8_1			8	
	row5			X						
	row6					8		8		8_1
	row7	X								
	row8						X			
	row9							8	8_1	

Pattern 3.033, continued.

A		**C**
	E	**F**
		I

Subpattern-2 is started in **(38)** with box order **C→A→I→F→E**

(38) zaps (32) adding **(22)**
(38) zaps (98) adding **(97)**
(38) zaps (48) and **(97)** zaps (67) adding **(69)** zaps (65) adding **(45)**

Subpattern-2 = **(38),(22),(97),(69),(45)**
C A I F E

3 G3 033

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		8_{2}					8_{1}		8
row3		8_{1}						8_{2}	
row4					8_{12}			8	
row5			X						
row6					8		8		8_{12}
row7	X								
row8						X			
row9							8_{2}	8_{1}	

Pattern 3.033, continued.

A		**C**
	E	**F**
		I

Subpattern-3 is started in **(29)** with box order **C→A→F→E→I**

(29) zaps (22) adding **(32)**
(29) zaps (69) adding **(48)** and pending ***(67)***
(48) zaps (45) adding **(65)**
(48) zaps (98) adding **(97)**

Subpattern-3 = **(29),(32),(48),(65),(97)**
C A F E I

3 033
G3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		8_{2}					8_{1}		8_{3}
row3		8_{13}						8_{2}	
row4					8_{12}			8_{3}	
row5			X				*P*		
row6					8_{3}		8		8_{12}
row7	X								
row8						X			
row9							8_{23}	8_{1}	

Pattern 3.033, continued.

A		**C**
	E	**F**
		I

Due to the pending situation
subpattern-4 must start in the same square **(29)** as subpattern-3
subpattern-4 must use same squares between starting and ending as subpatttern-3
subpattern-4 must include the pending square **(67)**

(29) zaps (22) adding **(32)**
(67) zaps (65) adding **(45)**
(67) zaps (97) adding **(98)**

Subpattern-4 = **(29),(32),(67),(45),(98)**
C A F E I

Back at the starting box C, there is no longer a ;pending condition, and no squares in any of the boxes are unclaimed. The analysis is complete.

3 033
G3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		8_{2}					8_{1}		8_{34}
row3		8_{134}						8_{2}	
row4					8_{124}			8_{3}	
row5			X				~~P~~		
row6					8_{3}		8_{4}		8_{12}
row7	X								
row8						X			
row9							8_{23}	8_{14}	

Pattern 3.024	Box Orientation	Patterns with the same box code
3 – 2 – 2 **| |** **2 – 3** **|** **2**	**G – I – H** **| |** **D – F** **|** **C**	**none**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-1 starts in **(68)** with box order **F→C→I→H→D→G**

(68) zaps (18) adding **(19)**
(68) zaps (88) adding **(77)** zaps (75) adding **(95)**
(68) zaps (62) adding **(51)** zaps (71) & (91) adding **(82)**

Subpattern-1 = **(68),(19),(77),(95),(51),(82)**
F C I H D G

3 B2 024

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								1	1_1
row2			X						
row3						X			
row4				X					
row5	1_1						1		
row6		1						1_1	1
row7	1				1		1_1		
row8		1_1						1	
row9	1				1_1				

Pattern 3.024, continued

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-2 starts in **(69)** with box order **F→C→I→H→D→G**

(69) zaps (19) adding **(18)** zaps (88) adding **(77)** zaps (75) adding **(95)**
(69) zaps (62) adding **(51)** zaps (71) & (91) adding **(82)**

Subpattern-2 = **(69),(18),(77),(95),(51),(82)**
F C I H D G

3 024
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								1_{2}	1_{1}
row2			X						
row3						X			
row4				X					
row5	1_{12}						1		
row6		1_{1}						1_{1}	1_{2}
row7	1				1		1_{12}		
row8		1_{12}						1	
row9	1				1_{12}				

Pattern 3.024, continued

		C
D		**F**
G	**H**	**I**

Subpattern-3 starts in **(57)** with box order **F→I→C→D→G→H**

(57) zaps (77) adding **(88)** zapping (18) adding **(19)**
(57) zaps (51) adding **(62)** zapping (82) adding **(71)** and pending ***(91)***
(71) zaps (75) adding **(95)**

Subpattern-3 = **(57),(88),(19),(62),(71),(95)**
F I C D G H

3 024
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								$1_{\mathbf{2}}$	$1_{\mathbf{13}}$
row2			X						
row3						X			
row4				X					
row5	$1_{\mathbf{12}}$						$1_{\mathbf{3}}$		
row6		$1_{\mathbf{3}}$						$1_{\mathbf{1}}$	$1_{\mathbf{2}}$
row7	$1_{\mathbf{3}}$				1		$1_{\mathbf{12}}$		
row8		$1_{\mathbf{12}}$						$1_{\mathbf{3}}$	
row9	1		*P*		$1_{\mathbf{123}}$				

Pattern 3.024, continued

		C
D		**F**
G	**H**	**I**

Due to pending condition, subpattern-4 must
start in the same square **(57)** as subpattern-3
and share the same squares, **(88), (19)** and **(66)** with subpattern-3

(91) zaps (95) adding **(75)**

Subpattern-4 = **(57),(88),(19),(66),(91),(75)**
F I C D G H

3 024
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								1_{2}	1_{134}
row2			X						
row3						X			
row4				X					
row5	1_{12}						1_{34}		
row6		1_{34}						1_{1}	1_{2}
row7	1_{3}				1_{4}		1_{12}		
row8		1_{12}						1_{34}	
row9	1_{4}		~~P~~		1_{123}				

Pattern 3.029	Box Orientation	Patterns with the same box code
3 – 3 – 2 | **2**	**C – A – B** | **I**	**031, 043, 044.**

A	**B**	**C**
		I

→	→	↓
		•

Box order throughout: A→B→C→I

Subpattern-1 starts in **(13)**

(13) zaps (15) adding **(25)**
(13) zaps (19) and **(25)** zaps (28) adding **(38)** zaps (78) adding **(79)**

Subpattern-1 = **(13),(25),(38),(79)**
A B C I

3 029
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			2_1		2				2
row2			2		2_1			2	
row3			2					2_1	
row4							X		
row5				X					
row6		X							
row7								2	2_1
row8	X					X			
row9									

Pattern 3.029, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

→	→	↓
		•

Box order throughout: A→B→C→I

Subpattern-2 starts in **(23)** zaps (25) adding **(15)**
(23) zaps (28) and **(15)** zaps (19) adding **(38)** zaps (78) adding **(79)**

Subpattern-2 = **(23),(15),(38),(79)**
A B C I

3 029
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			$2_{\mathbf{1}}$		$2_{\mathbf{2}}$				2
row2			$2_{\mathbf{2}}$		$2_{\mathbf{1}}$			2	
row3			2					$2_{\mathbf{12}}$	
row4							X		
row5				X					
row6		X							
row7								2	$2_{\mathbf{12}}$
row8	X					X			
row9									

Pattern 3.029, continued.

A	**B**	**C**
		I

→	→	↓
		•

Box order throughout: A→B→C→I

Subpattern-3 starts in **(33)** zaps row 3 of box B adding **(25)** and pending ***(15)***
(33) zaps (38) and **(25)** zaps (28) adding **(19)** zaps (79) adding **(78)**

Subpattern-3 = **(33),(25),(19),(78)**
A B C I

3 B3	029	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1			2_{1}		2_{2}				2_{3}
	row2			2_{2}		2_{13}			2	
	row3			2_{3}			P		2_{12}	
	row4							X		
	row5				X					
	row6		X							
	row7								2_{3}	2_{12}
	row8	X					X			
	row9									

Pattern 3.029, continued.

Box order throughout**: A→B→C→I**

Due to pending situation in **B,** subpattern-4 must
begin in same starting square **(33)** as subpattern=3
include pending square **(15) (**and erase pending P)

(33) zaps (38) and **(15)** zaps (19) adding **(28)** zaps (78) adding **(79)**

Subpattern-4 = **(33),(15),(28),(79)**
A B C I

Back at starting box, nothing pending, no unclaimed squares, analysis complete.

3 029
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			$2_{\mathbf{1}}$		$2_{\mathbf{24}}$				$2_{\mathbf{3}}$
row2			$2_{\mathbf{2}}$		$2_{\mathbf{13}}$			$2_{\mathbf{4}}$	
row3			$2_{\mathbf{34}}$			~~P~~		$2_{\mathbf{12}}$	
row4							X		
row5				X					
row6		X							
row7								$2_{\mathbf{3}}$	$2_{\mathbf{124}}$
row8	X					X			
row9									

Pattern 3.009	Box Orientation	Patterns with the same box code
2 | **3 – 3** | **2**	**F** | **H – I** | **B**	**010, 015, 018, 035, 037, 039, 041, 047, 050, 051**

	B	
		F
	H	**I**

Box order: H→I→F→B

Subpattern-1 starts in **(74)** zaps (77) & (79) adding **(97)** zaps(47) adding **(49)**
(74) zaps (14) adding **(15)**

Subpattern-1 = **(74),(97),(49),(15)**
H I F B

3 B4	009	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				1	1_1				
	row2	X								
	row3								X	
	row4							1		1_1
	row5						X			
	row6		X							
	row7				1_1			1		1
	row8			X						
	row9				1	1		1_1		

Pattern 3.009, continued.

	B	
		F
	H	**I**

Box order: H→I→F→B

Subpattern-2 is started in **(94)** zaps (97) adding **(77)** & pending ***(79)***
(77) zaps (47) adding **(49)**
(94) zaps (14) adding **(15)**

Subpattern-2 = **(94),(77),(49),(15)**
H I F B

3 B4	009	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				1	1_{12}				
	row2	X								
	row3								X	
	row4							1		1_{12}
	row5						X			
	row6		X							
	row7				1_1			1_2		1
	row8			X						
	row9				1_2	1		1_1		*P*

Pattern 3.009, continued.

	B	
		F
	H	**I**

Box order: H→I→F→B

Due to pending condition, subpattern-3 must
begin in same square **(94)** as subpattern-2
include pending square **(77)**

(77) zaps (47) adding **(49)**
(94) zaps (14) adding **(15)**

Subpattern-3 = **(94),(77),(49),(15)**
H I F B

3 009
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1	1_{123}				
row2	X								
row3								X	
row4							1_{3}		1_{12}
row5						X			
row6		X							
row7				1_{1}			1_{2}		1_{3}
row8			X						
row9				1_{23}	1		1_{1}		~~P~~

Pattern 3.009, continued.

	B	
		F
	H	**I**

Box order: H→I→F→B throughout.

Subpattern-4 starts in **(95)** zaps (97) adding **(77)** and pending ***(79)***
(77) zaps (47) adding **(49)**
(95) zaps (15) adding **(14)**

Subpattern-4 = **(95),(77),(49),(14)**
H I F B

3 009
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1_{4}	1_{123}				
row2	X								
row3								X	
row4							1_{3}		1_{124}
row5						X			
row6		X							
row7				1_{1}			1_{24}		1_{3}
row8			X						
row9				1_{23}	1_{4}		1_{1}		*P*

Pattern 3.009, continued.

	B	
		F
	H	**I**

Box order: H→I→F→B throughout.

Due to pending condition, subpattern-5 must
start in same beginning square **(95)** as subpattern-4
include pending square **(79)**

(79) zaps (49) adding **(47)**
(95) zaps (15) adding **(14)**

Subpattern-5 = **(95),(79),(47),(14)**
H I F B

Back at the starting box H, nothing remains pending, and no squares are unclaimed, so the analysis is complete.

3 009
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1_{45}	1_{123}				
row2	X								
row3								X	
row4							1_{35}		1_{124}
row5						X			
row6		X							
row7				1_{1}			1_{24}		1_{35}
row8			X						
row9				1_{23}	1_{45}		1_{1}		₽

Pattern 3.045	Box Orientation	Patterns with the same box code
3 – 2 – 2	**E – H – B**	**046**
| 2 – 3	**| I – F**	

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: E→F→I→H→B

Subpattern-1 is started in **(45)** zaps (48) adding **(58)** and pending ***(59)***
(58) zaps (78) adding **(79)**
(45) zaps (85) adding **(86)**
(45) zaps (35) adding **(34)**

Subpattern-1 = **(45),(58),(79),(86),(34)**
E F I H B

3 045
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3				4_1	4				
row4					4_1			4	
row5				4		4		4_1	4
row6			X				*P*		
row7								4	4_1
row8					4	4_1			
row9	X								

Pattern 3.045, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: E→F→I→H→B

Due to pending situation, subpattern-2 must
begin in same square **(45)** as subpattern-1
include pending square **(59)**

(59) zaps (79) adding **(78)**
(45) zaps (85) adding **(86)**
(45) zaps (35) adding **(34)**

Subpattern-2 = **(45),(59),(78),(86),(34)**
E F I H B

3 045
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3				4_{12}	4				
row4					4_{12}			4	
row5				4		4		4_1	4_2
row6			X				~~P~~		
row7								4_2	4_1
row8					4	4_{12}			
row9	X								

Pattern 3.045, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: E→F→I→H→B

Subpattern-3 is started in **(56)** zaps (58) & (59) adding **(48)** zaps (78) adding **(79)** **(56)** zaps (86) adding **(85)** zaps (35) adding **(34)**

Subpattern-3 = **(56),(48),(79),(85),(34)**
E F I H B

3 045
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3				4_{123}	4				
row4					4_{12}			4_{3}	
row5				4		4_{3}		4_{1}	4_{2}
row6			X						
row7								4_{2}	4_{13}
row8					4_{3}	4_{12}			
row9	X								

Pattern 3.045, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-4 is started in **(54)** with box order **E→F→I→B→H**

(54) zaps (58) & (59) adding **(48)** zaps (78) adding **(79)**
(54) zaps (34) adding **(35)** zaps (85) adding **(86)**

Subpattern-4 = **(54),(48),(79),(35),(86)**
E F I B H

Back at the starting box E, nothing remains pending, and no squares are unclaimed, so pattern analysis is complete.

3 045
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3				4_{123}	4_{4}				
row4					4_{12}			4_{34}	
row5				4_{4}		4_{3}		4_{1}	4_{2}
row6			X						
row7								4_{2}	4_{134}
row8					4_{3}	4_{124}			
row9	X								

Pattern 3.042	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | **2**	**D** | **I – C – F** | **A**	**none**

A		**C**
D		**F**
		I

Subpattern-1 begins in **(88)** with box order **I→F→C→A→D**

(88) zaps (58) adding **(59)** zaps (39) & (19) adding **(37)** zaps (33) adding **(11)** zaps (61) adding **(63)**

Subpattern-1 = **(88),(59),(37),(11),(63)**
I F C A D

3 042
G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_1								7
row2						X			
row3			7				7_1		7
row4				X					
row5								7	7_1
row6	7		7_1						
row7					X				
row8							7	7_1	7
row9		X							

Pattern 3.042, continued.

A		**C**
D		**F**
		I

Subpattern-2 begins in **(89)** with box order **I→F→C→A→D**

(89) zaps (59) adding **(58)**
(89) zaps (39) & (19) adding **(37)** zaps (33) adding **(11)** zaps (61) adding **(63)**

Subpattern-2 = **(89),(58),(37),(11),(63)**
I F C A D

3 G6	042	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	7_{12}								7
	row2						X			
	row3			7				7_{12}		7
	row4				X					
	row5								7_2	7_1
	row6	7		7_{12}						
	row7					X				
	row8							7	7_1	7_2
	row9		X							

Pattern 3.042, continued.

A		**C**
D		**F**
		I

Subpattern-3 begins in **(87)** with box order **I→C→F→A→D**

(87) zaps (37) adding **(39)** & pending ***(19)***
(39) zaps (59) adding **(58)**
(39) zaps (33) adding **(11)** zaps (61) adding **(63)**

Subpattern-3 = **(87),(39),(58),(11),(63)**
I F C A D

3 042
G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{123}						*P*		7
row2						X			
row3			7				7_{12}		7_{3}
row4				X					
row5								7_{23}	7_{1}
row6	7		7_{123}						
row7					X				
row8							7_{3}	7_{1}	7_{2}
row9		X							

Pattern 3.042, continued.

A		**C**
D		**F**
		I

Subpattern-3 begins in **(87)** with box order **I→C→F→A→D**

Due to pending condition in C, subpattern-4 must
begin in same square **(87)** and follow same squares as subpattern-3
until pending box, where it must include pending square **(19)**

(19) zaps (59) adding **(58)**
(19) zaps (11) adding **(33)** zaps (63) adding **(61)**

Subpattern-4 = **(87),(19),(58),(33),(61)**
I C F A D

Back at the starting box I, nothing remains pending and no boxes remain unclaimed.
The analysis is complete.

3 042
G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{123}						~~P~~		7_{4}
row2						X			
row3			7_{4}				7_{12}		7_{3}
row4				X					
row5								7_{234}	7_{1}
row6	7_{4}		7_{123}						
row7					X				
row8							7_{34}	7_{1}	7_{2}
row9		X							

Pattern 3.038	Box Orientation	Patterns with the same box code
3 – 3 – 2	**C – B – A**	**none**
|	|	
2 – 2	**H – I**	

A	B	C
	H	I

Subpattern-1 is started in **(39)** with box order **C→I→H→B→A**

(39) zaps (79) adding **(98)** zaps (96) adding **(76)**
(39) zaps (35) adding **(25)** and pending ***(15)***
(25) zaps (21) adding **(11)**

Subpattern-1 **= (39),(98),(76),(25),(11)**
C I H B A

3 038
G4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_1				4			4	4
row2	4				4_1				
row3					4				4_1
row4				X					
row5		X							
row6							X		
row7						4_1			4
row8			X						
row9						4		4_1	

Pattern 3.038, continued.

A	**B**	**C**
	H	**I**

Due to pending condition in box B, subpattern-2 must
start in same square **(39)** as subpattern-1
share same squares **(98)** & **(96)** in boxes leading up to pending square
include pending square **(15)**

(15) zaps (11 adding **(21)**

Subpattern-2 = **(39),(98),(96),(15),(21)**
C I H B A

3 038
G4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}				4_{2}			4	4
row2	4_{2}				4_{1}				
row3					4				4_{12}
row4				X					
row5		X							
row6							X		
row7						4_{12}			4
row8			X						
row9						4		4_{12}	

Pattern 3.038, continued.

A	B	C
	H	I

Subpattern-3 is started in **(18)** with box order **C→I→H→A→B**

(18) zaps (98) adding **(79)** zaps (76) adding **(96)**
(18) zaps (11) adding **(21)**
(21) zaps (25) and **(18)** zaps (15) adding **(35)**

Subpattern-3 = **(18),(79),(96),(21),(35)**
C I H A B

3 G4	038	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	4_{1}				4_{2}			4_{3}	4
	row2	4_{23}				4_{1}				
	row3					4_{3}				4_{12}
	row4				X					
	row5		X							
	row6							X		
	row7						4_{12}			4_{3}
	row8			X						
	row9						4_{3}		4_{12}	

Pattern 3.038, continued.

A	B	C
	H	I

Subpattern-4 is started in **(19)** with box order **C→I→H→A→B**

(19) zaps (79) adding **(98)** zaps (96) adding **(76)**
(19) zaps (11) adding **(21)**
(19) zaps (15) and **(21)** zaps (25) adding **(35)**

Subpattern-4 = **(19),(98),(76),(21),(35)**
C I H A B

Back at the starting box C, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

3 038
G4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}				4_{2}			4_{3}	4_{4}
row2	4_{234}				4_{1}				
row3					4_{34}				4_{12}
row4				X					
row5		X							
row6							X		
row7						4_{124}			4_{3}
row8			X						
row9						4_{3}		4_{124}	

Pattern 3.005	Box Orientation	Patterns with the same box code
2 – 2 | **3 – 3** | **2**	**F – C** | **H – E** | **G**	**none**

		C
	E	**F**
G	**H**	

Subpattern-1 begins in **(44)** with box order **E→F→C→H→G**

(44) zaps (47) adding **(69)** zaps (39) adding **(37)**
(44) zaps (74) & (84) adding **(76)** zaps (72) adding **(82)**

Subpattern-1 = **(44),(69),(37),(76),(82)**
E F C H G

3 005
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2			X						
row3							5_1		5
row4				5_1			5		
row5	X								
row6				5		5			5_1
row7		5		5		5_1			
row8		5_1		5					
row9								X	

Pattern 3.005

		C
	E	**F**
G	**H**	

Subpattern-2 begins in **(64)** with box order **E→F→C→H→G**

(64) zaps (69) adding **(47)** zapping (37) adding **(39)**
(64) zaps (74) & (84) adding **(76)** zaps (72) adding **(82)**

Subpattern-2 = **(64),(47),(39),(76),(82)**
E F C H G

3 005
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2			X						
row3							5_{1}		5_{2}
row4				5_{1}			5_{2}		
row5	X								
row6				5_{2}		5			5_{1}
row7		5		5		5_{12}			
row8		5_{12}		5					
row9								X	

Pattern 3.005

		C
	E	**F**
G	**H**	

Subpattern-3 begins in **(66)** with box order **E→F→C→H→G**

(66) zaps (69) adding **(47)** zaps (37) adding **(39)**
(66) zaps (76) adding **(74)** and pending ***(84)***
(74) zaps (72) adding **(82)**

Subpattern-3 = **(66),(47),(39),(74),(82)**
E F C H G

3 005
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2			X						
row3							5_{1}		5_{23}
row4				5_{1}			5_{23}		
row5	X								
row6				5_{2}		5_{3}			5_{1}
row7		5		5_{3}		5_{12}			
row8		5_{123}		5					
row9					*P*			X	

Pattern 3.005

		C
	E	**F**
G	**H**	

Due to pending condition in box H, subpattern-4 must
begin in same square **(66)** as subpattern-3
and share same squares **(47)** and **(39)** as subpattern-3 until pending box
include pending square **(84)**

(84) zaps (82) adding **(72)**

Subpattern-4 = **(66),(47),(39),(84),(72)**
E F C H G

Back at the starting box E, nothing is pending, and no squares are unclaimed, so the analysis is complete.

3 005
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2			X						
row3							5_{1}		5_{234}
row4				5_{1}			5_{234}		
row5	X								
row6				5_{2}		5_{34}			5_{1}
row7		5_{4}		5_{3}		5_{12}			
row8		5_{123}		5_{4}					
row9					~~P~~			X	

Pattern 3.035	Box Orientation	Patterns with the same box code
2 | **3 – 3** | **2**	**C** | **E – F** | **H**	**038**

		C
	E	**F**
	H	

We'll start subpattern-1 in **(45)** of box **E** with box order **E→H→F→C**

(45) zaps (47) and (49) adding **(69)** zaps (39) adding **(17)**
(45) zaps (85) adding **(96)**

Subpattern-1 = **(45),(69),(17),(96)**
E H F C

3 B4	035	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1							2_1		2
	row2	X								
	row3				X					
	row4					2_1	2	2		2
	row5			X						
	row6					2				2_1
	row7								X	
	row8					2	2_1			
	row9		X							

Pattern 3.035, continued.

		C
	E	**F**
	H	

We'll start subpattern-2 in **(46)** of box **E** with box order **E→H→F→C**

(46) zaps (47) & (49) adding **(69)** zaps (19) adding **(17)**
(46) zaps (86) adding **(85)**

Subpattern-2 = **(46),(69),(17),(85)**
E H F C

3 035
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{12}		2
row2	X								
row3				X					
row4					2_1	2_2	2		2
row5			X						
row6					2				2_{12}
row7								X	
row8					2_2	2_1			
row9		X							

Pattern 3.035, continued.

		C
	E	**F**
	H	

We'll start subpattern-3 in **(65)** of box **E** with box order **E→H→F→C**

(65) zaps (85) adding **(86)**
(65) zaps (69) adding **(47)** and pending ***(49)***
(47) zaps (17) adding **(19)**

Subpattern-3 = **(65),(86),(47),(19)**
E H F C

3 035
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{12}		2_{3}
row2	X								
row3				X					
row4					2_{1}	2_{2}	2_{3}		2
row5			X					*P*	
row6					2_{3}				2_{12}
row7								X	
row8					2_{2}	2_{13}			
row9		X							

Pattern 3.035, continued.

		C
	E	**F**
	H	

Due to pending condition in box **F**, subpattern-4 must
begin in same starting square **(65)** as subpattern-3
follow same squares as subpattern-3 until pending box is reached
include pending square **(49)**

(49) zaps (19) adding **(17)**
(65) zaps (85) adding **(86)**

Subpattern-4 = **(65),(86),(49),(17)**
E H F C

Back at the starting box E, nothing remains pending, and no squares are unclaimed, so the analysis is complete.

3 035
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{124}		2_{3}
row2	X								
row3				X					
row4					2_{1}	2_{2}	2_{3}		2_{4}
row5			X					~~P~~	
row6					2_{34}				2_{12}
row7								X	
row8					2_{2}	2_{134}			
row9		X							

Pattern 3.012	Box Orientation	Patterns with the same box code
2 | **2 – 2** | **3 – 3** | **2**	**I** | **B – C** | **D – E** | **G**	**none**

	B	C
D	E	
G		I

Subpattern-1 begins in **(54)** with box order **E→D→G→B→C→I**

(54) zaps (51) adding **(61)** and pending ***(62)***
(61) zaps (71) adding **(72)**
(54) zaps (24) adding **(36)** zaps (38) adding **(29)** zaps (99) adding **(98)**

Subpattern-1 = **(54),(61),(72),(36),(29),(98)**
E D G B C I

3 A6 012

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8					8_1
row3						8_1		8	
row4		*P*					X		
row5	8			8_1		8			
row6	8_1	8		8					
row7	8	8_1							
row8					X				
row9								8_1	8

Pattern 3.012, continued.

	B	**C**
D	**E**	
G		**I**

Due to pending condition in D, subpattern-2 must
begin in same starting square **(54)** as subpattern-1
follow same squares as subpattern-1 until pending box
include pending square **(62)**

(62) zaps (72) adding **(71)**
(54) zaps (24) adding **(36)** zaps (38) adding **(29)** zaps (99) adding **(98)**

Subpattern-2 = **(54),(62),(71),(36),(29),(98)**
E D G B C I

3 012
A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8					8_{12}
row3						8_{12}		8	
row4		~~P~~					X		
row5	8			8_{12}		8			
row6	8_1	8_2		8					
row7	8_2	8_1							
row8					X				
row9								8_{12}	8

Pattern 3.012, continued.

	B	**C**
D	**E**	
G		**I**

Subpattern-3 begins in **(56)** with box order **E→D→G→B→C→I**

(56) zaps (51) adding **(61)** and pending ***(62)***
(61) zaps (71) adding **(72)**
(56) zaps (36) adding **(24)** zaps (29) adding **(38)** zaps (98) adding **(99)**

Subpattern-3 = **(56),(62),(72),(24),(38),(99)**
E D G B C I

---

3 A6 012

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8_3					8_{12}
row3						8_{12}		8_3	
row4		~~P~~					X		
row5	8			8_{12}		8_3			
row6	8_{13}	8_2		8					
row7	8_2	8_{13}							
row8					X				
row9								8_{12}	8_3

Pattern 3.012, continued.

	B	**C**
D	**E**	
G		**I**

Due to pending condition in box **D**, subpattern-4 must
start in same square **(56)** as subpattern-3
follow same squares as subpattern-3 until pending box is reached
include pending square **(62)**

(62) zaps (72) adding **(71)**
(56) zaps (36) adding **(24)** zaps (29) adding **(38)** zaps (98) adding **(99)**

Subpattern-4 = **(56),(62),(71),(24),(38),(99)**
E D G B C I

---

3 012
A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8_{34}					8_{12}
row3						8_{12}		8_{34}	
row4		~~P~~					X		
row5	8			8_{12}		8_{34}			
row6	8_{13}	8_{24}		8					
row7	8_{24}	8_{13}							
row8					X				
row9								8_{12}	8_{34}

Pattern 3.012, continued.

	B	**C**
D	**E**	
G		**I**

Subpattern-5 begins in **(64)** with box order **E→D→G→B→C→I**

(64) zaps (61) & (62) adding **(51)** zaps (71) adding **(72)**
(64) zaps (24) adding **(36)** zaps (38) adding **(29)** zaps (99) adding **(98)**

Subpattern-5 = **(64),(51),(72),(36),(29),(98)**
E D G B C I

Back at the starting box E, no box remains pending, no square remains unclaimed. The analysis is complete.

---

3 012
A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8_{34}					8_{125}
row3						8_{125}		8_{34}	
row4		~~P~~					X		
row5	8_{5}			8_{12}		8_{34}			
row6	8_{13}	8_{24}		8_{5}					
row7	8_{24}	8_{135}							
row8					X				
row9								8_{125}	8_{34}

Pattern 3.030	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | | **2** | **2**	**C** | **D – F – E** | | **G** | **H**	**none**

		C
D	**E**	**F**
G	**H**	

Subpattern-1 starts in **(41)** with box order **D→G→E→H→F→C**

(41) zaps (71) adding **(73)**
(41) zaps (46) adding **(64)** zaps (84) adding **(86)**
(64) zaps (67) & (69) adding **(57)** zaps (37) adding **(39)**

Subpattern-1 = **(41),(73),(64),(86),(57),(39)**
D G E H F C

3 030
A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3							1		1_1
row4	1_1		1			1			
row5			1				1_1		
row6				1_1			1		1
row7	1		1_1						
row8				1		1_1			
row9								X	

Pattern 3.030, continued.

		C
D	**E**	**F**
G	**H**	

Subpattern-2 starts in **(43)** with box order **D→G→E→H→F→C**

(43) zaps (73) adding **(71)**
(43) zaps (46) adding **(64)** zaps (84) adding **(86)**
(64) zaps (67) & (69) adding **(57)** zaps (37) adding **(39)**

Subpattern-2 = **(43),(71),(64),(86),(57),(49)**
D G E H F C

3 030
A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3							1		1_{12}
row4	1_{1}		1_{2}			1			
row5			1				1_{12}		
row6				1_{12}			1		1
row7	1_{2}		1_{1}						
row8				1		1_{12}			
row9								X	

Pattern 3.030, continued.

		C
D	**E**	**F**
G	**H**	

Subpattern-3 starts in **(53)** with box order **D→G→F→C→E→H**

(53) zaps (73) adding **(71)**
(53) zaps (57) adding **(67)** and pending ***(69)***
(67) zaps (64) adding **(46)** zaps (86) adding **(84)**
(67) zaps (37) adding **(39)**

Subpattern-3 = **(53),(71),(67),(39).(46),(84)**
D G F C E H

3 030
A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3							1		1_{123}
row4	1_{1}		1_{2}			1_{3}			
row5			1_{3}				1_{12}		
row6				1_{12}			1_{3}		1
row7	1_{23}		1_{1}						
row8				1_{3}		1_{12}			
row9								X	

Pattern 3.030, continued.

		C
D	**E**	**F**
G	**H**	

Due to pending condition in box **F**, subpattern-4 must
begin in the same starting square **(53)** as subpattern-3
follow the same square **(71)** as subpattern-3 between starting and pending box
include the pending square **(69)**

(69) zaps (39) adding **(37)**
(69) zaps (64) adding **(46)** zaps (86) adding **(84)**

Subpattern-4 = (53),(71),(69),(37),(46),(84)
D G F C E H

Back at the starting box D, no pending situtation remain, and no squares are unclaimed. The analysis is complete.

3 030
A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3							1_{4}		1_{123}
row4	1_{1}		1_{2}			1_{34}			~~P~~
row5			1_{34}				1_{12}		
row6				1_{12}			1_{3}		1_{4}
row7	1_{234}		1_{1}						
row8				1_{34}		1_{12}			
row9								X	

Pattern 3.061	Box Orientation	Patterns with the same box code
2 | **3 – 2 – 3** | **2 – 2**	**D** | **A – B – C** | **I – H**	**none**

A	**B**	**C**
D		
	H	**I**

Subpattern-1 begins in **(12)** with box order **A→D→C→B→I→H**

(12) zaps (42) adding **(41)**
(12) zaps (15) adding **(35)**
(12) zaps (17) while **(35)** zaps (39) adding **(27)**
(27) zaps (97) adding **(89)** zaps (86) adding **(96)**

Subpattern-1 = **(12),(41),(35),(27),(89),(96)**
A D C B I H

3 061
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_1			8		8		
row2		8					8_1		
row3	8				8_1				8
row4	8_1	8							
row5								X	
row6				X					
row7			X						
row8						8			8_1
row9						8_1	8		

Pattern 3.061, continued.

A	**B**	**C**
D		
	H	**I**

Subpattern-2 begins in **(22)** with box order **A→D→C→B→I→H**

(22) zaps (42) adding **(41)**
(22) zaps (27) adding **(17)** and pending ***(39)***
(17) zaps (15) adding **(35)**
(17) zaps (97) adding **(89)** zaps (86) adding **(96)**

Subpattern-2 = **(22),(41),(17),(35),(89),(96)**
A D C B I H

3 061
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{1}			8		8_{2}		*P*
row2		8_{2}					8_{1}		
row3	8				8_{12}				8_{P}
row4	8_{12}	8							
row5								X	
row6				X					
row7			X						
row8						8			8_{12}
row9						8_{12}	8		

Pattern 3.061, continued.

A	**B**	**C**
D		
	H	**I**

Due to pending condition in C, subpattern-3 must
begin in same square **(22)** as subpattern-2
include square **(41)**
include pending square **(39)**

(39) zaps (35) adding **(15)**
(39) zaps (89) adding **(97)** zaps (96) adding **(86)**

Subpattern-3 = **(22),(41),(39),(15),(97),(86)**

3 061
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{1}			8_{3}		8_{2}		~~P~~
row2		8_{23}					8_{1}		
row3	8				8_{12}				8_{3}
row4	8_{123}	8							
row5								X	
row6				X					
row7			X						
row8						8_{3}			8_{12}
row9						8_{12}	8_{3}		

Pattern 3.061, continued.

A	**B**	**C**
D		
	H	**I**

Subpattern-4 begins in **(31)** with box order **A→D→B→C→I→H**

(31) zaps (41) adding **(42)**
(31) zaps (35) adding **(15)**
(31) zaps (39) and **(15)** zaps (17) adding **(39)** zaps (89) adding **(97)** zaps (96) adding **(86)**

Subpattern-4 = **(31),(42),(15),(39),(97),(86)**
A D B C I H

Back at the starting box A, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

3 061
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{1}			8_{34}		8_{2}		
row2		8_{23}					8_{14}		
row3	8_{4}				8_{12}				8_{3}
row4	8_{123}	8_{4}							
row5								X	
row6				X					
row7			X						
row8						8_{3}			8_{124}
row9						8_{124}	8_{3}		

Pattern 3.004	Box Orientation	Patterns with the same box code
3 – 2 **| |** **2 – 3 – 2** **|** **2**	**G – D** **| |** **I – F – C** **|** **H**	**024**

		C
D		**F**
G	**H**	**I**

Subpattern-1 is begun in **(72)** with box order **G→I→H→D→F→C**

(72) zaps (78) adding **(89)** zaps (86) adding **(96)**
(72) zaps (62) adding **(53)** zaps (59) adding **(67)** and pending ***(68)***
(67) zaps (17) adding **(18)**

Subpattern-1 = **(72),(89),(96),(53),(67),(18)**
G I H D F C

3 004
C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2	2_1	
row2					X				
row3	X								
row4				X			*P*		
row5			2_1						2
row6		2					2_1	2_P	
row7		2_1						2	
row8			2			2			2_1
row9			2			2_1			

Pattern 3.004, continued.

		C
D		**F**
G	**H**	**I**

Due to pending situation in **F**, subpattern-2 must
begin in same starting square **(72)** as subpattern-1
include pending square **(68)**
share same squares **(53)** as subpattern-3 between starting and pending boxes
(72) zaps (78) adding **(89)** zaps (86) adding **(96)**
(68) zaps (18) adding **(17)**

Subpattern-2 = **(72),(89),(96),(53),(68),(17)**
G I H D F C

3 004
C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{2}	2_{1}	
row2					X				
row3	X								
row4				X			~~2~~		
row5			2_{12}						2
row6		2					2_{1}	2_{2}	
row7		2_{12}						2	
row8			2			2			2_{12}
row9			2			2_{12}			

Pattern 3.004, continued.

		C
D		**F**
G	**H**	**I**

Subpattern-3 begins in **(83)** with box order **G→H→I→C→D→F**

(83) zaps (86) adding **(96)**
(83) zaps (89) adding **(78)** zaps (18) adding **(17)**
(83) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)**

Subpattern-3 = **(83),(96),(78),(17),(62),(59)**
G H I C D F

3 004
C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{23}	2_{1}	
row2					X				
row3	X								
row4				X					
row5			2_{12}						2_{3}
row6		2_{3}					2_{1}	2_{2}	
row7		2_{12}						2_{3}	
row8			2_{3}			2			2_{12}
row9			2			2_{123}			

Pattern 3.004, continued.

		C
D		**F**
G	**H**	**I**

Subpattern-4 begins in **(83)** with box order **G→H→D→F→I→C**

(83) zaps (86) adding **(96)**
(83) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)** zaps (89) adding **(78)**
zaps (18) adding **(17)**

Subpattern-4 = **(83),(96),(62),(59),(78),(17)**
G H D F I C

Back at the starting box G, no box is pending and no square unclaimed. The analysis is complete.

3 004
C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{234}	2_{1}	
row2					X				
row3	X								
row4				X					
row5			2_{12}						2_{34}
row6		2_{34}					2_{1}	2_{2}	
row7		2_{12}						2_{34}	
row8			2_{3}			2_{4}			2_{12}
row9			2_{4}			2_{123}			

Pattern 3.017	Box Orientation	Patterns with the same box code
3 – 2 – 2 **| |** **2 – 3** **|** **2**	**G – D – A** **| |** **I – F** **|** **E**	**none**

A		
D	**E**	**F**
G		**I**

Subpattern-1 begins in **(71)** with box order **G→I→F→E→D→A**

(71) zaps (77) adding **(99)** zaps (49) adding **(57)** and pending ***(67)***
(57) zaps (54) adding **(64)** zaps (61) adding **(42)** zaps (32) adding **(33)**

Subpattern-1 = **(71),(99),(57),(64),(42),(33)**
G I F E D A

3 017
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		2	2_1						
row4		2_1							2
row5				2			2_1		
row6	2			2_1			2_P		*P*
row7	2_1						2		
row8					X				
row9		2	2						2_1

Pattern 3.017, continued.

A		
D	**E**	**F**
G		**I**

Due to the pending situation in **F**, subpattern-2 must
begin in the same starting square **(71)** as subpattern-1
include the pending square **(67)**
follow same square **(99)** as subpattern-1 between starting and pending squares

(67) zaps (64) adding **(54)**
(67) zaps (61) adding **(42)** zaps (32) adding **(33)**

Subpattern-2 = **(71),(99),(67),(54),(42),(33)**
G I F E D A

3 017
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		2	2_{12}						
row4		2_{12}							2
row5				2_2			2_1		
row6	2			2_1			2_2		~~P~~
row7	2_{12}						2		
row8					X				
row9		2	2						2_{12}

Pattern 3.017, continued.

A		
D	**E**	**F**
G		**I**

Subpattern-3 begins in **(92)** with box order **G→I→F→D→C→A**

(92) zaps (99) adding **(77)** zaps(67) & (57) adding **(49)** zaps (42) adding **(61)**
(61) zaps (64) adding **(54)**
(92) zaps (32) adding **(33)**

Subpattern-3 = **(92),(77),(49),(61),(54),(33)**
G I F D C A

3 017
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		2	2_{123}						
row4		2_{12}							2_{3}
row5				2_{23}			2_{1}		
row6	2_{3}			2_{1}			2_{2}		
row7	2_{12}						2_{3}		
row8					X				
row9		2_{3}	2						2_{12}

Pattern 3.017, continued.

A		
D	**E**	**F**
G		**I**

Subpattern-4 begins in **(93)** with box order **G→I→F→D→C→A**

(93) zaps (99) adding **(77)** zaps (67) & (57) adding **(49)** zaps (42) adding **(61)** zaps (64) adding **(54)**
(93) zaps (33) adding **(32)**

Subpattern-4 = **(93),(77),(49),(61),(54),(32)**
G I F D C A

Back at the starting box G, no boxes are pending and no squares are unclaimed. The analysis is complete.

3 017
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		2_{4}	2_{123}						
row4		2_{12}							2_{34}
row5				2_{234}			2_{1}		
row6	2_{34}			2_{1}			2_{2}		
row7	2_{12}						2_{34}		
row8					X				
row9		2_{3}	2_{4}						2_{12}

Pattern 3.059	Box Orientation	Patterns with the same box code
3 – 2 – 3 **| |** **2 – 3** **|** **2**	**D – F – E** **| |** **G – I** **|** **C**	**none**

		C
D	**E**	**F**
G		**I**

Subpattern-1 starts in **(43)** with box order **D→G→I→F→C→E**

(43) zaps (93) adding **(71)** zaps (77) & (78) adding **(99)** zaps (49) adding **(68)**
(68) zaps (18) adding **(17)**
(43) zaps (44) adding **(54)**

Subpattern-1 = **(43),(71),(99),(68),(17),(54)**
D G I F C E

3 C9 059

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_1	1	
row2		X							
row3						X			
row4			1_1	1					1
row5			1	1_1					
row6	1							1_1	
row7	1_1						1	1	
row8					X				
row9			1						1_1

Pattern 3.059 continued.

		C
D	**E**	**F**
G		**I**

Subpattern-2 starts in **(53)** with box order **D→G→I→F→C→E**

(53) zaps (93) adding **(71)** zaps (77) & (78) adding **(99)** zaps (49) adding **(68)** zaps (18) adding **(17)**
(53) zaps (54) adding **(44)**

Subpattern-2 = **(53),(71),(99),(68),(17),(44)**
D G I F C E

3 059
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_{12}	1	
row2		X							
row3						X			
row4			1_{1}	1_{2}					1
row5			1_{2}	1_{1}					
row6	1							1_{12}	
row7	1_{12}						1	1	
row8					X				
row9			1						1_{12}

Pattern 3.059 continued.

		C
D	**E**	**F**
G		**I**

Subpattern-3 starts in **(61)** with box order **D→G→I→F→C→E**

(61) zaps (71) adding **(93)** zaps (99) adding **(77)** and pending ***(78)***
(77) zaps (17) adding **(18)** zaps (68) adding **(49)** zaps (44) adding **(54)**

Subpattern-3 = **(61),(93),(77),(18),(49),(54)**
D G I F C E

3 059
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_{12}	1_{3}	
row2		X							
row3						X			
row4			1_{1}	1_{2}					1_{3}
row5			1_{2}	1_{13}					
row6	1_{3}							1_{12}	
row7	1_{12}						1_{3}	1_{P}	
row8					X				
row9			1_{3}				*P*		1_{12}

Pattern 3.059 continued.

		C
D	**E**	**F**
G		**I**

Due to the pending condition in I, subpattern-4 must
begin in the same starting square **(61)** as subpattern-3
share the same square **(93)** with subpattern-3 between starting and pending square
include the pending square **(78)**

(78) zaps (68) adding **(49)**
(78) zaps (18) adding **(17)**
(49) zaps (44) adding **(54)**

Subpattern-4 = **(61),(93),(78),(49),(17),(54)**
D G I F C E

Back at the starting box D, nothing is pending and no squares are unclaimed. The analysis is complete

3 059 C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_{124}	1_{3}	
row2		X							
row3						X			
row4			1_{1}	1_{2}					1_{34}
row5			1_{2}	1_{134}					
row6	1_{34}							1_{12}	
row7	1_{12}						1_{3}	1_{4}	
row8					X				
row9			1_{34}				*P*		1_{12}

Pattern 3.006	Box Orientation	Patterns with the same box code
3 – 3 | | **3 – 2**	**E – F** | | **H – I**	**019, 021, 023, 028, 036.**

	E	**F**
	H	**I**

Subpattern-1 begins in **(54)** with box order **E→F→I→H**
(54) zaps (57) adding **(67)** and pending ***(68)***
(67) zaps (87) adding **(98)**
(54) zaps (84) and **(98)** zaps (96) adding **(86)**

Subpattern-1 = **(54),(67),(98),(86)**
E F I H

3 D1 006

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4	X							*P*	
row5				$1_{\mathbf{1}}$		1	1		
row6				1			$1_{\mathbf{1}}$	$1_{\mathbf{P}}$	
row7			X						
row8				1		$1_{\mathbf{1}}$	1		
row9						1		1_{1}	

Pattern 3.006, continued.

	E	**F**
	H	**I**

Due to pending situation in **F**, subpattern-2 must
begin in the same square **(54)** as subpattern-1
follow the same squares as subpattern-1 until pending box is reached
include the pending square **(68)**

(68) zaps (98) adding **(87)** zaps (84) & (86) adding **(96)**

Subpattern-2 = **(54),(68),(87),(96)**
E F I H

3 006
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4	X							~~P~~	
row5				1_{12}		1_{3}	1_{4}		
row6				1_{4}			1_{13}	1_{2}	
row7			X						
row8				1_{3}		1_{14}	1_{2}		
row9						1_{2}		1_{134}	

Pattern 3.006, continued.

	E	**F**
	H	**I**

Subpattern-3 begins in **(56)** with box order **E→H→I→F**

(56) zaps (86) & (96) adding **(84)** zaps (87) adding **(98)**
(56) zaps (57) while **(98)** zaps (68) adding **(67)**

Subpattern-3 = **(56),(84),(98),(67)**
E H I F

3 D1	006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1									X
	row2					X				
	row3		X							
	row4	X								
	row5				1_{12}		1_{3}	1		
	row6				1			1_{13}	1_{2}	
	row7			X						
	row8				1_{3}		1_{1}	1_{2}		
	row9						1_{2}		1_{13}	

Pattern 3.006, continued.

	E	**F**
	H	**I**

Subpattern-4 begins in **(64)** with box order **E→H→I→F**

(64) zaps (67) & (68) adding **(57)** zaps (87) adding **(98)**
(64) zaps (84) while **(98)** zaps (96) adding **(86)**

Subpattern-4 = **(64),(57),(98),(86)**
E H I F

Back at the starting box E, nothing is pending and no squares are unclaimed, so the analysis is complete.

3 006
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4	X								
row5				1_{12}		1_{3}	1_{4}		
row6				1_{4}			1_{13}	1_{2}	
row7			X						
row8				1_{3}		1_{14}	1_{2}		
row9						1_{2}		1_{134}	

Pattern 3.025	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 3** | | **2 – 2**	**E** | **G – A – D** | | **I –- C**	**none**

A		**C**
D	**E**	
G		**I**

Subpattern-1 begins in **(11)** with box order **A→D→E→C→I→G**

(11) zaps (61) adding **(53)** and pending ***(63)***
(53) zaps (55) adding **(65)**
(11) zaps (17) adding **(39)** zaps (79) adding **(87)** zaps (82) & (83) adding **(72)**

Subpattern-1 = **(11),(53),(65),(39),(87),(72)**
A D E C I G

3 D2 025

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$1_{\mathbf{1}}$						1		
row2						X			
row3	1	1							$1_{\mathbf{1}}$
row4			*P*					X	
row5			$1_{\mathbf{1}}$		1				
row6	1		1		$1_{\mathbf{1}}$				
row7		$1_{\mathbf{1}}$							1
row8		1	1				$1_{\mathbf{1}}$		
row9				X					

Pattern 3.025, continued.

A		**C**
D	**E**	
G		**I**

Due to the pending situation in **E**, subpattern-2 must
begin in the same square **(11)** as subpattern-1
follow the same squares as subpattern-1 until pending box is reached
include the pending square **(63)**

(63) zaps (65) adding **(55)**
(11) zaps (17) adding **(39)** zaps (79) adding **(87)** zaps (82) & (83) adding **(72)**

Subpattern-2 = **(11),(63),(55),(39),(87),(72)**
A D E C I G

3 025
D2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}						1		
row2						X			
row3	1	1							1_{12}
row4			*P*					X	
row5			1_{1}		1_{2}				
row6	1		1_{2}		1_{1}				
row7		1_{12}							1
row8		1	1				1_{12}		
row9				X					

Pattern 3.025, continued.

A		**C**
D	**E**	
G		**I**

Subpattern-3 begins in **(31)** with box order **A→D→E→C→I→G**

(31) zaps (61) adding **(53)** and pending ***(63)***
(53) zaps (55) adding **(65)**
(31) zaps (39) adding **(17)** zaps (87) adding **(79)**
(79) zaps (72) while **(53)** zaps (83) adding **(82)**

Subpattern-3 = **(31),(53),(65),(17),(79),(82)**
A D E C I G

3 025
D2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}						1_{3}		
row2						X			
row3	1_{3}	1							1_{12}
row4			*P*					X	
row5			1_{13}		1_{2}				
row6	1		1_{2}		1_{13}				
row7		1_{12}							1_{3}
row8		1_{3}	1				1_{12}		
row9				X					

Pattern 3.025, continued.

A		**C**
D	**E**	
G		**I**

Due to the pending situation in **D**, subpattern-4 must
begin in the same square **(31)** as subpattern-3
follow the same squares as subpattern-3 until pending box is reached
include the pending square **(63)**

(63) zaps (65) adding **(55)**
(31) zaps (39) adding **(17)** zaps (87) adding **(79)**
(79) zaps (72) while **(63)** zaps (83) adding **(82)**

Subpattern-4 = **(31),(63),(55),(17),(79),(82)**
A D E C I G

3 025
D2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$1_{\mathbf{12}}$						$1_{\mathbf{34}}$		
row2						X			
row3	$1_{\mathbf{34}}$	1							$1_{\mathbf{12}}$
row4			*P*					X	
row5			$1_{\mathbf{13}}$		$1_{\mathbf{24}}$				
row6	1		$1_{\mathbf{24}}$		$1_{\mathbf{13}}$				
row7		$1_{\mathbf{12}}$							$1_{\mathbf{34}}$
row8		$1_{\mathbf{34}}$	1				$1_{\mathbf{12}}$		
row9				X					

Pattern 3.025, continued.

A		**C**
D	**E**	
G		**I**

Subpattern-5 begins in **(32)** with order of boxes **A→G→D→E→I→C**

(32) zaps (72) & (82) adding **(83)** zaps (63) & (53) adding **(61)** zaps (65) adding **(55)**
(83) zaps (87) adding **(79)** zaps (39) adding **(17)**

Subpattern-5 = **(32),(83),(61),(55),(79),(17)**
A G D E I C

Back at the starting box A, nothing is pending and no squares are unclaimed.
The pattern analysis is complete.

3 025
D2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}						1_{345}		
row2						X			
row3	1_{34}	1_{5}							1_{12}
row4			*P*					X	
row5			1_{13}		1_{245}				
row6	1_{5}		1_{24}		1_{13}				
row7		1_{1}							1_{345}
row8		1_{34}	1_{5}				1_{12}		
row9				X					

Pattern 3.026	Box Orientation	Patterns with the same box code
3 – 3 – 3 **| |** **3 – 2**	**A – C – B** **| |** **G – I**	**none**

A	**B**	**C**
G		**I**

Subpattern-1 starts in **(12** with box order **A→B→C→I→G**

(12 zaps (14) adding **(24)** and pending ***(34)***
(12) zaps (14) while **(24)** zaps (29) adding **(39)**
(39) zaps (89) adding **(78)** zaps (71) & (72) adding **(81)**

Subpattern-1 = **(12,(24),(39),(78),(81)**
A B C I G

3 026
D3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		$1_{\mathbf{1}}$		1		*P*		1	
row2	1			$1_{\mathbf{1}}$					1
row3		1		$1_{\mathbf{P}}$					$1_{\mathbf{1}}$
row4						X			
row5							X		
row6			X						
row7	1	1						$1_{\mathbf{1}}$	
row8	$1_{\mathbf{1}}$								1
row9					X				

Pattern 3.026, continued.

A	B	C
G		I

Due to pending condition in **B**, subpattern-2 must
begin in same square **(12** as subpattern-1
follow same squares as subpattern-1 until pending box is reaches
include pending square **(34)**

(12) zaps (18) and **(34)** zaps (39) adding **(29)** zaps (89) adding **(78)**
(78) zaps (71) & (72) adding **(81)**

Subpattern-2 = **(12),(34),(29),(78),(81)**
A B C I G

3 026
D3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{12}		1		*P*		1	
row2	1			1_{1}					1_{2}
row3		1		1_{2}					1_{1}
row4						X			
row5							X		
row6			X						
row7	1	1						1_{12}	
row8	1_{12}								1
row9					X				

Pattern 3.026, continued.

A	**B**	**C**
G		**I**

Subpattern-3 starts in **(21)** with box order **A→G→I→C→B**

(21) zaps (71) & (81) adding **(72)** zaps (78) adding **(89)**
(89) zaps (29) & (39) adding **(18)**
(18) zaps (34) while **(21)** zaps (24) adding **(14)**

Subpattern-3 = **(21),(72),(89),(18),(14)**
A G I C B

3 D3	026	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1		1_{12}		1				1_{3}	
	row2	1_{3}			1_{1}					1_{2}
	row3		1		1_{23}					1_{1}
	row4						X			
	row5							X		
	row6			X						
	row7	1	1_{3}						1_{12}	
	row8	1_{12}								1_{3}
	row9					X				

Pattern 3.026, continued.

A	**B**	**C**
G		**I**

Subpattern-4 starts in **(32)** with box order **A→B→C→I→G**

(32) zaps (34) adding **(24)** and pending ***(14)***
(32) zaps (39) while **(24)** zaps (29) adding **(18)**
(18) zaps (78) adding **(89)**
(32) zaps (72) while **(89)** zaps (81) adding **(72)**

Subpattern-4 = **(32),(24),(18),(89),(72)**
A B C I G

3 D3	026	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1		1_{12}		1_{P}				1_{34}	
	row2	1_{3}			1_{14}		P			1_{2}
	row3		1_{4}		1_{23}					1_{1}
	row4						X			
	row5							X		
	row6			X						
	row7	1	1_{34}						1_{12}	
	row8	1_{12}								1_{34}
	row9					X				

Pattern 3.026, continued.

A	B	C
G		I

Due to pending condition in **C**, subpattern-5 must
start in same square **(32)** as subpattern-4
follow same squares as subpattern-4 until pending box is reached
include pending square **(14)**

(32) zaps (39) while **(14)** zaps (18) adding **(29)**
(29) zaps (89) adding **(78)** zaps (71) & (72) adding **(81)**

Subpattern-5 = **(32),(13),(29),(78),(81)**
A B C I G

Back at the starting box A, nothing remains pending and no squares remain unclaimed, so the pattern analysis is complete.

3 026
D3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{12}		1_{5}				1_{34}	
row2	1_{3}			1_{14}		*P*			1_{25}
row3		1_{45}		1_{23}					1_{1}
row4						X			
row5							X		
row6			X						
row7	1_{4}	1_{3}						1_{125}	
row8	1_{125}								1_{34}
row9					X				

Pattern 3.001	Box Orientation	Patterns with the same box code
4 – 2 – 2	**B – C – A**	**007, 022, 049.**
|	**|**	
2	**H**	

A	**B**	**C**
	H	

Subpattern-1 starts in **(14)** with box order **B→C→A→H**

(14) zaps (17) adding **(27)** zaps (12) adding **(32)**
(14) zaps (94) adding **(95)**

Subpattern-1 = **(14),(27),(32),(95)**
B C A H

3 001
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		6		6_1	6		6		
row2				6			6_1		
row3		6_1			6				
row4						X			
row5			X						
row6								X	
row7									X
row8	X								
row9				6	6_1				

Pattern 3.001, continued.

A	B	C
	H	

Subpattern-2 starts in **(15)** with box order **B→C→A→H**

(15) zaps (17) adds **(27)**
(15) zaps (12) adds **(32)**
(15) zaps (95) adds **(94)**

Subpattern-2 = **(15),(27),(32),(94)**
B C A H

3 E1	001	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1		6_{4}		6_{1}	6_{2}		6_{3}		
	row2				6_{3}			6_{124}		
	row3		6_{123}			6_{4}				
	row4						X			
	row5			X						
	row6								X	
	row7									X
	row8	X								
	row9				6_{24}	6_{13}				

Pattern 3.001, continued.

A	B	C
	H	

Subpattern-3 starts in **(24)** with box order **B→C→A→H**

(24) zaps (27) adding **(17)** zaps (12) adding **(32)**
(24) zaps (94) adding **(95)**

Subpattern-3 = **(24),(17),(32),(95)**
B C A H

3 001
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		6_{4}		6_{1}	6_{2}		6_{3}		
row2				6_{3}			6_{124}		
row3		6_{123}			6_{4}				
row4						X			
row5			X						
row6								X	
row7									X
row8	X								
row9				6_{24}	6_{13}				

Pattern 3.001, continued.

A	B	C
	H	

Subpattern-4 starts in **(35)** with box order **B→A→C→H**

(35) zaps (32) adding **(12)** zaps (17) adding **(27)**
(35) zaps (95) adding **(94)**

Subpattern-4 = **(35),(12),(27),(94)**
B A C H

Back at the starting box A, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

3 001
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		6_{4}		6_{1}	6_{2}		6_{3}		
row2				6_{3}			6_{124}		
row3		6_{123}			6_{4}				
row4						X			
row5			X						
row6								X	
row7									X
row8	X								
row9				6_{24}	6_{13}				

Example 3.001 continued.

Pictorial view of zapping by subpattern-1:

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

Arbitrary choice of first member of subpattern-1 in box B..

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

After zapping by first member, showing zapped area in dark. Forced choice of second member of subpattern-1 in box C.

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

After zapping by second member of subpattern-1 in box C, showing zapped area in dark. Forced choice of third member of subpattern-1 in in box A

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

After zapping by third member of subpattern-1 in box A, showing zapped area in dark. Forced choice of fourth member of subpattern-1 in box H.

continued on next page

Example 3.001 continued.

End of pictorial view of zapping by subpattern-1.

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

After zapping by final subpattern member, showing total zapped area. No choices left for further members in other boxes.

Pictorial view of zapping by subpattern-2:

	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

Arbitrary choice of first member of subpattern-2 from remaining choices in box B.

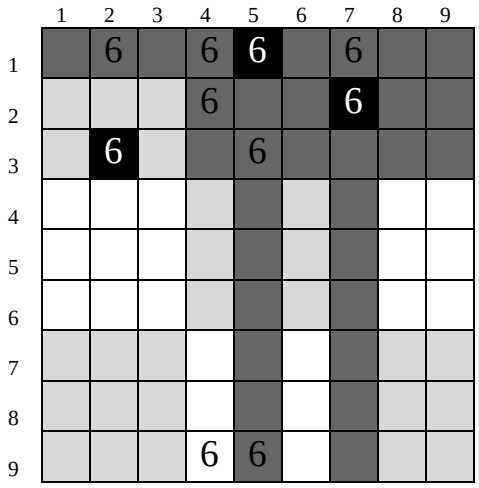
	1	2	3	4	5	6	7	8	9
1		6		6	6		6		
2				6			6		
3		6			6				
4									
5									
6									
7									
8									
9				6	6				

After zapping by first member, showing zapped area in dark. Forced choice of second member of subpattern-2 in box C.

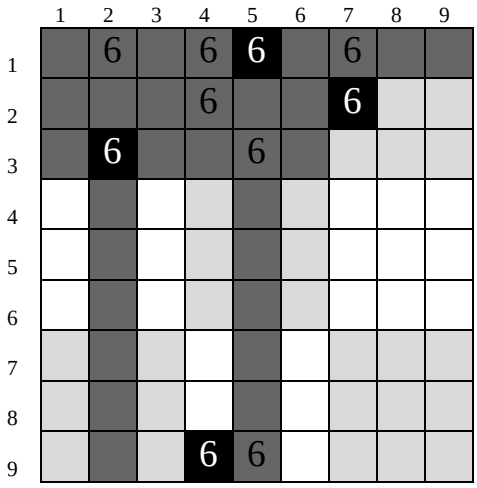
continued on next page

Example 3.001 continued.

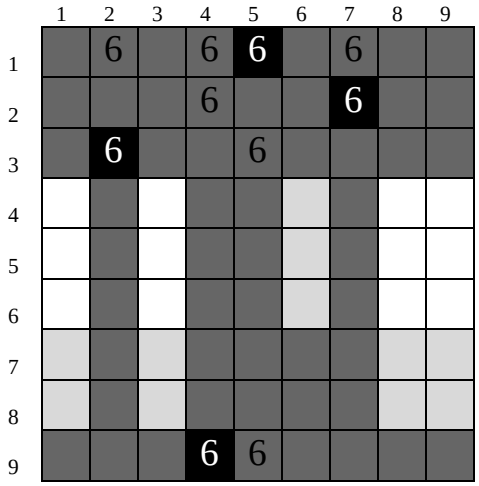
Pictorial view of zapping by subpattern-2, continued;



After zapping by second member of subpattern-1 in box C, showing zapped area in dark. Forced choice of third member of subpattern-1 in in box A



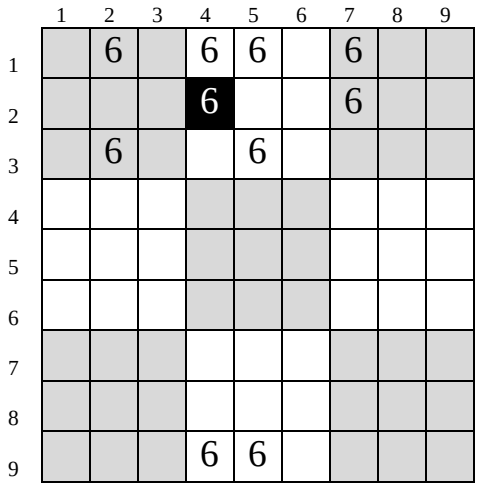
After zapping by third member of subpattern-1 in box A, showing zapped area in dark. Forced choice of fourth member of subpattern-1 in box H.



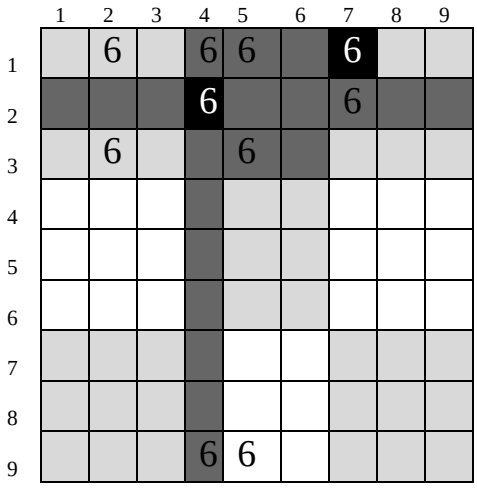
After zapping by final subpattern member, showing total zapped area. No choices left for further members in other boxes.

Example 3.001 continued.

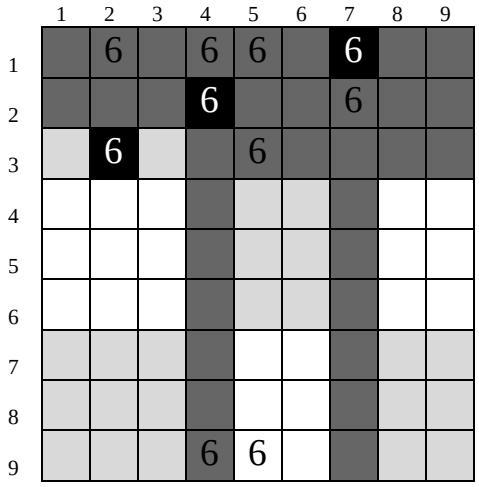
Pictorial view of zapping by subpattern-3:



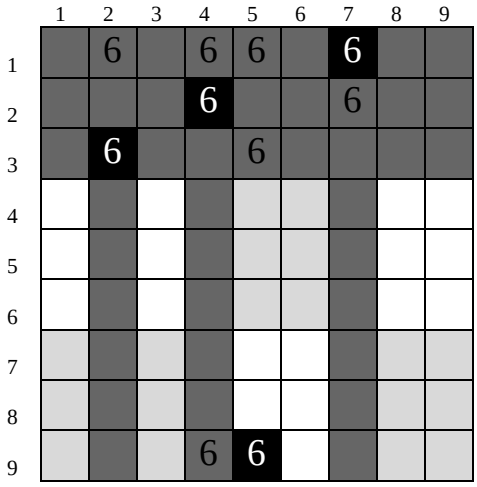
Arbitrary choice of first member of subpattern-3 from remaining choices in box B.



After zapping by first member, showing zapped area in dark. Forced choice of second member of subpattern-3 in box C.



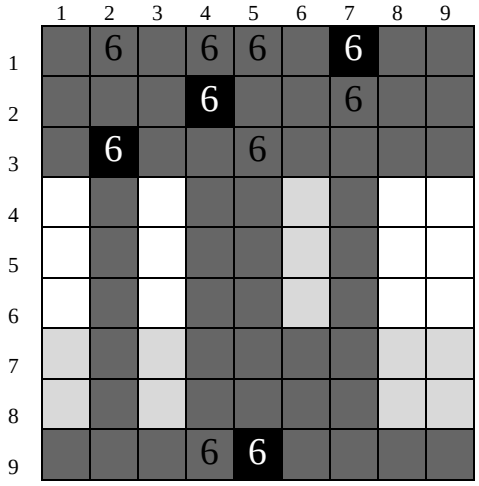
After zapping by second member of subpattern-1 in box C, showing zapped area in dark. Forced choice of third member of subpattern-1 in in box A



After zapping by third member of subpattern-1 in box A, showing zapped area in dark. Forced choice of fourth member of subpattern-1 in box H.

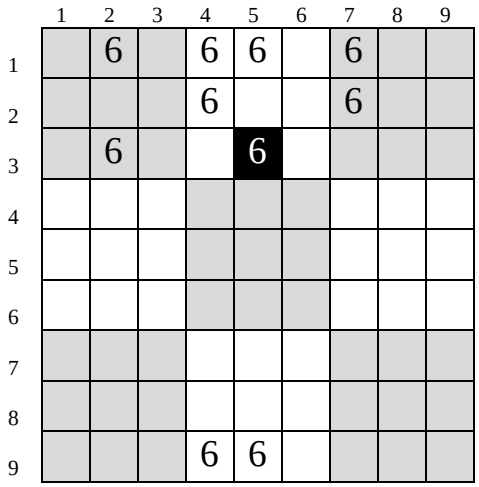
Example 3.001 continued.

End of pictorial view of zapping by subpattern-3.

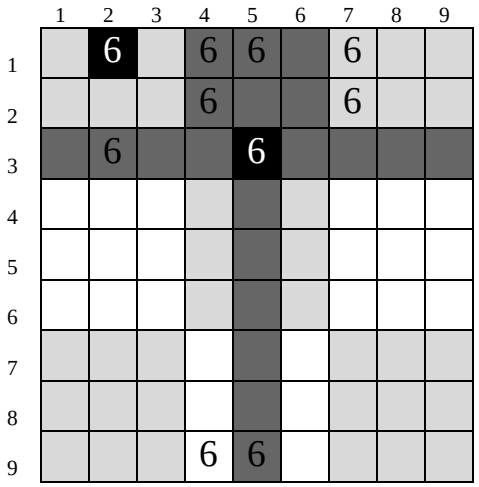


After zapping by final subpattern member, showing total zapped area. No choices left for further members in other boxes.

Pictorial view of zapping by subpattern-4:



Forced choice of first member of subpattern-3 in box B

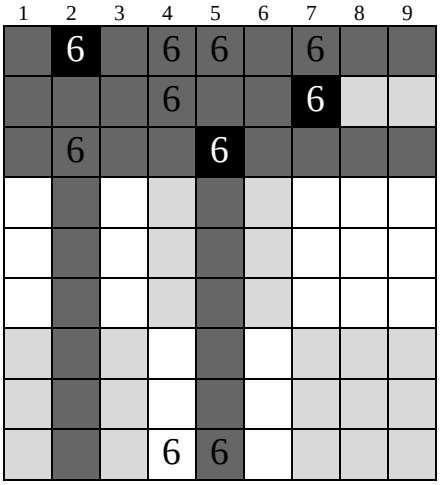


After zapping by first member, showing zapped area in dark. Forced choice of second member of subpattern-3 in box A.

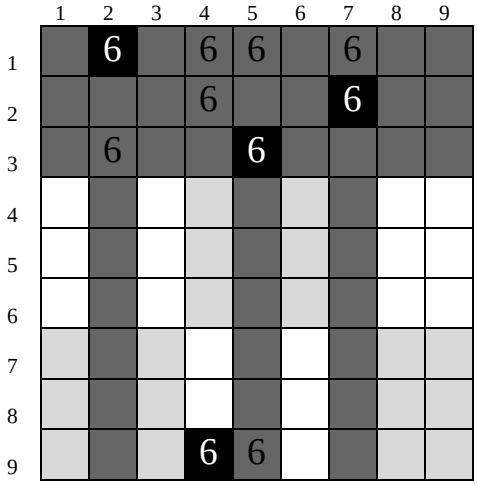
continued on next page

Example 3.001 continued.

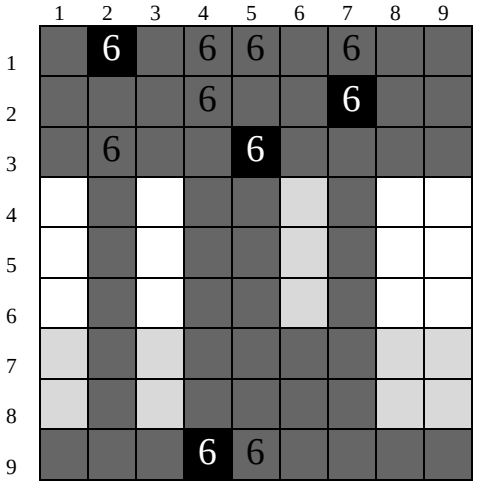
Pictorial view of zapping by subpattern-4, continued.



After zapping by second member of subpattern-1 in box C, showing zapped area in dark. Forced choice of third member of subpattern-1 in in box C



After zapping by third member of subpattern-1 in box A, showing zapped area in dark. Forced choice of fourth member of subpattern-1 in box H.



After zapping by final subpattern member, showing total zapped area. No choices left for further members in other boxes.

Pattern 3.040	Box Orientation	Patterns with the same box code
4 – 2 – 2	**F – E – D**	**none**
|	|	
2 – 2	**I – H**	

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-1 starts in **(69)** with box order **F→E→D→H→I**

(69) zaps (66) adding **(46)**
(69) zaps (63) adding **(63)**
(69) zaps (79) adding **(88)** zaps (85) adding **(75)**

Subpattern-1 = **(69),(46),(63),(88),(75)**
F E D H I

3 040
G5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							X		
row3				X					
row4						$7_{\mathbf{1}}$		7	
row5			$7_{\mathbf{1}}$					7	7
row6			7			7			$7_{\mathbf{1}}$
row7					$7_{\mathbf{1}}$				7
row8					7			$7_{\mathbf{1}}$	
row9	X								

Pattern 3.040, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-2 starts in **(48)** with box order **F→E→D→H→I**

(48) zaps (46) adding **(66)** zaps (63) adding **(53)**
(48) zaps (88) adding **(79)** zaps (75) adding **(85)**

Subpattern-2 = **(48),(66),(53),(79),(85)**
F E D H I

3 040
G5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							X		
row3				X					
row4						$7_{\mathbf{1}}$		$7_{\mathbf{2}}$	
row5			$7_{\mathbf{12}}$					7	7
row6			7			$7_{\mathbf{2}}$			$7_{\mathbf{1}}$
row7					$7_{\mathbf{1}}$				$7_{\mathbf{2}}$
row8					$7_{\mathbf{2}}$			$7_{\mathbf{1}}$	
row9	X								

Pattern 3.040, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-3 starts in **(58)** with box order **F→E→D→H→I**

(58) zaps (53) adding **(63)** zaps (66) adding **(46)**
(58) zaps (88) adding **(79)** zaps (75) adding **(85)**

Subpattern-3 = **(58),(63),(46),(79),(85)**
F E D H I

3 040
G5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							X		
row3				X					
row4						7_{134}		7_{2}	
row5			7_{12}					7_{3}	7_{4}
row6			7_{34}			7_{2}			7_{1}
row7					7_{14}				7_{23}
row8					7_{23}			7_{14}	
row9	X								

Pattern 3.040, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-4 starts in **(59)** with box order **F→E→D→H→I**

(59) zaps (53) adding **(63)** zaps (66) adding **(46)**
(59) zaps (79) adding **(88)** zaps (85) adding **(75)**

Subpattern-4 = **(59),(63),(46),(88),(75)**
F E D H I

Back at the starting box, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

3 040
G5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							X		
row3				X					
row4						7_{134}		7_{2}	
row5			7_{12}					7_{3}	7_{4}
row6			7_{34}			7_{2}			7_{1}
row7					7_{14}				7_{23}
row8					7_{23}			7_{14}	
row9	X								

Pattern 3.060	Box Orientation	Patterns with the same box code
4 – 2 – 2 **| |** **2 – 2** **|** **2**	**C – B – A** **| |** **F – E** **|** **I**	**none**

A	**B**	**C**
	E	**F**
		I

Subpattern-1 begins in **(17)** with box order **C→I→F→E→B→A**

(17) zaps (97) adding **(98)** zaps (58) adding **(69)** zaps (65) adding **(69)**
(69) zaps (66) adding **(54)** zaps (14) adding **(25)** zaps (21) adding **(31)**

Subpattern-1 = **(17),(98),(69),(54),(25),(31)**
C I F E B A

3 060
G8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2			2_1	2	
row2	2				2_1				2
row3	2_1								2
row4		X							
row5				2_1				2	
row6					2				2_1
row7			X						
row8						X			
row9							2	2_1	

Pattern 3.060, continued.

A	**B**	**C**
	E	**F**
		I

Subpattern-2 begins in **(18)** with box order **C→F→I→E→B→A**

(18) zaps (98) adding **(97)**
(18) zaps (58) adding **(69)** zaps (65) adding **(54)** zaps (14) adding **(25)**
(25) zaps (21) adding **(31)**

Subpattern-2 = **(18),(97),(69),(54),(25),(31)**
C F I E B A

3 060
G8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2			2_{1}	2_{2}	
row2	2				2_{12}				2
row3	2_{12}								2
row4		X							
row5				2_{12}				2	
row6					2				2_{12}
row7			X						
row8						X			
row9							2_{2}	2_{1}	

Pattern 3.060, continued.

A	**B**	**C**
	E	**F**
		I

Subpattern-3 begins in **(29)** with box order **C→F→I→E→B→A**

(29) zaps (69) adding **(58)** zaps (98) adding **(97)**
(58) zaps (54) adding **(65)** zaps (25) adding **(14)**
(29) zaps (21) adding **(31)**

Subpattern-3 = **(29),(58),(97),(65),(14),(31)**
C F I E B A

3 060
G8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{3}			2_{1}	2_{2}	
row2	2				2_{12}				2_{3}
row3	2_{123}								2
row4		X							
row5				2_{12}				2_{3}	
row6					2_{3}				2_{12}
row7			X						
row8						X			
row9							2_{23}	2_{1}	

Pattern 3.060, continued.

A	**B**	**C**
	E	**F**
		I

Subpattern-4 begins in **(39)** with box order **C→F→I→E→B→A**

(39) zaps (69) adding **(58)** zaps (98) adding **(97)**
(58) zaps (54) adding **(65)** zaps (25) adding **(14)**
(39) zaps (31) adding **(21)**

Subpattern-4 = **(39),(58),(97),(65),(14),(21)**
C F I E B A

Back at the starting box A, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

3 060
G8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{34}			2_{1}	2_{2}	
row2	2_{4}				2_{12}				2_{3}
row3	2_{123}								2_{4}
row4		X							
row5				2_{12}				2_{34}	
row6					2_{34}				2_{12}
row7			X						
row8						X			
row9							2_{234}	2_{1}	

Pattern 3.056	Box Orientation	Patterns with the same box code
4 – 3 – 2	**F – E - D**	
|	**|**	
2	**A**	

		C
D	**E**	**F**

Subpattern-1 begins in square **(48)** with box order **F→C→D→E**

(48) zaps (38) adding **(39)**
(48) zaps (41) adding **(51)**
(48) zaps (45) and **(51)** zaps (55) adding **(65)**

Subpattern-1 = **(48),(39),(51),(65)**
F C D E

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4	4_1
row4	4				4			4_1	
row5	4_1				4				4
row6					4_1			4	4
row7							X		
row8						X			
row9			X						

Pattern 3.056, continued.

		C
D	**E**	**F**

Subpattern-2 begins in **(59)** with box order **F→C→D→E**

(59) zaps (39) adding **(38)**
(59) zaps (51) adding **(41)**
(59) zaps (55) while **(41)** zaps (45) adding **(65)**

Subpattern-2 = **(59),(38),(41),(65)**
F C D E

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_2	4_1
row4	4_2				4			4_1	
row5	4_1				4				4_2
row6					4_{12}			4	4
row7							X		
row8						X			
row9			X						

Pattern 3.056, continued.

		C
D	**E**	**F**

Subpattern-3 begins in **(68)** with box order **F→C→D→E**

(68) zaps (38) adding **(39)**
(68) zaps (65) adding **(55)** and pending **(45)**
(55) zaps (51) adding **(41)**

Subpattern-3 = **(68),(39),(55),(41)**
F C D E

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_{2}	4_{13}
row4	4_{23}				4_{P}	P		4_{1}	
row5	4_{1}				4_{3}				4_{2}
row6					4_{12}			4_{3}	4
row7							X		
row8						X			
row9			X						

Pattern 3.056, continued.

		C
D	**E**	**F**

Subpattern-4 begins in **(68)** with box order **F→C→D→E**

Due to pending situation in box E, subpattern-4 must
start in same square **(68)** as subpattern-3
follow same square **(39)** as subpattern-3 between starting and pending boxes
include pending square **(45)**

(45) zaps (41) adding **(51)**

Subpattern-4 = **(68),(39),(45),(51)**

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_{2}	4_{134}
row4	4_{23}				4_{4}	~~P~~		4_{1}	
row5	4_{14}				4_{3}				4_{2}
row6					4_{12}			4_{34}	4
row7							X		
row8						X			
row9			X						

Pattern 3.056, continued.

		C
D	**E**	**F**

Subpattern-5 begins in **(69)** with box order **F→C→D→E**

(69) zaps (39) adding **(38)**
(69) zaps (65) adding **(55)** and pending ***(45)***
(55) zaps (51) adding **(41)**

Subpattern-5 = **(69),(38),(55),(45)**
F C D E

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_{25}	4_{134}
row4	4_{235}				4_{4P}	*P*		4_{1}	
row5	4_{14}				4_{35}				4_{2}
row6					4_{12}			4_{34}	4_{5}
row7							X		
row8						X			
row9			X						

Pattern 3.056, continued.

		C
D	**E**	**F**

Due to pending condition in box F, subpattern-5 must
start in same square **(68)** as subpattern-4
follow same square **(38)** as subpattern-4 between starting and pending boxes
include pending square **(45)**

(45) zaps (41) adding **(51)**

Subpattern-6 = **(68),(38),(45),(51)**
F C D E

Back at the starting box F, no box is pending, and no squares are unclaimed, so the pattern analysis is complete.

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_{256}	4_{134}
row4	4_{235}				4_{46}	~~P~~		4_{1}	
row5	4_{146}				4_{35}				4_{2}
row6					4_{12}			4_{34}	4_{56}
row7							X		
row8						X			
row9			X						

Pattern 3.062	Box Orientation	Patterns with the same box code
2 | **4 – 3** | **2**	**C** | **H – B** | **G**	**none**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H(→G)→B→C**

Subpattern-1 begins in **(74)** zaps (72) adding **(82)**
(74) zaps (14) adding **(16)** and pending ***(26)***
(16) zaps (18) adding **(28)**

Subpattern-1 = **(74),(82),(16),(28)**
H G B C

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2		$2_{\mathbf{1}}$		2	
row2						$2_{\mathbf{P}}$		$2_{\mathbf{1}}$	
row3	X				*P*				
row4					X				
row5			X						
row6									X
row7		2		$2_{\mathbf{1}}$		2			
row8		$2_{\mathbf{1}}$		2		2			
row9							X		

Pattern 3.062, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H→G→B→C**

Due to pending condition in box **B**, subpattern-2 must
begin in the same square **(74)** as subpattern-1
share **(82)** with subpattern-1
include the pending square **(26)**

(26) zaps (28) adding **(18)**

subpattern-2 = **(74),(82),(26),(18)**
H G B C

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2		$2_{\mathbf{1}}$		$2_{\mathbf{2}}$	
row2						$2_{\mathbf{2}}$		$2_{\mathbf{1}}$	
row3	X				*P*				
row4					X				
row5			X						
row6									X
row7		2		$2_{\mathbf{12}}$		2			
row8		$2_{\mathbf{12}}$		2		2			
row9							X		

Pattern 3.062, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H→G→B→C**

Subpattern-3 begins in **(76)** zaps (72) adding **(82)**
(76) zaps (16) & (26) adding **(14)** zaps (18) adding **(28)**

Subpattern-3 = **(76),(82),(14),(28)**
H G B C

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$2_{\mathbf{3}}$		$2_{\mathbf{1}}$		$2_{\mathbf{2}}$	
row2						$2_{\mathbf{2}}$		$2_{\mathbf{13}}$	
row3	X								
row4					X				
row5			X						
row6									X
row7		2		$2_{\mathbf{12}}$		$2_{\mathbf{3}}$			
row8		$2_{\mathbf{123}}$		2		2			
row9							X		

Pattern 3.062, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H→G→B→C**

Subpattern-4 begins in **(84)** zaps (82) adding **(72)**

(84) zaps (14) adding **(16)** and pending ***(26)***
(16) zaps (18) adding **(28)**

Subpattern-4 = **(84),(72),(16),(28)**
H G B C

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$2_{\mathbf{3}}$		$2_{\mathbf{14}}$		$2_{\mathbf{2}}$	
row2						$2_{\mathbf{2}}$		$2_{\mathbf{134}}$	
row3	X				*P*				
row4					X				
row5			X						
row6									X
row7		$2_{\mathbf{4}}$		$2_{\mathbf{12}}$		$2_{\mathbf{3}}$			
row8		$2_{\mathbf{123}}$		$2_{\mathbf{4}}$		2			
row9							X		

Pattern 3.062, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H→G→B→C**

Due to the pending condition in **B**, subpattern-5 must
start in the same square **(84)** as subpattern-4
share square **(72)** with subpattern-4
include the pending square **(26)**

(26) zaps (28) adding **(18)**

Subpattern-5 = **(84),(72),(26),(18)**
H G B C

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$2_{\mathbf{36}}$		$2_{\mathbf{14}}$		$2_{\mathbf{25}}$	
row2						$2_{\mathbf{25}}$		$2_{\mathbf{1346}}$	
row3	X				*P*				
row4					X				
row5			X						
row6									X
row7		$2_{\mathbf{456}}$		$2_{\mathbf{12}}$		$2_{\mathbf{3}}$			
row8		$2_{\mathbf{123}}$		$2_{\mathbf{45}}$		$2_{\mathbf{6}}$			
row9							X		

Pattern 3.062, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: **H→G→B→C**

Subpattern-6 starts in **(86)** zaps (82) adding **(72)**
(86) zaps (16) & (26) adding **(14)** zaps (18) adding **(28)**

Subpattern-6 = **(86),(72),(14),(28)**
H G B C

Back at the starting box I, nothing is pending and no squares unclaimed, so the pattern analysis is complete.

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$2_{\mathbf{36}}$		$2_{\mathbf{14}}$		$2_{\mathbf{25}}$	
row2						$2_{\mathbf{25}}$		$2_{\mathbf{1346}}$	
row3	X								
row4					X				
row5			X						
row6									X
row7		$2_{\mathbf{456}}$		$2_{\mathbf{12}}$		$2_{\mathbf{3}}$			
row8		$2_{\mathbf{123}}$		$2_{\mathbf{45}}$		$2_{\mathbf{6}}$			
row9							X		

Pattern 3.003	Box Orientation	Patterns with the same box code
4 – 3 | | **2 – 3**	**D – F** | | **A – C**	**053**

A		**C**
D		**F**

Subpattern-1 starts in (51) with box order **D→A→F→C**

(51) zaps (11) adding **(33)**
(51) zaps (58) & (59) adding **(69)**
(69) zaps (19) while **(33)** zaps (38) adding **(18)**

Subpattern-1 = **(51),(33),(69),(18)**

3 003
G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	**2**							**2_1**	**2**
row2						X			
row3			**2_1**					**2**	
row4				X					
row5	**2_1**		**2**					**2**	**2**
row6	**2**		**2**						**2_1**
row7					X				
row8		X							
row9							X		

Pattern 3.003, continued.

A		**C**
D		**F**

Subpattern-2 starts in **(53)** with box order **D→A→C→F**

(53) zaps (33) adding **(11)** zaps (18) & (19) adding **(38)**
(53) zaps (58) & (59) adding **(69)**

Subpattern-2 = **(53),(11),(38),(69)**
D A C F

3 003
G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_2							2_1	2
row2						X			
row3			2_1					2_2	
row4				X					
row5	2_1		2_2					2	2
row6	2		2						2_{12}
row7					X				
row8		X							
row9							X		

Pattern 3.003, continued.

A		**C**
D		**F**

Subpattern-3 starts in **(61)** with box order **D→A→C→F**

(61) zaps (11) adding **(33)** zaps (38) adding **(19)** and pending ***(18)***
(19) zaps (59) & (69) adding **(58)**

Subpattern-3 = **(63),(11),(19),(58)**
D A C F

3 003
G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_2							2_1	2_3
row2						X			*P*
row3			2_{13}					2_2	
row4				X					
row5	2_1		2_2					2_3	2
row6	2_3		2						2_{12}
row7					X				
row8		X							
row9							X		

Pattern 3.003, continued.

A		**C**
D		**F**

Due to the pending situation in **C**, subpattern-4 must
start in the same square **(61)** as subpattern-3
share square **(33)** with subpattern-3
include the pending square **(18)**

(18) zaps (58) & **(61)** zaps (69) adding **(59)**

Subpattern-4 = **(61),(33),(18),(59)**

Back at the starting box D, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

3 003
G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{25}							2_{14}	2_{3}
row2						X			*P*
row3			2_{134}					2_{25}	
row4				X					
row5	2_{1}		2_{2}					2_{3}	2_{45}
row6	2_{34}		2_{5}						2_{12}
row7					X				
row8		X							
row9							X		

Pattern 3.057	Box Orientation	Patterns with the same box code
4 – 3 – 2 | | **3 – 3**	**D – E – F** | | **A – B**	**058**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-1 begins in square **(43)** with box order **D→A→B→E→F**

(43) zaps (23) & (33) adding **(21)** zaps (24) & (26) adding **(36)**
(36) zaps (46) & (56) adding **(54)**
(43) zaps (68) adding **(48)**

Subpattern-1 = **(43),(21),(36),(54),(48)**
D A B E F

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_1		8	8		8			
row3			8			8_1			
row4			8_1			8		8	
row5	8		8	8_1		8			
row6	8							8_1	
row7									X
row8		X							
row9					X				

Pattern 3.057, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-2 starts in **(51)** with box order **D→E→F→B→A**

(51) zaps (54) & (56) adding **(46)** zaps (48) adding **(68)**
(46) zaps (26) & (36) adding **(24)** zaps (21) & (23) adding **(33)**

Subpattern-2 = **(51),(46),(68),(24),(33)**
D E F B A

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}		8	8_{2}		8			
row3			8_{2}			8_{1}			
row4			8_{1}			8_{2}		8	
row5	8_{2}		8_{K}	8_{1}		8			
row6	8							8_{12}	
row7									X
row8		X							
row9					X				

Pattern 3.057, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-3 begins in **(53)** with box order **D→A→B→E→F**
(53) zaps (23) & (33) adding **(21)** zaps (24) & (26) adding **(36)**
(36) zaps (46) & (56) adding **(54)**

These evaluations have all been forced, and now we have both (53) and (54) in the same row 5, and in the same subpattern-3. Therefore (53) cannot have a candidate, and we must give it the K subscript (for killer).

We'll retry subpattern-3 in a different starting square (61) (the only remaining choice in box D). We'll use the box order D→A→B→F→E.

(61) zaps (21) adding **(23)** and pending ***(33)***
(61) zaps (68) adding **(48)**
(23) zaps (24) & (26) adding **(36)** zaps (46) & (56) adding **(54)**
(61) zaps (68) adding **(48)**

Subpatterrn-3 = **(61),(23),(36),(48),(54)**

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		*P*					X		
row2	8_{1}		8_{3}	8_{2}		8			
row3			8_{2}			8_{13}			
row4			8_{1}			8_{2}		8_{3}	
row5	8_{2}		8_{K}	8_{13}		8			
row6	8_{3}							8_{12}	
row7									X
row8		X							
row9					X				

Pattern 3.057, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Due to the pending situation in **A**, subpattern-4 must
begin in the same square **(61)** as subpattern-3
follow the same squares **(34)** as subpattern-3 between starting and pending boxes
include the pending square **(33)**

(33) zaps (36) adding **(26)** and pending ***(24)***
(As the pending situation in A is now resolved, B is the only remaining pending box)

(61) zaps (68) adding **(48)**
(26) zaps (46) & (56) adding **(54)**

Subpattern-4 = **(61),(33),(26),(48),(54)**
D A B E F

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					*P*		X		
row2	8_{1}		8_{3}	8_{2p}		8_{4}			
row3			8_{24}			8_{13}			
row4			8_{1}			8_{2}		8_{345}	
row5	8_{2}		8_{K}	8_{134}		8_{5}			
row6	8_{345}							8_{12}	
row7									X
row8		X							
row9					X				

Pattern 3.057, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Due to the pending situation in **B**, subpattern-5 must
start in the same square **(61)** as subpattern-4
share square **(33)** with subpattern-4
include the pending square **(24)**

(61) zaps (68) adding **(48)**
(48) zaps (46) and **(24)** zaps (54) adding **(56)**

Subpattern-5 = **(61),(33),(24),(48),(56)**

Back at the starting box D, no box is pending and no squares are unclaimed, so the analysis is complete.

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}		8_{3}	8_{25}		8_{4}			
row3			8_{245}			8_{13}			
row4			8_{1}			8_{2}		8_{345}	
row5	8_{2}		8_{K}	8_{134}		8_{5}			
row6	8_{345}							8_{12}	
row7									X
row8		X							
row9					X				

Pattern 3.027	Box Orientation	Patterns with the same box code
4 – 3 – 3 | | | **2 – 2** | | | **2--------2**	**I – C – F** | | | **H – B** | | | **G ------D**	**none**

	B	**C**
D		**F**
G	**H**	**I**

Subpattern-1 started in **(77)** with box order **I→G→H→B→C→F→D**

(77) zaps (71) adding **(93)** zaps (94) adding **(86)** zaps (16) adding **(34)**
(34) zaps (38) while **(77)** zaps (17) adding **(18)**
(18) zaps (48) while **(77)** zaps (67) adding **(49)**
(93) zaps (43) adding **(61)**

Subpattern-1 = **(77),(93),(86),(34),(18),(49),(61)**
I G H B C F D

3 027
E8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9	9	9_1	
row2		X							
row3				9_1				9	
row4			9					9	9_1
row5					X				
row6	9_1						9		
row7	9						9_1	9	
row8						9_1			9
row9			9_1	9					9

Pattern 3.027, continued.

	B	**C**
D		**F**
G	**H**	**I**

Subpattern-2 is started in **(78)** with box order **I→G→H→B→C→F→D**

(78) zaps (71) adding **(93)** zaps (94) adding **(86)** zaps (16) adding **(34).**
(78) zaps (18) & (38), adding **(17)**
(78) zaps (48) while **(17)** zaps (67) adding **(49)**
(93) zaps (43) adding **(61)**

Subpattern-2 = **(78),(93),(86),(34),(17),(49)**
I G H B C F

3 027
E8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9	9_{2}	9_{1}	
row2		X							
row3				9_{12}				9	
row4			9					9	9_{12}
row5					X				
row6	9_{12}						9		
row7	9						9_{1}	9_{2}	
row8						9_{12}			9
row9			9_{12}	9					9

Pattern 3.027, continued.

	B	**C**
D		**F**
G	**H**	**I**

Subpattern-3 is started in **(89)** with box order **I→H→G→D→F→B→C**

(89) zaps (86) adding **(94)** zaps (93) adding **(71)** zaps (61) adding **(43)**
(43) zaps (48) & (49) adding **(67)**
(94) zaps (34) adding **(16)** zaps (17) & (18) adding **(38)**

Subpattern-3 = **(89),(94),(71),(43),(67),(16),(38)**
I H G D F B C

3 027
E8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9_{3}	9_{2}	9_{1}	
row2		X							
row3				9_{12}				9_{3}	
row4			9_{3}					9	9_{12}
row5					X				
row6	9_{12}						9_{3}		
row7	9_{3}						9_{1}	9_{2}	
row8						9_{12}			9_{3}
row9			9_{12}	9_{3}					9

Pattern 3.027, continued.

	B	**C**
D		**F**
G	**H**	**I**

Subpattern-4 is started in **(89)** with box order **I→G→D→F→H→B→C**

(99) zaps (93) adding **(71)** zaps (61) adding **(43)** zaps (48) & (49) adding **(67)**
(99) zaps (94) adding **(86)** zaps (16) adding **(34)**
(34) zaps (38) while **(67)** zaps (17) adding **(18)**

Subpattern-4 = **(99),(71),(43),(67),(86),(34),(18)**
I G D F H B C

Back at the starting box I, nothing is pending, and no squares are unclaimed, so the pattern analysis is complete.

3 027
E8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9_{3}	9_{2}	9_{14}	
row2		X							
row3				9_{124}				9_{3}	
row4			9_{34}					9_{K}	9_{12}
row5					X				
row6	9_{12}						9_{34}		
row7	9_{34}						9_{1}	9_{2}	
row8						9_{124}			9_{3}
row9			9_{12}	9_{3}					9_{4}

Pattern 3.034	Box Orientation	Patterns with the same box code
5 – 2 – 2 | **2**	**E – B – H** | **F**	**none**

	B	
	E	**F**
	H	

Subpatttern-1 starts in **(44)** with box order **E→H→B→F**

(44) zaps (75) adding **(74)** zaps (14) adding **(16)**
(44) zaps (48) adding **(58)**

Subpattern-1 = **(44),(74),(16),(58)**
E H B F

3 034
F1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2		2_1			
row2			X						
row3							X		
row4	X			2_1	2	2		2	
row5					2	2		2_1	
row6									
row7				2	2_1				
row8									X
row9		X							

Pattern 3.034, continued.

	B	
	E	**F**
	H	

Subpatttern-2 starts in **(45)** with box order **E→H→B→F**

(45) zaps (75) adding **(74)** zaps (14) adding **(16)**
(45) zaps (48) adding **(58)**

Subpattern-2 = **(45),(74),(16),(58)**
E H B F

3 F1	034	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				2		2_{12}			
	row2			X						
	row3							X		
	row4	X			2_{1}	2_{2}	2		2	
	row5					2	2		2_{12}	
	row6									
	row7				2_{2}	2_{1}				
	row8									X
	row9		X							

Pattern 3.034, continued.

	B	
	E	**F**
	H	

Subpatttern-2 starts in **(45)** with box order **E→H→B→F**

(45) zaps (75) adding **(74)** zaps (13) adding **(16)**
(45) zaps (48) adding **(58)**

Subpattern-2 = **(45),(74),(16),(58)**
E H B F

3 F1	034	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				2		2_{12}			
	row2			X						
	row3							X		
	row4	X			2_{1}	2_{2}	2		2	
	row5					2	2		2_{12}	
	row6									
	row7				2_{2}	2_{1}				
	row8									X
	row9		X							

Pattern 3.034, continued.

	B	
	E	**F**
	H	

Subpatttern-3 starts in **(46)** with box order **E→B→H→F**

(46) zaps (16) adding **(14)** zaps (74) adding **(75)**
(46) zaps (48) adding **(58)**

Subpattern-3 = **(46),(14),(75),(58)**
E B H F

3 F1	034	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				$2_{\mathbf{3}}$		$2_{\mathbf{12}}$			
	row2			X						
	row3							X		
	row4	X			$2_{\mathbf{1}}$	$2_{\mathbf{2}}$	$2_{\mathbf{3}}$		2	
	row5					2	2		$2_{\mathbf{123}}$	
	row6									
	row7				$2_{\mathbf{2}}$	$2_{\mathbf{13}}$				
	row8									X
	row9		X							

Pattern 3.034, continued.

	B	
	E	**F**
	H	

Subpatttern-4 starts in **(55)** with box order **E→H→B→F**

(55) zaps (75) adding **(74)** zaps (14) adding **(16)**
(55) zaps (58) adding **(48)**

Subpattern-4 = **(55),(74),(16),(48)**
E H B F

3 F1	034	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				$2_{\mathbf{3}}$		$2_{\mathbf{124}}$			
	row2			X						
	row3							X		
	row4	X			$2_{\mathbf{1}}$	$2_{\mathbf{2}}$	$2_{\mathbf{3}}$		$2_{\mathbf{4}}$	
	row5					$2_{\mathbf{4}}$	2		$2_{\mathbf{123}}$	
	row6									
	row7				$2_{\mathbf{24}}$	$2_{\mathbf{13}}$				
	row8									X
	row9		X							

Pattern 3.034, continued.

	B	
	E	**F**
	H	

Subpatttern-5 starts in **(56)** with box order **E→B→H→F**

(56) zaps (16) adding **(14)** zaps (74) adding **(75)**
(56) zaps (58) adding **(48)**

Subpattern-5 = **(56),(14),(75),(48)**
E B H F

Back at the starting box E, nothing is pending and no squares unclaimed, so the pattern analysis is complete.

3 034
F1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{35}		2_{124}			
row2			X						
row3							X		
row4	X			2_{1}	2_{2}	2_{3}		2_{45}	
row5					2_{4}	2_{5}		2_{123}	
row6									
row7				2_{24}	2_{135}				
row8									X
row9		X							

Pattern 3.002	Box Orientation	Patterns with the same box code
2 | **5 – 2 – 2** | **2**	**F** | **H – I – G** | **B**	**013, 016.**

	B	
		F
G	**H**	**I**

Subpattern-1 begins in (75) with box order H→G→I→B→F

(75) zaps (72) adding **(82)**
(75) zaps (77) adding **(99)** zaps (49) adding **(47)**
(75) zaps (35) adding **(36)**

Subpattern-1 = **(75),(82),(99),(47),(36)**
H G I B F

3 002
F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			X						
row3					3	3_1			
row4							3_1		3
row5	X								
row6				X					
row7		3			3_1		3		
row8		3_1			3	3			
row9					3	3			3_1

Pattern 3.002, continued.

	B	
		F
G	**H**	**I**

Subpattern-2 begins in **(85)** with box order **H→G→I→F→B**

(85) zaps (82) adding **(72)** zaps (77) adding **(99)** zaps (49) adding **(47)**
(85) zaps (35) adding **(36)**

Subpattern-2 = **(85),(72),(99),(47),(36)**
H G I F B

3 F2	002	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1								X	
	row2			X						
	row3					3	3_{12}			
	row4							3_{12}		3
	row5	X								
	row6				X					
	row7		3_2			3_1		3		
	row8		3_1			3_2	3			
	row9					3	3			3_{12}

Pattern 3.002, continued.

	B	
		F
G	**H**	**I**

Subpattern-3 begins in **(86)** with box order **H→G→I→F→B**

(86) zaps (82) adding **(72)** zaps (77) adding **(99)** zaps (49) adding **(47)**
(86) zaps (36) adding **(35)**

Subpattern-3 = **(86),(72),(99),(47),(35)**
H G I F B

3 002
F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			X						
row3					3_{3}	3_{12}			
row4							3_{123}		3
row5	X								
row6				X					
row7		3_{23}			3_{1}		3		
row8		3_{1}			3_{2}	3_{3}			
row9					3	3			3_{123}

Pattern 3.002, continued.

	B	
		F
G	**H**	**I**

Subpattern-4 begins in **(95)** with box order **H→I→F→G→B**

(95) zaps (99) adding **(77)** zaps (47) adding **(49)**
(77) zaps (72) adding **(82)**
(95) zaps (35) adding **(36)**

Subpattern-4 = **(95),(77),(49),(82),(36)**
H I F G B

3 F2	002	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1								X	
	row2			X						
	row3					3_{3}	3_{124}			
	row4							3_{123}		3_{4}
	row5	X								
	row6				X					
	row7		3_{23}			3_{1}		3_{4}		
	row8		3_{14}			3_{2}	3_{3}			
	row9					3_{4}	3			3_{123}

Pattern 3.002, continued.

	B	
		F
G	**H**	**I**

Subpattern-5 begins in **(96)** with box order **H→I→G→F→B**

(96) zaps (99) adding **(77)** zaps (47) adding **(49)**
(77) zaps (72) adding **(92)**
(96) zaps (36) adding **(35)**

Subpattern-5 = **(96),(77),(49),(92),(35)**
H I G F B

Back at the starting box H, nothing is pending, and no squares are unclaimed, so the pattern analysis is complete.

3 002
F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			X						
row3					3_{35}	3_{124}			
row4							3_{123}		3_{45}
row5	X								
row6				X					
row7		3_{23}			3_{1}		3_{45}		
row8		3_{145}			3_{2}	3_{3}			
row9					3_{4}	3_{5}			3_{123}

Chapter 4. Patterns with four subscripts.

Pattern 4.019	Box Orientation	Patterns with the same box code
3 – 3 – 2	**H – G – I**	**none**
|	**|**	
2 – 3	**D – E**	

D	**E**	
G	**H**	**I**

Box order: H→E→D→G→I
Since the top three rows aren't involved, we'll get them out of our visual way.

Subpattern-1 begins in **(95)** zaps (65) & (45) adding **(44)** zaps (42) adding **(62)**
(95) zaps (91) adding **(71)** and pending ***(81)***
(71) zaps (78) adding **(88)**

Subpattern-1 = **(95),(44),(62),(71),(88)**
H E D G I

Due to the pending situation, subpattern-2 must
begin in the same starting square **(95)** as subpattern-1
share squares **(44)** and **(62)** with subpattern-1
include the pending square **(81)**

(81) zaps (88) adding **(78)**

Subpattern-2 = **(95),(44),(62),(81),(78)**
H E D G I

4 019

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row4		3		3_{12}	3				
row5									X
row6		3_{12}			3				
row7	3_1		*P*		3			3_2	
row8	3_2			3				3_1	
row9	3				3_{12}				

Pattern 4.019, continued.

D	**E**	
G	**H**	**I**

Box order: H→E→D→G→I

Subpattern-3 begins in **(75)** zaps (65) and (45) adding **(44)**
(44) zaps (42) adding **(62)**
(75) zaps (78) adding **(88)**
(88) zaps (81) while **(75)** zaps (71) adding **(91)**

Subpattern-3 = **(75),(44),(62),(88),(91)**
H E D G I

Subpattern-4 begins in **(84)** zaps (88) adding **(78)**
(78) zaps (71) while **(84)** zaps (81) adding **(91)**
(84) zaps (44) adding **(45)** and pending ***(65)***
(45) zaps (42) adding **(62)**

Subpattern-4 = **(84),(78),(91),45),(62)**
H E D G I

4	019	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row4		3		3_{123}	3_{4}	*P*			
	row5									X
	row6		3_{1234}			3				
	row7	3_{1}				3_{3}			3_{24}	
	row8	3_{2}			3_{4}				3_{13}	
	row9	3_{34}				3_{12}				

Pattern 3.019, continued.

D	**E**	
G	**H**	**I**

Due to the pending situation in **E**, subpattern-5 must:
begin in the same starting square (84) as subpattern-4
share squares **(78)** and **(91)** with subpattern-4
include pending square **(65)**

(65) zaps (62) adding **(42)**

Subpattern-5 = **(84),(78),(91),(65),(42)**
H E D G I

Back at the starting box, nothing is pending and no boxes remain unclaimed. The pattern analysis is complete.

4 019
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							X		
row3						X			
row4		3_5		3_{123}	3_4	~~P~~			
row5									X
row6		3_{1234}			3_5				
row7	3_1				3_3			3_{245}	
row8	3_2			3_{45}				3_{13}	
row9	3_{345}				3_{12}				

Pattern 4.020	Box Orientation	Patterns with the same box code
3 – 2 | **3 – 2** | **2**	**I – H** | **A – C** | **D**	**none**

A		**C**
D		
	H	**I**

Subpattern-1 starts in **(22)** with box order **A→C→I→H→D**

(22) zaps (27) adding **(39)** zaps (79) & (89) adding **(77)** zaps (75) adding **(85)**
(22) zaps (42) adding **(43)**

Subpattern-1 **= (22),(39),(77),(85),(43)**
A C I H D

4 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		2_1					2		
row3		2	2						2_1
row4		2	2_1						
row5						X			
row6								X	
row7					2		2_1		2
row8					2_1				2
row9	X								

Pattern 4.020, continued.

A		**C**
D		
	H	**I**

Subpattern-2 starts in **(32)** with box order **A→C→I→H→D**

(32) zaps (39) adding **(27)** zaps (77) adding **(79)** and pending ***(89)***
(79) zaps (75) adding **(85)**
(32) zaps (42) adding **(43)**

Subpattern-2 = **(32),(27),(79),(85),(43)**
A C I H D

4 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		$2_{\mathbf{1}}$					$2_{\mathbf{2}}$		
row3		$2_{\mathbf{2}}$	2						$2_{\mathbf{1}}$
row4		2	$2_{\mathbf{12}}$						
row5						X			
row6								X	
row7					2		$2_{\mathbf{1}}$		$2_{\mathbf{2}}$
row8					$2_{\mathbf{12}}$				$2_{\mathbf{P}}$
row9	X								*P*

Pattern 4.020, continued.

A		**C**
D		
	H	**I**

Subpattern-3 starts in **(32)** with box order **A→C→I→H→D**

Due to the pending situation in **I,** subpattern-3 must
begin in the same starting square **(32)** as subpattern-2
follow the same squares **(27)** as subpattern-2 between starting & pending boxes
include pending square **(89)**

(32) zaps (42) adding **(43)**
(89) zaps (85) adding **(75)**

Subpattern-3 = **(32),(27),(89),(75),(43)**
A C I H D

4 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		$2_{\mathbf{1}}$					$2_{\mathbf{23}}$		
row3		$2_{\mathbf{23}}$	2						$2_{\mathbf{1}}$
row4		2	$2_{\mathbf{123}}$						
row5						X			
row6								X	
row7					$2_{\mathbf{3}}$		$2_{\mathbf{1}}$		$2_{\mathbf{2}}$
row8					$2_{\mathbf{12}}$				$2_{\mathbf{3}}$
row9	X								~~P~~

Pattern 4.020, continued.

A		**C**
D		
	H	**I**

Subpattern-4 starts in **(33)** with box order **A→C→I→H→D**

(33) zaps (39) adding **(27)** zaps (77) adding **(79)** and pending ***(89)***
(79) zaps (75) adding **(85)**
(33) zaps (43) adding **(42)**

Subpattern-4 = **(33),(27),(79),(85),(42)**
A C I H D

4 A4	020	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				X					
	row2		$2_{\mathbf{1}}$					$2_{\mathbf{234}}$		
	row3		$2_{\mathbf{23}}$	$2_{\mathbf{4}}$						2_{1}
	row4		$2_{\mathbf{4}}$	$2_{\mathbf{123}}$						
	row5						X			
	row6								X	
	row7					$2_{\mathbf{3}}$		$2_{\mathbf{1}}$		$2_{\mathbf{24}}$
	row8					$2_{\mathbf{124}}$				$2_{\mathbf{3}}$
	row9	X								*P*

Pattern 4.020, continued.

A		**C**
D		
	H	**I**

Subpattern-4 starts in **(33)** with box order **A→C→I→H→D**

Due to pending condition in **I**, subpattern-5 must
begin in same starting **(33)** square as subpattern-4
share same square **(27)** with subpattern-3
include pending square **(89)**

(89) zaps (85) adding **(75)**
(33) zaps (43) adding **(42)**

Subpattern-5 = **(33),(27),(89),(75),(42)**
A C I H D

Back at the starting box A, no pending condition remains, and no squares are unclaimed, so the pattern analysis is complete.

4 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		2_{1}					2_{2345}		
row3		2_{23}	2_{45}						2_{1}
row4		2_{45}	2_{123}						
row5						X			
row6								X	
row7					2_{35}		2_{1}		2_{24}
row8					2_{124}				2_{35}
row9	X								~~P~~

Pattern 4.036	Box Orientation	Patterns with the same box code
3 – 2 | **3 – 3** | **2**	**B – C** | **G – H** | **D**	**none**

	B	**C**
D		
G	**H**	

Subpattern-1 starts in **(14)** with box order **B→H→G→D→C**

(14) zaps (94) adding **(75)** and pending **(95)**
(75) zaps (72) & (73) adding **(93)** zaps (43) adding **(42)**
(14) zaps (17) adding **(37)**

Subpattern-1 = **(14),(75),(93),(42),(37)**
B H G D C

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_1	2		2		
row2	X								
row3					2		2_1		
row4		2_1	2						
row5						X			
row6								X	
row7		2	2		2_1				
row8						*P*			X
row9			2_1	2	2				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Due to the pending condition in **H**, subpattern-2 must
begin in the same starting square **(14)** as subpattern-1
include the pending square **(95)**

(95) zaps (93) adding **(72)** and pending ***(73)***
(72) zaps (42) adding **(43)**
(14) zaps (17) adding **(37)**

Subpattern-2 = **(14),(95),(72),(43),(37)**
B H G D C

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				$2_{\mathbf{12}}$	2		2		
row2	X								
row3					2		$2_{\mathbf{12}}$		
row4		2_1	$2_{\mathbf{2}}$						
row5						X			
row6								X	
row7	P_2	$2_{\mathbf{2}}$	$2_{\mathbf{P}}$		$2_{\mathbf{1}}$				
row8						$\cancel{P}$			X
row9			2_1	2	$2_{\mathbf{2}}$				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Due to the pending condition in **G**, subpattern-3 must
begin in the same starting square **(14)** as subpattern-2
share square **(95)** with subpattern-2
include the pending square **(73)**

(73) zaps (43) adding **(42)**
(14) zaps (17) adding **(37)**

Subpattern-3 = **(14),(95),(73),(42),(37)**
B H G D C

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{123}	2		2		
row2	X								
row3					2		2_{123}		
row4		2_{13}	2_{2}						
row5						X			
row6								X	
row7	~~P_{2}~~	2_{2}	2_{3}		2_{1}				
row8									X
row9			2_{1}	2	2_{23}				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Subpattern-4 begins in **(15)** zaps (75) & (95) adding **(94)**
(94) zaps (93) adding **(72)** and pending ***(73)***
(72) zaps (42) adding **(43)**
(15) zaps (17) adding **(37)**

Subpattern-4 = **(15),(94),(72),(43),(37)**
B H G D C

4 A5	036	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				2_{123}	2_{4}		2		
	row2	X								
	row3					2		2_{1234}		
	row4		2_{13}	2_{24}						
	row5						X			
	row6								X	
	row7	*P3*	2_{24}	2_{3P}		2_{1}				
	row8									X
	row9			2_{1}	2_{4}	2_{23}				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Since a pending situation exists in **G**, subpattern-5 must
begin in the same starting square **(15)** as subpattern-4
share square **(94)** with subpattern-4
include the pending square **(73)**

(73) zaps (43) adding **(42)**
(15) zaps (17) adding **(37)**

Subpattern-5 = **(15),(94),(73),(42),(37)**

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{123}	$2_{\mathbf{45}}$		2		
row2	X								
row3					2		2_{12345}		
row4		2_{135}	$2_{\mathbf{24}}$						
row5						X			
row6								X	
row7	~~P3~~	$2_{\mathbf{24}}$	$2_{\mathbf{35}}$		$2_{\mathbf{1}}$				
row8									X
row9			2_{1}	$2_{\mathbf{45}}$	$2_{\mathbf{23}}$				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Subpattern-6 starts in **(35)** zaps (75) & (95) adding **(94)**
(35) zaps (37) adding **(17)**
(94) zaps (93) adding **(72)** and pending ***(73)***
(72) zaps (42) adding **(43)**

Subpattern-6 = **(35),(94),(72),(43),(17)**
B H G D C

4 A5 036	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{123}	2_{45}		2_{6}		
row2	X								
row3					2_{6}		2_{12345}		
row4		2_{135}	2_{246}						
row5						X			
row6								X	
row7	*P3*	2_{246}	2_{35}		2_{1}				
row8									X
row9			2_{1}	2_{456}	2_{23}				

Pattern 4.036, continued.

	B	C
D		
G	H	

Box order **B→H→G→D→C**

Due to pending condition in **G**, subpattern-7 must
begin in same starting square **(35)** as subpattern-6
share square **(94)** with subpattern-6
include pending square **(73)**

(35) zaps (37) adding **(17)**
(73) zaps (43) adding **(42)**

Subpattern-7 = **(35),(94),(73),(42),(17)**
B H G D C

Back at the starting box, nothing is pending, and no squares unclaimed, so the pattern analysis is complete.

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{123}	2_{45}		2_{67}		
row2	X								
row3					2_{67}		2_{12345}		
row4		2_{1357}	2_{246}						
row5						X			
row6								X	
row7	~~P3~~	2_{246}	2_{357}		2_{1}				
row8									X
row9			2_{1}	2_{4567}	2_{23}				

Pattern 4.004	Box Orientation	Patterns with the same box code
3 – 2 | **3 – 2** | **2 – 3**	**B – A** | **F – E** | **G – I**	**none**

A	**B**	
	E	**F**
G		**I**

Subpattern-1 starts in **(47)** with box order **F→I→G→E→B→A**

(47) zaps (77) adding **(78)** and pending ***(98)***
(78) zaps (72) adding **(92)**
(47) zaps (44) adding **(66)** zaps (36) &(26) adding **(24)** zaps (23) adding **(33)**

Subpattern-1 = **(47),(78),(92),(66),(24),(33)**
F I G E B A

4	004	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1									X
	row2			5	5_1		5			
	row3			5_1			5			
	row4				5			5_1	5	
	row5	X								
	row6						5_1		5	
	row7		5					5	5_1	*P*
	row8					X				
	row9		5_1						5_P	

Pattern 4.004, continued.

A	**B**	
	E	**F**
G		**I**

Box order is **F→I→G→E→B→A**

Due to pending condition in **I**, subpattern-2 must
begin in the same starting square **(47)** as subpattern-1
include the pending square **(98)**

(98) zaps (92) adding **(72)**
(47) zaps (44) adding **(66)** zaps (26) & (36) adding **(24)** zaps (23) adding **(33)**

Subpattern-2 = **(47),(92),(72),(66)),(24),(33)**
F I G E B A

4 004 A6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2			5	5_{12}		5			
row 3			5_{12}			5			
row 4				5			5_{12}	5	
row 5	X								
row 6						5_{12}		5	
row 7		5_{2}					5	5_{1}	*P*
row 8					X				
row 9		5_{1}						5_{2}	

Pattern 4.004, continued.

A	**B**	
	E	**F**
G		**I**

Subpattern-3 begins in **(48)** with box order **F→I→G→E→B→A**

(48) zaps (78) & (98) adding **(77)** zaps (92) adding **(72)**
(48) zaps (44) adding **(66)** zaps (26) & (36) adding **(24)** zaps (23) adding **(33)**

Subpattern-3 = **(48),(77),(72),(66),(24),(33)**
F I G E B A

4 004 A6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2			5	5_{123}		5			
row 3			5_{123}			5			
row 4				5			5_{12}	5_{3}	
row 5	X								
row 6						5_{123}		5	
row 7		5_{2}					5_{3}	5_{1}	
row 8					X				
row 9		5_{13}						5_{2}	

Pattern 4.004, continued.

A	**B**	
	E	**F**
G		**I**

Subpattern-4 begins in **(68)** with box order **F→I→G→E→B→A**

(68) zaps (78) & (98) adding **(77)** zaps (72) adding **(92)**
(68) zaps (66) adding **(44)** zaps (24) adding **(26)** and pending ***(36)***
(26) zaps (23) adding **(33)**

Subpattern-4 = **(68),(77),(92),(44),(26),(33)**
F I G E B A

4 004 A6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1						*P*			X
row 2			5	5_{123}		5_{4}			
row 3			5_{1234}			5_{P}			
row 4				5_{4}			5_{12}	5_{3}	
row 5	X								
row 6						5_{123}		5_{4}	
row 7		5_{2}					5_{34}	5_{1}	
row 8					X				
row 9		5_{134}						5_{2}	

Pattern 4.004, continued.

A	**B**	
	E	**F**
G		**I**

Subpattern-5 begins in **(68)** with box order **F→I→G→E→B→A**

Due to pending situation in box **B**, subpattern-5 must
begin in same starting square **(68)** as subpattern-4
share squares **(77), (92), (44)** with subpattern-4
include pending square **(36)**
(36) zaps (23) adding **(23)**

Subpattern-5 = **(68),(77),(92),(44),(36),(23)**
F I G E B A

At the starting box, nothing is pending and no squares unclaimed. We are done.

4 004 A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1						*P*			X
row 2			5_{5}	5_{123}		5_{4}			
row 3			5_{1234}			5_{5}			
row 4				5_{45}			5_{12}	5_{3}	
row 5	X								
row 6						5_{123}		5_{45}	
row 7		5_{2}					5_{345}	5_{1}	
row 8					X				
row 9		5_{1345}						5_{2}	*P*

Pattern 4.008	Box Orientation	Patterns with the same box code
3 – 3 – 2	**G – I – H**	**011, 031**
| |	| |	
3 – 2	**A – C**	

A		**C**
G	**H**	**I**

Box order **A→C→I→H→G**

Subpattern-1 begins in **(12)** zaps (17) adds **(39)** zaps (89) & (99) adding **(77)**
(12) zaps (72) & (92) adding **(93)**

Subpattern-1 = **(12),(39),(77),(86),(99)**
A C I H G

4 008

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_1					4		
row2					X				
row3		4	4						4_1
row4	X								
row5								X	
row6				X					
row7		4				4	4_1		
row8						4_1			4
row9		4	4_1						4

Pattern 4.008, continued.

A		**C**
G	**H**	**I**

Subpattern-2 starts in **(32)** with box order **A→C→G→I→H**

(32) zaps (39) adding **(17)**
(32) zaps (72) & (92) adding **(93)**
(17) zaps (77) while **(93)** zaps (99) adding **(89)**
(89) zaps (86) adding **(76)**

Subpattern-2 = **(32),(17),(93),(89),(76)**
A C G I H

4 008 A8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		4_1					4_2		
row 2					X				
row 3		4_2	4						4_1
row 4	X								
row 5								X	
row 6				X					
row 7		4				4_2	4_1		
row 8						4_1			4_2
row 9		4	4_{12}						4

Pattern 4.008, continued.

A		**C**
G	**H**	**I**

Subpattern-3 starts in **(32)** with box order **A→C→G→I→H**

(32) zaps (39) adding **(17)**
(32) zaps (72) & (92) adding **(93)**
(17) zaps (71) while **(93)** zaps (99) adding **(89)**

Subpattern-3 = **(32),(17),(93),(89),(76)**
A C G I H

4 008 A8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		4_{1}					4_{23}		
row 2					X				
row 3		4_{23}	4						4_{1}
row 4	X								
row 5								X	
row 6				X					
row 7		4				4_{23}	4_{1}		
row 8						4_{1}			4_{23}
row 9		4	4_{123}						4

Pattern 4.008, continued.

A		**C**
G	**H**	**I**

Subpattern-4 starts in **(33)** with box order **A→C→G→I→H**

(33) zaps (39) adding **(17)**
(33) zaps (93) adding **(92)** and pending ***(72)***
(92) zaps (99) and **(17)** zaps (77) adding **(89)**

Subpattern-4 = **(33),(17),(92),(89),(76)**
A C G I H

4 008 A8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		4_{1}					4_{234}		
row 2					X				
row 3		4_{23}	4_{4}						4_{1}
row 4	X								
row 5								X	
row 6				X					
row 7		4_{P}				4_{234}	4_{1}		
row 8						4_{1}			4_{234}
row 9	*P*	4_{4}	4_{123}						4

Pattern 4.008, continued.

A		**C**
G	**H**	**I**

Subpattern-5 starts in **(33)** with box order **A→C→G→H→I**

Due to the pending situation in **G**, subpattern-5 must
begin in the same starting square **(33)** as subpattern-4
share square **(86)** with subpattern-4 between starting and pending boxes
include the pending square **(72)**

(33) zaps (39) adding **(17)**
(72) zaps (76) adding **(86)**
(72) zaps (77) and **(86)** zaps (89) adding **(99)**

Subpattern-5 = **(33),(72),(86),(99),(17)**
A C G H I

At the starting box, nothing pending and no squares unclaimed. Analysis complete.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_{1}					4_{2345}		
row2					X				
row3		4_{23}	4_{45}						4_{1}
row4	X								
row5								X	
row6				X					
row7		4_{5}				4_{234}	4_{1}		
row8						4_{15}			4_{234}
row9	X	4_{4}	4_{123}						4_{5}

Pattern 4.039	Box Orientation	Patterns with the same box code
2 | **3 – 3 – 2** | | **2 – 2** | **2**	**B** | **D – F – E** | | **G – I** | **A**	**none**

A	**B**	
D	**E**	**F**
G		**I**

Subpattern-1 starts in **(43)** with box order **D→E→B→F→I→G→A**

(43) zaps (46) adding **(64)** zaps (34) adding **(36)**
(64) zaps (76) while **(43)** zaps (47) adding **(58)**
(43) zaps (93) adding **(81)** zaps (21) adding **(22)**

Subpattern-1 = **(43),(64),(36),(58),(97),(81),(22)**
D E B F I G A

4	039	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1									X
	row2	8	8_1							
	row3				8		8_1			
	row4			8_1			8	8		
	row5	8	8						8_1	
	row6				8_1			8		
	row7					X				
	row8	8_1							8	
	row9			8				8_1		

Pattern 4.039, continued.

A	**B**	
D	**E**	**F**
G		**I**

Subpattern-2 starts in **(51)** with box order **D→A→G→I→F→E→B**

(51) zaps (21) adding **(22)**
(51) zaps (81) adding **(93)** zaps (97) adding **(88)** zaps (58) adding **(47)** and pending ***(67)***
(47) zaps (46) adding **(64)** zaps (34) adding **(36)**

Subpattern-2 = **(51),(22),(93),(88),(47),(64),(36)**
D A G I F E B

4 039

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	8	8_{12}							
row3				8		8_{12}			
row4			8_1			8	8_2		
row5	8_2	8						8_1	*P*
row6				8_{12}			8		
row7					X				
row8	8_1							8_2	
row9			8_2				8_1		

Pattern 4.039, continued.

A	**B**	
D	**E**	**F**
G		**I**

Box order: **D→A→G→I→F→E→B**

Due to the pending condition in **F**, subpattern-3 must
begin in the same starting square **(51)** as subpattern-2
share squares **(22),(93),(88)** with subpattern-2 between starting and pending boxes
include the pending square **(67)**

(67) zaps (64) adding **(46)** zaps (36) adding **(34)**

Subpattern-3 **= (51),(22),(93),(88),(67),(46),(34)**
D A G I F E B

4 039

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	8	8_{123}							
row3				8_{3}		8_{12}			
row4			8_{1}			8_{3}	8_{2}		
row5	8_{23}	8						8_{1}	~~P~~
row6				8_{12}			8_{3}		
row7					X				
row8	8_{1}							8_{23}	
row9			8_{23}				8_{1}		

Pattern 4.039, continued.

A	**B**	
D	**E**	**F**
G		**I**

Subpattern-4 begins in **(52)** with box order **D→A→G→I→F→E→B**

(52) zaps (22) adding **(21)** zaps (81) adding **(93)** zaps (97) adding **(88)**
(88) zaps (58) adding **(47)** and pending ***(67)***
(47) zaps (46) adding **(64)** zaps (34) adding **(36)**

Subpattern-4 = **(52),(21),(93),(88),(47),(64),(36)**
D A G I F E B

4 039 A9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2	8_{4}	8_{123}							
row 3				8_{3}		8_{124}			
row 4			8_{1}			8_{3}	8_{24}		
row 5	8_{23}	8_{4}						8_{1}	
row 6				8_{124}			8_{3P}		*P*
row 7					X				
row 8	8_{1}							8_{234}	
row 9			8_{234}				8_{1}		

Pattern 4.039, continued.

A	**B**	
D	**E**	**F**
G		**I**

Due to the pending condition in F, subpattern-5 must
begin in the same starting square **(52)** as subpattern-4
share squares **(21),(93),(88)** with subpattern-4
include pending square **(67)**

(67) zaps (64) adding **(46)** zaps (36) adding **(34)**

Subpattern-5 = **(52),(21),(93),(88),(67),(46),(34)**
D A G I F E B

Back at the starting box, nothing pending, no squares unclaimed, analysis complete.

4 039 A9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2	8_{45}	8_{123}							
row 3				8_{35}		8_{124}			
row 4			8_{1}			8_{35}	8_{24}		
row 5	8_{23}	8_{45}						8_{1}	
row 6				8_{124}			8_{35}		₽
row 7					X				
row 8	8_{1}							8_{2345}	
row 9			8_{2345}				8_{1}		

Pattern 4.003	Box Orientation	Patterns with the same box code
4 – 3 – 2	H – E – B	016,022
|	|	
2	I	

	B	
	E	
	H	**I**

Box order: **H→I→E→B**

Subpattern-1 startx in **(74)** zaps (77) adding **(87)**
(74) zaps (64) adding **(65)** and pending ***(66)***
(65) zaps (15) adding **(16)**

Subpattern-1 = **(74),(87),(65),(16)**
H I E B

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2	$2_{\mathbf{1}}$			
row2		X							
row3									X
row4			X						
row5				*P*				X	
row6				2	$2_{\mathbf{1}}$	$2_{\mathbf{p}}$			
row7				$2_{\mathbf{1}}$		2	2		
row8				2		2	$2_{\mathbf{1}}$		
row9	X								

Pattern 4.003, continued.

	B	
	E	
	H	**I**

Box order: **H→I→E→B**

Due to the pending situation in **E**, subpattern-2 must
begin in the same starting square, **(74)** as subpattern-1
share square **(87)** with subpattern-1
include pending square **(66)**

(66) zaps (16) adding **(15)**

Subpattern-2 = **(74),(87),(66),(15)**
H I E B

---

4 003	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
B1 row 1					2_{2}	2_{1}			
row 2		X							
row 3									X
row 4			X	~~P~~					
row 5								X	
row 6				2	2_{1}	2_{2}			
row 7				2_{12}		2	2		
row 8				2		2	2_{12}		
row 9	X								

Pattern 4.003, continued.

	B	
	E	
	H	**I**

Box order: **H→I→B→E**

Subpattern-3 will start in **(84)** zaps (87) adding **(77)**
(84) zaps (64) adding **(65)** and pending ***(66)***

Subpattern-3 = **(84),(77),(65),(16)**
H I B E

---

4 003 B1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					$2_{\mathbf{2}}$	$2_{\mathbf{13}}$			
row 2		X							
row 3									X
row 4			X			*P*			
row 5								X	
row 6				2	$2_{\mathbf{13}}$	$2_{\mathbf{p}}$			
row 7				$2_{\mathbf{12}}$		2	$2_{\mathbf{3}}$		
row 8				$2_{\mathbf{3}}$		2	$2_{\mathbf{12}}$		
row 9	X								

Pattern 4.003, continued.

	B	
	E	
	H	**I**

Box order: **H→I→B→E**

Due to the pending situation in **E**, subpattern-4 must
begin in the same starting square **(84)** as subpattern-3
share square **(77)** with subpattern-3
include pending square **(66)**

(66) zaps (16) adding **(15)**

Subpattern-4 = **(84),(77),(66),(15)**
H I B E

4 003 B1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					2_{24}	2_{13}			
row 2		X							
row 3									X
row 4			X			~~P~~			
row 5								X	
row 6				2	2_{13}	2_{24}			
row 7				2_{12}		2	2_{34}		
row 8				2_{34}		2	2_{12}		
row 9	X								

Pattern 4.003, continued.

	B	
	E	
	H	**I**

Box order: **H→I→B→E**

Subpattern-5 begins in **(76)** zaps (77) adding **(87)**
(76) zaps (16) adding **(15)**
(15) zaps (65) while **(76)** zaps (66) adding **(64)**

Subpattern-5 = **(76),(97),(15),(64)**
H I B E

4 003 B1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					$2_{\mathbf{245}}$	$2_{\mathbf{13}}$			
row 2		X							
row 3									X
row 4			X						
row 5								X	
row 6				$2_{\mathbf{5}}$	$2_{\mathbf{13}}$	$2_{\mathbf{24}}$			
row 7				$2_{\mathbf{12}}$		$2_{\mathbf{5}}$	$2_{\mathbf{34}}$		
row 8				$2_{\mathbf{34}}$		2	$2_{\mathbf{125}}$		
row 9	X								

Pattern 4.003, continued.

	B	
	E	
	H	**I**

Box order: **H→I→B→E**

Subpattern-6 begins in **(86)** zaps (87) adding **(77)**
(86) zaps (16) adding **(15)**
(86) zaps (66) and **(15)** zaps (65) adding **(64)**

Subpattern-6 = **(86),(77),(15),(64)**
H I B E

Back at the starting box H, nothing is pending and no squares are unclaimed. Done.

4 003

B1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					2_{2456}	2_{13}			
row 2		X							
row 3									X
row 4			X						
row 5								X	
row 6				2_{56}	2_{13}	2_{24}			
row 7				2_{12}		2_{5}	2_{346}		
row 8				2_{34}		2_{6}	2_{125}		
row 9	X								

Pattern 4.027	Box Orientation	Patterns with the same box code
2 | **4 – 3** | **2**	**A** | **E – D** | **H**	**038**

A		
D	**E**	
	H	

Subpattern-1 starts in **(44)** with box order **E→H→D→A**

(44) zaps (84) adding **(85)**
(44) zaps (41) & (42) adding **(62)** zaps (12) adding **(11)**

Subpattern-1 = **(44),(85),(62),(11)**
E H D A

---

4 027
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_1	3							
row2							X		
row3						X			
row4	3	3		3_1	3				
row5									X
row6		3_1		3	3				
row7								X	
row8				3	3_1				
row9			X						

Pattern 4.027, continued.

A		
D	**E**	
	H	

Subpattern-2 starts in **(45)** with box order **E→H→D→A**

(45) zaps (85) adding **(84)**
(45) zaps (41) & (42) adding **(62)** zaps (12) adding **(11)**

Subpattern-2 = **(45),(84),(62),(11)**

Subpattern-3 starts in **(64)** with box order **E→H→D→A**

(64) zaps (84) adding **(85)**
(64) zaps (62) adding **(41)** and pending ***(42)***
(41) zaps (11) adding **(12)**

Subpattern-3 = **(64),(85),(41),(12)**
E H D A

---

4 B2	027	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	3_{12}	$3_{\mathbf{3}}$							
	row2							X		
	row3						X			
	row4	$3_{\mathbf{3}}$	3		$3_{\mathbf{1}}$	$3_{\mathbf{2}}$				
	row5									X
	row6	***P***	3_{12}		$3_{\mathbf{3}}$	3				
	row7								X	
	row8				3_{2}	3_{13}				
	row9			X						

Pattern 4.027, continued.

A		
D	**E**	
	H	

Box order: **E→H→D→A**

Due to the pending condition in **D**, subpattern-4 must
begin in the same starting square **(64)** as subpattern-3
share **(85)** with subpattern-3
include the pending square **(62)**

(62) zaps (12) adding **(11)**

Subpattern-4 = **(64),(85),(62),(11)**
E H D A

---

4 027
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_{124}	3_{3}							
row2							X		
row3						X			
row4	3_{3}	3_{4}		3_{1}	3_{2}				
row5									X
row6	~~p~~	3_{12}		3_{34}	3				
row7								X	
row8				3_{2}	3_{134}				
row9			X						

Pattern 4.027, continued.

A		
D	**E**	
	H	

Subpattern-5 begins in **(65)** with box order **E→H→D→A**

(65) zaps (85) adding **(84)**
(65) zaps (62) adding **(41)** and pending **(42)**
(41) zaps (11) adding **(12)**

Subpattern-5 = **(65),(84),(41),(12)**
E H D A

4 027
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_{124}	3_{35}							
row2							X		
row3						X			
row4	3_{35}	3_4		3_1	3_2				
row5									X
row6	~~p~~	3_{12}		3_{34}	3_5				
row7								X	
row8				3_{25}	3_{134}				
row9			X						

Pattern 4.027, continued.

A		
D	**E**	
	H	

Box order is E→H→D→A

Due to pending situation in **D**, subpattern-6 must
begin in same starting square **(65)** as subpattern-5
share **(84)** with subpattern-5, as it lies between starting and pending boxes
include the pending square **(62)**

(62) zaps (12) adding **(11)**
Subpattern-6 = **(65),(84),(62),(11)**
E H D A

Back at the starting box, nothing is pending and no squares are unclaimed. The pattern analysis is complete

4 027
B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_{1246}	3_{35}							
row2							X		
row3						X			
row4	3_{35}	3_{46}		3_{1}	3_{2}				
row5									X
row6	~~P~~	3_{12}		3_{34}	3_{56}				
row7								X	
row8				3_{256}	3_{134}				
row9			X						

Pattern 4.026	Box Orientation	Patterns with the same box code
2 | **4 – 3 – 2** | **2**	**C** | **D – A – G** | **E**	**028, 033**

A		**C**
D	**E**	
G		

Subpattern-1 starts in **(51)** with box order **D→E→A→C→G**

(51) zaps (55) adding **(65)**
(51) zaps (11) & (13) adding **(12)** zaps (18) adding **(38)**
(51) zaps (71) adding **(73)**

Subpattern-1 = **(51),(65),(73),(38),(73)**

D E A C G

---

4 B3 026

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9	$9_{\mathbf{1}}$						9	
row2						X			
row3	9							$9_{\mathbf{1}}$	
row4									X
row5	9_1	9	9		9				
row6			9		$9_{\mathbf{1}}$				
row7	9		$9_{\mathbf{1}}$						
row8							X		
row9				X					

Pattern 4.026, continued.

A		**C**
D	**E**	
G		

Subpattern-2 starts in **(52)** with box order **D→E→A→C→G**

(52) zaps (55) adding **(65)**
(52) zaps (12) adding **(11)** and pending ***(31)***
(11) zaps (18) adding **(38)**
(11) zaps (71) adding **(73)**

Subpattern-2 = **(52),(65),(11),(38),(73)**
D E A C G

---

4 026
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_{2}	9_{1}						9	
row2						X			
row3	9_{3}		~~P~~					9_{12}	
row4									X
row5	9_{1}	9_{2}	9		9				
row6			9		9_{12}				
row7	9		9_{12}						
row8							X		
row9				X					

Pattern 4.026, continued.

A		**C**
D	**E**	
G		

Subpattern-3 will keep the same box order **D→E→A→C→G**

Due to the pending situation in A, subpattern-3 must
begin in the same starting square **(52)** as subpattern-2
share **(65)** [between starting & pending boxes] with subpattern-2
include the pending square **(31)**

(31) zaps (38) adding **(18)**
(31) zaps (71) adding **(73)**

Subpattern 3 = **(52),(65),(31),(18),(73)**
D E A C G

---

4 B3 026

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_2	9_1						9_3	
row2						X			
row3	9_3							9_{12}	
row4									X
row5	9_1	9_{23}	9		9				
row6			9		9_{123}				
row7	9		9_{123}						
row8							X		
row9				X					

Pattern 4.026, continued.

A		**C**
D	**E**	
G		

Subpattern-4 starts in **(53)** with box order **D→E→G→A→C**

(53) zaps (55) adding **(65)**
(53) zaps (73) adding **(71)** zaps (11) & (13) adding **(12)** zaps (18) adding **(38)**

Subpattern-4 = **(53),(65),(71),(12),(38)**
D E G A C

---

4 026
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_{2}	9_{14}						9_{3}	
row2						X			
row3	9_{3}							9_{124}	
row4									X
row5	9_{1}	9_{23}	9_{4}		9				
row6			9		9_{1234}				
row7	9_{4}		9_{123}						
row8							X		
row9				X					

Pattern 4.026, continued.

A		**C**
D	**E**	
G		

Subpattern-5 starts in **(63)** with box order **D→E→G→A→C**

(63) zaps (65) adding **(55)**
(63) zaps (73) adding **(71)** zaps (11)&(13) adding **(12)** zaps(18) adding **(38)**

Subpattern-5 = **(63)(55),(71),(12),(38)**
D E G A C

Back at the starting box D, nothing is pending and no squares are unclaimed.
The pattern analysis is complete.

4 026
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_{2}	9_{145}						9_{3}	
row2						X			
row3	9_{3}							9_{1245}	
row4									X
row5	9_{1}	9_{23}	9_{4}		9_{5}				
row6			9_{5}		9_{1234}				
row7	9_{45}		9_{123}						
row8							X		
row9				X					

Pattern 4.017	Box Orientation	Patterns with the same box code
3 – 2 | **4 – 2** | **2**	**D – F** | **H – G** | **B**	**none**

	B	
D		**F**
G	**H**	

Box order: **H→G→D→F→B**

Subpattern-1 starts in **(75)** zaps (72) adding **(81)** zaps (51)&(61) adding **(52)**
(52) zaps (58) adding **(68)**
(75) zaps (25) adding **(26)**

Subpattern-1 = **(75),(81),(52),(68),(26)**
H G D F B

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1	1_1			
row3			X						
row4				X					
row5	1	1_1						1	
row6	1							1_1	
row7		1			1_1	1			
row8	1_1				1	1			
row9							X		

Pattern 4.017, continued.

	B	
D		**F**
G	**H**	

Box order: **H→G→D→F→B**

Subpattern-2 starts in **(76)** zaps (72) adding **(81)** zaps (61)&(51) adding **(52)**
(52) zaps (58) adding **(68)**
(76) zaps (26) adding **(25)**

Subpattern-2 = **(76),(81),(52),(68),(25)**
H G D F B

Subpattern-3 starts in **(85)** zaps (81) adding **(72)** zaps (52) adding **(51)** and pending ***(61)***
(51) zaps (58) adding **(68)**
(85) zaps (25) adding **(26)**

Subpattern-3 = **(85),(72),(51),(68),(26)**
H G D F B

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1_{2}	1_{13}			
row3			X						
row4			*P*	X					
row5	1_{3}	1_{12}						1	
row6	1							1_{123}	
row7		1_{3}			1_{1}	1_{2}			
row8	1_{12}				1_{3}	1			
row9							X		

Pattern 4.017, continued.

	B	
D		**F**
G	**H**	

Box order: **H→G→D→F→B**

Due to the pending condition in **D**, subpattern-4 must
begin in the same starting square **(85)** as subpattern-3
share **(72)** with subpattern-3 [between starting and pending boxes]
include the pending square **(61)**

(61) zaps (68) adding **(58)**
(85) zaps (25) adding **(26)**

Subpattern-4 = **(85),(72),(61),(58),(26)**
H→G→D→F→B

---

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1_{2}	1_{134}			
row3			X						
row4			*P*	X					
row5	1_{3}	1_{12}						1_{4}	
row6	1_{4}							1_{123}	
row7		1_{34}			1_{1}	1_{2}			
row8	1_{12}				1_{34}	1			
row9							X		

Pattern 4.017, continued.

	B	
D		**F**
G	**H**	

Box order: **H→G→D→F→B**

Subpattern-5 starts in **(86)** zaps (81) adding **(72)** zaps (52) adding **(51)** and pending ***(61)***
(51) zaps (58) adding **(68)**
(86) zaps (26) adding **(25)**

Subpattern-5 = **(86),(72),(51),(68),(25)**
H G D F B

---

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1_{25}	1_{134}			
row3			X						
row4				X					
row5	1_{35}	1_{12}						1_{4}	
row6	1_{4}		~~1~~					1_{1235}	
row7		1_{345}			1_{1}	1_{2}			
row8	1_{12}				1_{34}	1_{5}			
row9							X		

Pattern 4.017, continued.

	B	
D		**F**
G	**H**	

Box order: **H→G→D→F→B**

Due to the pending condition in **D**, subpattern-6 must
begin in the same starting square **(86)** as subpattern-5
share the same square **(72)** with subpattern-5 [between starting & pending boxes]
include the pending square **(61)**

(61) zaps (68) adding **(58)**
(86) zaps (26) adding **(25)**

Subpattern-6 = **(86),(72),(61),(58),(25)**
H G D F B

Back at the starting box H, nothing is pending & no boxes unclaimed. We are done.

---

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1_{256}	1_{134}			
row3			X						
row4				X					
row5	1_{35}	1_{12}						1_{46}	
row6	1_{46}		~~P~~					1_{1235}	
row7		1_{3456}			1_{1}	1_{2}			
row8	1_{12}				1_{34}	1_{56}			
row9							X		

Pattern 4.023	Box Orientation	Patterns with the same box code
2 | **4 – 4 – 2** | **2**	**D** | **I – F – C** | **G**	**034**

		C
D		**F**
G		**I**

Box order: F→C→I→G→D

Subpattern-1 starts in **(57)** zaps (17) adds **(18)**
[(18) zaps (78) & (88) and **(57)** zaps (77)**]** adding **(89)** zaps (82) adding **(72)**
(57) zaps (53) adding **(63)**

Subpattern-1 = **(57),(18),(89),(72),(63)**
F C I G D

---

4 B5	023	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1							2	2_1	
	row2	X								
	row3					X				
	row4									
	row5			2				2_1	2	
	row6			2_1				2		2
	row7		2_1					2	2	
	row8		2						2	2_1
	row9				X					

Pattern 4.023, continued.

		C
D		**F**
G		**I**

Box order: F→C→I→G→D

Subpattern-2 starts in **(58)** zaps (18) adding **(17)**
(17) zaps (77) and **(58)** zaps (78) & (88) adding **(89)** zaps (82) adding **(72)**
(58) zaps (53) adding **(63)**

Subpattern-2 = **(58),(17),(89),(72),(63)**
F C I G D

Subpattern-3 starts in **(67)** zaps (17) adding **(18)**
(18) zaps (78) & (88) while **(67)** zaps (77) adding **(89)**
(89) zaps (82) adding **(72)**
(67) zaps (63) adding **(53)**

Subpattern-3 = **(67),(18),(89),(72),(53)**
F C I G D

---

4 023
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{2}	2_{13}	
row2	X								
row3					X				
row4									
row5			2_{3}				2_{1}	2_{2}	
row6			2_{12}				2_{3}		2
row7		2_{123}					2	2	
row8		2						2	2_{123}
row9				X					

Pattern 4.023, continued.

		C
D		**F**
G		**I**

Box order: F→C→I→G→D

Subpattern-4 starts in **(69)** zaps (19) adding **(18)** and pending ***(17)***
(18) zaps (78) & (88) while **(69)** zaps (89) adding **(77)** zaps (72) adding **(82)**
(69) zaps (63) adding **(53)**

Subpattern-4 = **(69),(18),(77),(82),(53)**
F C I G D

---

4 B5	023	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1							2_{2p}	2_{134}	P_1
	row2	X								
	row3					X				
	row4									
	row5			2_{34}				2_1	2_2	
	row6			2_{12}				2_3		2_4
	row7		2_{123}					2_4	2	
	row8		2_4						2_P	2_{123}
	row9				X					P_2

Pattern 4.023, continued.

		C
D		**F**
G		**I**

Box order: F→C→I→G→D

Due to the pending condition in **I,** subpattern-5 must
begin in the same starting square **(69)** as subpattern-4
include pending square **(17)**

(18) zaps <u>(78) & (88)</u> while **(69)** zaps (89) adding **(78)** and pending ***(88)***
(78) zaps (72) adding **(82)**
(69) zaps (63) adding **(53)**

Subpattern-5 = **(69),(18),(78),(82),(53)**
F C I G D

---

4 B5	023	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1							2_{25}	2_{134}	
	row2	X								
	row3					X				
	row4									
	row5			2_{345}				2_{1}	2_{2}	
	row6			2_{12}				2_{3}		2_{45}
	row7		2_{123}					2_{4}	2_{5}	
	row8		2_{45}						2	2_{123}
	row9				X					P_2

Pattern 4.023, continued.

		C
D		**F**
G		**I**

Box order: F→C→I→G→D

Due to the pending condition in **I**, subpattern-6 must
begin in the same starting square **(69)** as subpattern-5
share square **(17)** with subpattern-5 [between starting and pending boxes]
include the pending square **(88)**

(88) zaps (82) adding **(72)**
(69) zaps (63) adding **(53)**

Subpattern-6 = **(69),(17),(88),(72),(53)**
F C I G D

Back at the starting box F, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

4 023
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{256}	2_{134}	
row2	X								
row3					X				
row4									
row5			2_{3456}				2_{1}	2_{2}	
row6			2_{12}				2_{3}		2_{456}
row7		2_{1236}					2_{4}	2_{5}	
row8		2_{45}						2_{6}	2_{123}
row9				X					P_2

Pattern 4.021	Box Orientation	Patterns with the same box code
4 – 2 | **3 – 2** | **2**	**A – B** | **F – D** | **I**	**none**

A	**B**	
D		**F**
		I

Box order: **A→B→D→F→I**

Subpattern-1 begins in **(11)** zaps (14) adding **(24)**
(11) zaps (61) adding **(43)** zaps (49) adding **(68)** and pending ***(69)***
(68) zaps (88) adding **(89)**

Subpattern-1 = **(11),(24),(43),(68),(89)**
A B D F I

4 B6 021

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_1		4	4					
row2	4		4	4_1					
row3							X		
row4			4_1						4
row5					X				*P*
row6	4							4_1	4_P
row7		X							
row8								4	4_1
row9						X			

Pattern 4.021, continued.

A	**B**	
D		**F**
		I

Box order: **A→B→D→F→I**

Due to the pending condition in **A**, subpattern-2 must
begin in the same starting square **(11)** as subpattern-1
share the same squares **(24), (43),** between starting and pending boxes
include the pending square **(69)**

(69) zaps (89) adding **(88)**

Subpattern-2:= **(11),(24),(43),(69),(88)**
A B D F I

---

4 021
B6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}		4	4					
row2	4		4	4_{12}					
row3							X		
row4			4_{12}						4
row5					X				*P*
row6	4							4_1	4_2
row7		X							
row8								4_2	4_1
row9						X			

Pattern 4.021, continued.

A	**B**	
D		**F**
		I

Box order: **A→B→D→F→I**

Subpattern-3 begins in **(13)** zaps (14) adding **(24)**
(13) zaps (61) adding **(43)** zaps (68) & (69) adding **(49)** zaps (89) adding **(88)**

Subpattern-3 = **(13),(24),(43),(49),(88)**
A B D F I

---

4 021
B6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}		4_{3}	4					
row2	4		4	4_{123}					
row3							X		
row4			4_{12}						4_{3}
row5					X				
row6	4_{3}							4_{1}	4_{2}
row7		X							
row8								4_{23}	4_{1}
row9						X			

Pattern 4.021, continued.

A	**B**	
D		**F**
		I

Box order: **A→B→D→F→I**

Subpattern-4 begins in **(21)** zaps (24) adding **(14)**
(21) zaps (61) adding **(43)** zaps (49) adding **(68)** and pending ***(69)***
(68) zaps (88) adding **(89)**

Subpattern-4 = **(21),(14),(43),(68),(89)**
A B D F I

Due to the pending condition in **F**, subpattern-5 must
start in the same square **(21)** as subpattern-4
share squares **(14)** & **(43)** with subpattern-4 [all squares betw start & pend boxes]
include pending square **(69)**
(69) zaps (89) adding **(88)**

Subpattern-5 = **(21),(14),(43),(69),(88)**
A B D F I

4 021
B6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}		4_{3}	4_{45}					
row2	4_{45}		4	4_{123}					
row3							X		
row4			4_{1245}						4_{3}
row5					X				*P*
row6	4_{3}							4_{14}	4_{25}
row7		X							
row8								4_{235}	4_{14}
row9						X			

Pattern 4.021, continued.

A	**B**	
D		**F**
		I

Box order: **A→B→D→F→I**

Subpattern-6 starts in **(23)** zaps (24) adding **(14)**
(23) zaps (43) adding **(61)** zaps (68) & (69) adding **(49)** zaps (89) adding **(88)**

Subpattern-6 = **(23),(14),(61),(49),(88)**

Back at the starting box A, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

4 021
B6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}		4_{3}	4_{456}					
row2	4_{45}		4_{6}	4_{123}					
row3							X		
row4			4_{1245}						4_{36}
row5					X				
row6	4_{36}							4_{14}	4_{25}
row7		X							
row8								4_{2356}	4_{14}
row9						X			

Pattern 4.029	Box Orientation	Patterns with the same box code
4 – 2 – 2 | **2 – 3**	**G – D – A** | **E – H**	**none**

A		
D	**E**	
G	**H**	

Subpattern-1 begins in **(71)** with box order **G→A→D→H→E**

(71) zaps (21) adding **(22)**
(71) zaps (61) adding **(63)**
(71) zaps (74) & (76) adding **(94)** zaps (54) adding **(56)**

Subpattern-1 = **(71),(22).(64).(94).(56)**

4 029
B7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2	8	8_1							
row3					X				
row4									X
row5				8		8_1			
row6	8		8_1						
row7	8_1	8	8	8		8			
row8							X		
row9			8	8_1					

Pattern 4.029, continued.

A		
D	**E**	
G	**H**	

Subpattern-2 begins in **(72)** with box order **G→A→D→H→E**

(72) zaps (22) adding **(21)** zaps (61) adding **(63)**
(72) zaps (74) & (76) adding **(54)** zaps (74) & (94) adding **(76)**

Subpattern-2 = **(72),(21),(63),(54),(76)**
G A D H E

Subpattern-3 begins in **(73)** with box order **G→D→A→H→E**

(73) zaps (63) adding **(61)** zaps (21) adding **(22)**
(73) zaps (74) & (76) adding **(94)** zaps (54) adding **(56)**

Subpattern-3 = **(73),(61),(22),(94),(56)**
G A D H E

4 029
B7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2	8_{2}	8_{1345}							
row3					X				
row4									X
row5				8_{4}		8_{1235}			
row6	8_{345}		8_{12}						
row7	8_{1}	8_{2}	8_{3}	8_{5}		8_{4}			
row8							X		
row9			8_{45}	8_{123}					

Pattern 4.029, continued.

A		
D	**E**	
G	**H**	

box order is G→D→A→H→E

Subpattern-4 begins in **(93)** zaps (63) adding **(61)** zaps (21) adding **(22)**
(93) zaps (94) adding (74) and pending ***(76)***

Subpattern-4 = **(93),(61),(22),(94),(56)**
G D A H E

Due to the pending condition in **H**, subpattern-5 must
begin in the same starting square **(93)** as subpattern-4
share squares **(61)**& **(22)** with subpattern-5 [between starting & pending boxes]
include the pending square **(76)**
(76) zaps (56) adding **(54)**

Subpattern-5 **= (93),(61),(22),(76),(54)**
G D A H E

Back at the starting box, nothing is pending & no squares unclaimed. We are done.

4 029
B7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2	8_{2}	8_{1345}							
row3					X				
row4									X
row5				8_{5}		8_{1234}			
row6	8_{345}		8_{12}						
row7	8_{1}	8_{2}	8_{3}	8_{4}		8_{5}			
row8					*P*		X		
row9			8_{45}	8_{123}					

Pattern 4.024	Box Orientation	Patterns with the same box code
2 – 4 | **3 – 2 – 2**	**I – G** | **D – E – F**	**none**

D	**E**	**F**
G		**I**

Box order: G→I→D→E→F

Subpattern-1 is begun in **(72)** zaps (77) adding **(87)**
(72) zaps (62) & (42) adding **(53)** zaps (56) adding **(46)**
(46) zaps (48) adding **(68)**
(72) zaps (77) adding **(87)**

Subpattern-1 = **(72),(87),(53),(46),(68)**
G I D E F

---

4 024
B8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2									X
row3	X								
row4		6				6_1		6	
row5			6_1			6			
row6		6						6_1	
row7		6_1	6				6		
row8		6	6				6_1		
row9					X				

Pattern 4.024, continued.

D	**E**	**F**
G		**I**

Box order: G→I→D→F→E

Subpattern-2 begins in **(73)** zaps (77) adding **(87)**
(73) zaps (53) adding **(42)** and pending ***(62)***
(42) zaps (46) adding **(56)**
(42) zaps (48) adding **(68)**

Subpattern-2 = **(73),(87),(42),(68),(56)**
G I D F E

Due to the pending situation in D, subpattern-3 must
begin in the same starting square **(73)** as subpattern-2
share square **(87)** with subpattern-2 [between starting & pending boxes]
include the pending square **(62)**
(62) zaps (68) adding **(48)** zaps (46) adding **(56)**

Subpattern-3 = **(73),(87),(42),(48),(56)**
G I D F E

4 B8	024	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1				X					
	row2									X
	row3	X								
	row4		6_2				6_1		6_3	
	row5	*P*		6_1			6_{23}			
	row6		6_3						6_{12}	
	row7		6_1	6_{23}				6		
	row8		6	6				6_{123}		
	row9					X				

Pattern 4.024, continued.

D	**E**	**F**
G		**I**

Box order: G→I→D→F→E

Subpattern-4 starts in **(82)** zaps (87) adding **(77)**
(82) zaps (62) & (42) adding **(53)** zaps (56) adding **(46)** zaps (48) adding **(68)**

Subpattern-4 = **(82),(77),(53),(46),(68)**
G I D F E

Subpattern-5 starts in **(83)** zaps (87) adding **(77)**
(83) zaps (53) adding **(42)** and pending ***(62)***
(42) zaps (48) adding **(68)**
(42) zaps (46) adding **(56)**

Subpattern-5 = **(83),(77),(42),(68),(56)**
G I D F E

4 024
B8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2									X
row3	X								
row4		6_{25}				6_{14}		6_{3}	
row5			6_{14}			6_{235}			
row6		6_{3}	*P*					6_{1245}	
row7		6_{1}	6_{23}				6_{45}		
row8		6_{4}	6_{5}				6_{123}		
row9					X				

Pattern 4.024, continued.

D	**E**	**F**
G		**I**

Box order: G→I→D→F→E

Due to the pending condition in **D**, subpattern-6 must
begin in the same starting square **(83)** as subpattern-5
share **(77)** with subpattern-5 [all squares between starting & pending boxes]
include the pending square **(62)**
(62) zaps (68) adding **(48)** zaps (46) adding **(56)**

Subpattern-6 = **(83),(77),(62),(48),(56)**
G I D F E

Back at the starting box G, nothing is pending, and no squares are unclaimed.
The pattern analysis is complete.

4 024 B8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2									X
row3	X								
row4		6_{25}				6_{14}		6_{36}	
row5			6_{14}			6_{2356}			
row6		6_{36}	*P*					6_{1245}	
row7		6_{1}	6_{23}				6_{456}		
row8		6_{4}	6_{56}				6_{123}		
row9					X				

Pattern 4.025	Orientation	Patterns with the same box code
4 – 3 | | **3 – 3**	**C – B** | | **I – H**	**032**

	B	**C**
	H	**I**

Box order: C→B→H→I

Subpattern-1 begins in **(17)** zaps (15) adding **(25)** and pending ***(26)***
(25) zaps (75) & (95) adding **(76)**
(76) zaps (79) while **(17)** zaps (97) adding **(99)**

Subpattern-1 = **(17),(25),(76),(99)**
C B H I

---

4 C2	025	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1					7		7_{12}		7
	row2				$\cancel{P}_1$	7_1	7_2	7		7
	row3		X							
	row4			X						
	row5								X	
	row6				X					
	row7					7_2	7_1			7
	row8	X			P_2					
	row9					7_p		7_2		7_1

Pattern 4.025, continued.

	B	**C**
	H	**I**

Box order: C→B→H→I

Due to the pending condition in H, subpattern-2 must
begin in the same starting squjare **(17)** as subpattern-1
include the pending square **(26)**

(26) zaps (76) adding **(75)** and pending ***(76)***
(75) zaps (79) while **(17)** zaps (97) adding **(97)**

Subpattern-2 = **(17),(26),(75),(97)**
C B H I

---

4 025
C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7		7_{12}		7
row2				$\cancel{P}_1$	7_1	7_2	7		7
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_2	7_1			7
row8	X			P_2					
row9					7_p		7_2		7_1

Pattern 4.025, continued.

	B	**C**
	H	**I**

Box order: C→B→H→I

Due to the pending condition in H, subpattern-3 must
start in the same square **(17)** as subpattern-2
share **(26)** with subpattern-2 [between starting & pending squares]
include the pending square **(95)**

(95) zaps (97) & (99) adding **(79)**

Subpattern-3 = **(17),(26),(95),(79)**
C B H I

Subpattern-4 begins in **(19)** zaps (15) adding **(25)** and pending ***(26)***
(25) zaps (75) & (95) adding **(76)**
(19) zaps (79) & (99) adding **(97)**

Subpattern-4 = **(19),(25),(76),(97)**
C B H I

4 C2	025	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1					7		7_{123}		7_4
	row2					7_{14}	7_{23P}	7		7
	row3		X		***P₄***					
	row4			X						
	row5								X	
	row6				X					
	row7					7_2	7_{14}			7_3
	row8	X			~~***P₂***~~					
	row9					7_3		7_4		7_{12}

Pattern 4.025, continued.

	B	**C**
	H	**I**

Box order: C→B→H→I

Due to the pending condition in B, subpattern-5 must
start in the same square **(19)** as subpattern-4
include the pending square **(26)**

(26) zaps (76) adding **(75)** and pending ***(95)***
(19) zaps (79) & (99) adding **(97)**

Subpattern-5 = **(19),(26),(75),(97)**
C B H I

---

4 025
C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7		7_{123}		7_{45}
row2				~~P_4~~	7_{14}	7_{235}	7		7
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_{25}	7_{14}			7_3
row8	X			P_5					
row9					7_3		7_{45}		7_{12}

Pattern 4.025, continued.

	B	**C**
	H	**I**

Box order: C→B→H→I

Due to the pending condition in **H**, subpattern-6 must
begin in the same square **(19)** as subpattern-5
share **(26)** with subpattern-5]between starting & pending boxes]
include the pending square **(95)**

(95) zaps (97) & (99) adding (79)

But now, two squares of subpattern-6 [(19) & (79)] are in the same column. This is a violation of sudoku rules. Therefore we cannot begin subpattern-6 in (19), but must choose a square in row 2 of box C for the beginning of subpattern-6.

4 025
C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7		7_{123}		7_{456}
row2				~~P_4~~	7_{14}	7_{2356}	7		7
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_{25}	7_{14}			7_{36}
row8	X			P_5					
row9					7_{36}		7_{45}		7_{12}

Pattern 4.025, continued.

	B	**C**
	H	**I**

Because subpattern-6, as well as any ensuing subpatterns, will all start in row 2, their continuations must all be in square (15), which is in the same column as the pending P in square (95). This means that square (95) cannot be a member of any future subpatterns, so we shall erase the pending P in square (95) before continuing any further. See the next page for the continuation of this pattern analysis. Due to the erasure of the pending P in square (95), there is no longer a pending situation for subpattern-6 to be affected by. The sudoku below is as it was before beginning subpattern-6, except for the erasures of the pending P in box H and the pending subscript in square (95). It is from this point that we shall, on the next page, develop the correct subpattern-6.

---

4 025
C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7		7_{123}		7_{45}
row2					7_{14}	7_{235}	7		7
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_{25}	7_{14}			7_{3}
row8	X								
row9					7_{3}		7_{45}		7_{12}

Pattern 4.025, continued.

	B	**C**
	H	**I**

Box order: C→B→H→I

Subpattern-6 is begun anew in square **(27)**
(27) zaps (25) & (26) adding **(15)** zaps (75) & (95) adding **(76)**
(76) zaps (79) while **(27)** zaps (97) adding **(99)**

Subpattern-6 = **(27),(15),(76),(99)**
C B H I

Subpattern-7 is begun in **(29)** zaps (25) & (26) adding **(15)**
(15) zaps (75) & (95) adding **(76)**
(29) zaps (79) & (99) adding **(97)**

Subpattern-7 = **(29),(15),(76),(97)**
C B H I

At the starting box C, nothing is pending and no squares are unclaimed. Done.

4 025
C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_{67}		7_{123}		7_{45}
row2					7_{14}	7_{235}	7_{6}		7_{7}
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_{25}	7_{1467}			7_{3}
row8	X								
row9					7_{3}		7_{457}		7_{126}

Pattern 4.012	Orientation	Patterns with the same box code
2 | **4 – 3 – 2** | **2**	**H** | **A – G – D** | **B**	**none**

A	**B**	
D		
G	**H**	

Box order: A→B→G→H→D

Subpattern-1 starts in **(11)** zaps (15) adding **(35)**
(11) zaps (81) adding **(83)** and pending ***(93)***
(83) zaps (43) adding **(42)**

Subpattern-1 **= (11),(35),(83),(94),(42)**
A B G H D

4	012	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	8_1	8			8				
	row2								X	
	row3		8	8		8_1				
	row4		8_1	8						
	row5							X		
	row6						X			
	row7		P_1							X
	row8	8		8_1	8					
	row9			8_P	8_1					

Pattern 4.012, continued.

A	**B**	
D		
G	**H**	

Box order: A→B→G→H→D

Due to the pending situation in G, subpattern-2 must
start in the same square **(11)**
share **(42)** with subpattern-1 [betweeen starting & pending boxes]
include pending square **(93)**

(11) zaps (15) adding **(35)**
(93) zaps (94) adding **(84)**

Subpattern-2 = **(11),(35),(93),(84),(42)**
A B G H D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{12}	8			8				
row2								X	
row3		8	8		8_{12}				
row4		8_{12}	8						
row5							X		
row6						X			
row7		P_1							X
row8	8		8_1	8_2					
row9			8_2	8_1					

Pattern 4.012, continued.

A	**B**	
D		
G	**H**	

Box order: A→B→D→G→H

Subpattern-3 starts in **(12)** zaps (15) adding **(35)**
(12) zaps (42) adding **(43)** zaps (83) & (93) adding **(82)** zaps (84) adding **(94)**
Subpattern-2 = **(12),(35),(43),(82),(94)**
A B D G H

Subpattern-4 starts in **(32)** zaps (35) adding **(15)**
(32) zaps (42) adding **(43) zaps** (83) & (93) adding **(81)** zaps (84) adding **(94)**
Subpattern-4 = **(32),(15),(43),(81),(94)**
A B D G H

4 012 C3	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	8_{12}	8_{3}			8				
row 2								X	
row 3		8	8		8_{123}				
row 4		8_{12}	8_{3}						
row 5							X		
row 6						X			
row 7									X
row 8	8_{3}		8_{1}	8_{2}					
row 9			8_{2}	8_{13}					

Pattern 4.012, continued.

A	**B**	
D		
G	**H**	

Box order: A→B→D→G→H

Subpattern-5 begins in **(33)** zaps (35) adding **(15)**
(33) zaps (43) adding **(42)**
(33) zaps (83) & (93) adding **(81)** zaps (84) adding **(94)**

Subpattern-5 = **(33),(15),(42),(81),(94)**
A B D G H

Back at the starting box A, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

4 012 C3	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	8_{12}	8_{3}			8_{45}				
row 2								X	
row 3		8_{4}	8_{5}		8_{123}				
row 4		8_{125}	8_{34}						
row 5							X		
row 6						X			
row 7									X
row 8	8_{345}		8_{1}	8_{2}					
row 9			8_{2}	8_{1345}					

Pattern 4.002	Orientation	Patterns with the same box code
4 – 3 – 2 **| |** **2 – 2** **|** **2**	**E – F – D** **| |** **H – I** **|** **B**	**none**

	B	
D	**E**	**F**
	H	**I**

Subpattern-1 starts in **(45)** with box order **E→D→F→I→H→B**

(45) zaps (43) adding **(63)**
(45) zaps (47) while **(63)** zaps (67) adding **(58)** zaps (78) adding **(97)**
(97) zaps (95) adding **(76)** zaps (36) adding **(34)**

Subpattern-1 = **(45),(63),(58),(97),(76),(34)**
E D F I H B

4	002	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1		X							
	row2									X
	row3				4_1		4			
	row4			4		4_1		4		
	row5				4		4		4_1	
	row6			4_1		4		4		
	row7						4_1		4	
	row8	X								
	row9					4		4_1		

Pattern 4.002, continued.

	B	
D	**E**	**F**
	H	**I**

Box order: **E→B→H→I→F→D**

Subpattern-2 starts in **(54)** zaps (34) adding **(36)** zaps (76) adding **(95)**
(95) zaps (97) adding **(78)** zaps (58) adding **(47)** and pending ***(67)***
(47) zaps (43) adding **(63)**

Subpattern-2 = **(54),(36),(95),(78),(47),(63)**
E B H I F D

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_1		4_2			
row 4			4		4_1		4_2		P_2
row 5				4_2		4		4_1	
row 6			4_{12}		4		4_P		
row 7						4_1		4_2	
row 8	X								
row 9					4_2		4_1		

Pattern 4.002, continued.

	B	
D	**E**	**F**
	H	**I**

Box order: **E→B→H→I→F→D**

Due to the pending condition in F, subpattern-3 must
begin in the same square **(54)** as subpattern-2
share **(36), (95), (78)** with subpattern-2 [between starting & pending boxes]
include pending square **(67)**

(67) zaps (63) adding **(43)**

Subpattern-3 **= (54),(36),(95),(78),(67),(43)**
E B H I F D

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_1		4_{23}			
row 4			4_3		4_1		4_2		~~P_2~~
row 5				4_{23}		4		4_1	
row 6			4_{12}		4		4_3		
row 7						4_1		4_{23}	
row 8	X								
row 9					4_{23}		4_1		

Pattern 4.002, continued.

	B	
D	**E**	**F**
	H	**I**

Box order: **E→B→H→I→F→D**

Subpattern-4 begins in **(56)** zaps (36) adding **(34)**
(56) zaps (76) adding **(95)** zaps (97) adding **(78)** zaps (58) adding **(47)** and pending ***(67)***
(47) zaps (43) adding **(63)**

Subpattern-4 = **(56),(34),(95),(78),(47),(63)**
E B H I F D

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_{14}		4_{23}			
row 4			4_3		4_1		4_{24}		
row 5				4_{234}		4_4		4_1	
row 6			4_{12}		4		4_3		P_4
row 7						4_1		4_{234}	
row 8	X								
row 9					4_{234}		4_1		

Pattern 4.002, continued.

	B	
D	**E**	**F**
	H	**I**

Box order for subpatterns 2 to 5: **E→B→H→I→F→D**

Due to the pending condition in F, subpattern-5 must
start in the same square **(56)** as subpattern-4
share **(34), (95), (78)** with subpattern-4 [between starting & pending boxes]
include the pending square **(67)**

(67) zaps (63) adding **(43)**
Subpattern-5 = **(56),(34),(95),(78),(67),(43)**
E B H I F D

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_{145}		4_{23}			
row 4			4_{35}		4_{1}		4_{24}		
row 5				4_{234}		4_{45}		4_{1}	
row 6			4_{12}		4		4_{35}		P_4
row 7						4_{1}		4_{2345}	
row 8	X								
row 9					4_{2345}		4_{1}		

Pattern 4.002, continued.

	B	
D	**E**	**F**
	H	**I**

Subpattern-6 starts in **(65)** with box order **E→D→F→I→H→B**
(65) zaps (63) adding **(43)**
(43) zaps (47) while **(65)** zaps (67) adding **(58)** zaps (78) adding **(97)**
(97) zaps (95) adding **(76)** zaps (36) adding **(34)**

Subpattern-6 = **(65),(43),(58),(97),(76),(34)**
E D F I H B

Back at the starting box E, nothing is pending and no squares are unclaimed, so the pattern analysis is complete.

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_{1456}		4_{23}			
row 4			4_{356}		4_{1}		4_{24}		
row 5				4_{234}		4_{45}		4_{16}	
row 6			4_{12}		4_{6}		4_{35}		
row 7						4_{16}		4_{2345}	
row 8	X								
row 9					4_{2345}		4_{16}		

Pattern 4.005	Orientation	Patterns with the same box code
4 – 3 – 2 **| |** **2 – 3**	**I – C – F** **| |** **G – A**	**none**

A		**C**
		F
G		**I**

Subpattern-1 starts in **(77)** with box order **I→F→C→G→A**

(77) zaps (67) adding **(69)** zaps (19) & (29) adding **(18)**
(77) zaps (73) adding **(91)** zaps (11) & (21) adding **(23)**

Subpattern-1 = **(77),(69),(18),(91),(23)**
I F C G A

4 005 C4	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2							2_1	2
row 2	2		2_1						2
row 3					X				
row 4		X							
row 5				X					
row 6							2		2_1
row 7			2				2_1	2	
row 8						X			
row 9	2_1							2	2

Pattern 4.005, continued.

A		**C**
		F
G		**I**

Subpattern-2 starts in **(78)** with box order **I→G→A→C→F**

(78) zaps (73) adding **(91)** zaps (11) & (21) adding **(23)**
(23) zaps (29) while **(78)** zaps (18) adding **(19)** zaps (69) adding **(61)**

Subpattern-2 = **(78),(91),(23),(19),(61)**
I G A C F

---

4 005 C4	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2							2_1	2_2
row 2	2		2_{12}						2
row 3					X				
row 4		X							
row 5				X					
row 6							2_2		2_1
row 7			2				2_1	2_2	
row 8						X			
row 9	2_{12}							2	2

Pattern 4.005, continued.

A		**C**
		F
G		**I**

Subpattern-3 starts in **(98)** with box order **I→G→A→C→F**

(98) zaps (91) adding **(73)** zaps (23) adding **(11)** and pending ***(21)***
(11) zaps (18) & (19) adding **(29)** zaps (69) adding **(67)**

Subpattern-3 = **(98),(73),(11),(29),(67)**
I G A C F

4 005 C4	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2_3							2_1	2_{24}
row 2	2_4		2_{12}						2_3
row 3		P_3			X				
row 4		X							
row 5				X					
row 6							2_{234}		2_1
row 7			2_{34}				2_1	2_2	
row 8						X			
row 9	2_{12}							2_{34}	2

Pattern 4.005, continued.

A		**C**
		F
G		**I**

Box order for subpattern-4: **I→G→A→C→F**

Due to the pending condition in **A**, subpattern-4 must
start in the same square **(98)** as subpattern-3
share **(71)** with subpattern-3 [between starting & pending boxes]
include the pending square **(21)**

(21) zaps (29) while **(98)** zaps (18) adding **(19)** zaps (69) adding **(67)**

Subpatten-4 = **(98),(71),(21),(19),(67)**
I G A C F

4 005 C4	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2_3							2_1	2_{24}
row 2	2_4		2_{12}						2_3
row 3					X				
row 4		X							
row 5				X					
row 6							2_{234}		2_1
row 7			2_{34}				2_1	2_2	
row 8						X			
row 9	2_{12}							2_{34}	2

Pattern 4.005, continued.

A		**C**
		F
G		**I**

Subpattern-5 starts in **(99)** with box order **I→F→C→G→A**

(99) zaps (69) adding **(67)**
(99) zaps (19) & (29) adding **(18)**
(99) zaps (91) adding **(73)**
(73) zaps (23) while **(18)** zaps (11) adding **(21)**
Subpattern-5 = **(99),(67),(18),(73),(21)**
I F C G A

Back at the starting box I, nothing is pending and no squares are unclaimed. The pattern analysis is complete.

4 005 C4	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2_{3}							2_{15}	2_{24}
row 2	2_{45}		2_{12}						2_{3}
row 3					X				
row 4		X							
row 5				X					
row 6							2_{2345}		2_{1}
row 7			2_{345}				2_{1}	2_{2}	
row 8						X			
row 9	2_{12}							2_{34}	2_{5}

Pattern 4.018	Orientation	Patterns with the same box code
4 – 2 – 3 **| |** **2 – 3**	**B – E – H** **| |** **C – F**	**none**

	B	**C**
	E	**F**
	H	

Subpattern-1 begins in **(24)** with box order **B→E→H→C→F**

(24) zaps (64) adds **(55)**
(24) zaps (74) while **(55)** zaps (75) adding **(76)**
(24) zaps (28) adding **(39)** zaps (55) & (65) adding **(68)**

Subpattern-1 = **(24),(55),(76),(39),(68)**
B E H C F

---

4 018
C5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				9_1				9_2	
row3				9_2	9	9			9_1
row4		X							
row5					9_{12}				9
row6				9				9_1	9_2
row7				9	9	9_{12}			
row8			X						
row9							X		

Pattern 4.018, continued.

	B	**C**
	E	**F**
	H	

Subpattern-2 begins in **(34)** with box order **B→E→H→C→F**

(34) zaps (64) adding **(55)**
(34) zaps (74) while **(55)** zaps (75) adding **(76)**
(34) zaps (39) adding **(28)**
(28) zaps (68) while **(55)** zaps (59) adding **(69)**

Subpattern-2 = **(34),(55),(76),(28),(69)**
B E H C F

4 C5	018	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	X								
	row2				9_1				9_2	
	row3				9_2	9	9			9_1
	row4		X							
	row5					9_{12}				9
	row6				9				9_1	9_2
	row7				9	9	9_{12}			
	row8			X						
	row9							X		

Pattern 4.018, continued.

	B	**C**
	E	**F**
	H	

Subpattern-3 starts in **(35)** with box order **B→E→F→C→H**

(35) zaps (55) adding **(64)** zaps (68) & (69) adding **(59)** zaps (39) adding **(28)**
(35) zaps75) while **(64)** zaps (74) adding **(76)**

Subpattern-3 = **(35),(64),(59),(28),(76)**
B E F C H

Subpattern-4 starts in **(36)** with box order **B→H→E→C→F**

(36) zaps (76) adding **(74)** and pending ***(75)***
(74) zaps (64) adding **(55)**
(36) zaps (39) adding **(28)**
(28) zaps (68) while **(55)** zaps (59) adding **(69)**

Subpattern-4 = **(36),(74),(55),(28),(69)**
B H E C F

4 018
C5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				9_1				9_{234}	
row3				9_2	9_3	9_4			9_1
row4		X							
row5					9_{124}				9_3
row6				9_3				9_1	9_{24}
row7				9_4	9_P	9_{123}			
row8			X		*P*				
row9							X		

Pattern 4.018, continued.

	B	**C**
	E	**F**
	H	

Box order for subpattern-5: **B→H→E→F→C**

Due to the pending condition in **H**, subpattern-5 must
start in the same square **(36)** as subpattern-4
include the pending square **(75)**

(75) zaps (55) adding **(64)** zaps (68) & (69) adding **(59)**
(36) zaps (39) adding **(28)**

Subpattern-5 = **(36),(75),(64),(59),(28)**
B H E F C

Back at the starting box B, nothing pending & no squares unclaimed. Done.

4 018
C5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				9_{1}				9_{2345}	
row3				9_{2}	9_{3}	9_{45}			9_{1}
row4		X							
row5					9_{124}				9_{35}
row6				9_{35}				9_{1}	9_{24}
row7				9_{4}	9_{5}	9_{123}			
row8			X		*P*				
row9							X		

Pattern 4.006	Orientation	Patterns with the same box code
2 – 2 | **4 – 3 – 2** | **2**	**C – B** | **H – G – I** | **D**	**none**

	B	C
D		
G	H	I

Box order: H→I→G→D→B→C

Subpattern-1 begins in **(75)** zaps (79) adding **(89)**
(89) zaps (81) while **(75)** zaps (73) adding **(93)**
(93) zaps (53) adding **(51)**
(75) zaps (15) adding **(26)** zaps (28) adding **(18)**

Subpattern-1 **= (75),(89),(93),(51),(26),(18)**
H I G D B C

4	006	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1					5			5_1	
	row2						5_1		5	
	row3		X							
	row4							X		
	row5	5_1		5						
	row6				X					
	row7			5		5_1	5			5
	row8	5					5			5_1
	row9			5_1		5				

Pattern 4.006, continued.

	B	C
D		
G	H	I

Box order: H→I→G→D→B→C

Subpattern-2 begins in **(75)** zaps (79) adding **(89)**
(89) zaps (81) while **(75)** zaps (73) adding **(93)**
(93) zaps (53) adding **(51)**
(75) zaps (15) adding **(26)** zaps (28) adding **(18)**

Subpattern-2 = **(75),(89),(93),(51),(26),(18)**
H I G D B C

4 006 C6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					5_{2}			5_{1}	
row 2						5_{1}		5_{2}	
row 3		X							
row 4							X		
row 5	5_{12}		5						
row 6				X					
row 7			5		5_{1}	5_{2}			5
row 8	5					5			5_{12}
row 9			5_{12}		5				

Pattern 4.006, continued.

	B	C
D		
G	H	I

Box order: H→I→G→D→B→C

Subpattern-3 begins in **(86)** zaps (89) adding **(79)**
(79) zaps (73) while **(86)** zaps (81) adding **(93)**
(93) zaps (53) adding **(51)**
(86) zaps (26) adding **(15)** zaps (18) adding **(28)**

Subpattern-3 = **(86),(79),(93),(51),(15),(28)**
H I G D B C

---

4 006 C6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					5_{23}			5_{1}	
row 2						5_{1}		5_{23}	
row 3		X							
row 4							X		
row 5	5_{123}		5						
row 6				X					
row 7			5		5_{1}	5_{2}			5_{3}
row 8	5					5_{3}			5_{12}
row 9			5_{123}		5				

Pattern 4.006, continued.

	B	**C**
D		
G	**H**	**I**

Box order: H→I→G→D→B→C

Subpattern-4 begins in **(95)** zaps (nothing) adding **(79)** and pending ***(89)***
(95) zaps (93) while **(79)** zaps (73) adding **(81)**
(81) zaps (51) adding **(53)**
(95) zaps (15) adding **(26)** zaps (28) adding **(18)**

Subpattern-4 = **(95),(79),(81),(53,(26),(18)**
H I G D B C

4 006 C6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					$5_{\mathbf{23}}$			$5_{\mathbf{14}}$	
row 2						$5_{\mathbf{14}}$		$5_{\mathbf{23}}$	
row 3		X							
row 4							X		
row 5	$5_{\mathbf{123}}$		$5_{\mathbf{4}}$						
row 6				X					
row 7			5		$5_{\mathbf{1}}$	$5_{\mathbf{2}}$			$5_{\mathbf{34}}$
row 8	$5_{\mathbf{4}}$					$5_{\mathbf{3}}$			$5_{\mathbf{12P}}$
row 9			$5_{\mathbf{123}}$		$5_{\mathbf{4}}$			*P*	

Pattern 4.006, continued.

	B	C
D		
G	H	I

Box order: H→I→G→D→B→C

Due to the pending situation in box **I**, subpattern-5 must
begin in the same square **(95)** as subpattern-4
include the pending square **(89)**
(95) zaps (93) while **(89)** zaps (81) adding **(73)** zaps (53) adding **(51)**
(95) zaps (15) adding **(26)** zaps (28) adding **(18)**

Subpattern-5 = **(95),(89),(73),(51),(26),(18)**
H I G D B C

Back at the starting box H, nothing is pending, and no squares are unclaimed. Done.

4 006 C6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					5_{23}			5_{145}	
row 2						5_{145}		5_{23}	
row 3		X							
row 4							X		
row 5	5_{1235}		5_{4}						
row 6				X					
row 7			5_{5}		5_{1}	5_{2}			5_{34}
row 8	5_{4}					5_{3}			5_{125}
row 9			5_{123}		5_{45}			₽	

Pattern 4.013	Orientation	Patterns with the same box code
2 | **4 – 3 – 3** | | **2 – 2**	**E** | **H – I – G** | | **C - A**	**014**

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Subpattern-1 starts in **(74)** zaps (54) adding **(56)**
(74) zaps (77) adding **(89)** and pending ***(97)***
(89) zaps (29) adding **(17)** zaps (13) adding **(21)**
(21) zaps (81) while **(74)** zaps (73) adding **(93)**

Subpattern-1 = **(74),(56),(89),(17),(21),(93)**
H E I C A G

4 013

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			5				5_1		
row2	5_1								5
row3					X				
row4		X							
row5				5		5_1			
row6								X	
row7			5	5_1		5	5		
row8	5								5_1
row9			5_1	5		5	5_p	P_1	

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Due to the pending condition in I, subpattern-2 must
start in the same square **(74)** as subpattern-1
include the pending square **(97)**

(74) zaps (54) adding **(56)**
(97) zaps (17) adding **(29)** zaps (21) adding **(13)** zaps (73) & (93) adding **(81)**

Subpattern-2 = **(74),(56),(97),(29),(13),(81)**
H E I C A G

4 013

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			5_{2}				5_{1}		
row2	5_{1}								5_{2}
row3					X				
row4		X							
row5				5		5_{12}			
row6								X	
row7			5	5_{12}		5	5		
row8	5_{2}								5_{1}
row9			5_{1}	5		5	5_{2}	$\cancel{P}_{1}$	

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Subpattern-3 starts in **(76)** zaps (54) adding **(56)**
(76) zaps (77) adding **(89)** and pending ***(97)***
(89) zaps (29) adding **(17)** zaps (13) adding **(21)**
(21) zaps (81) while **(76)** zaps (73) adding **(93)**

Subpattern-3 = **(76),(56),(89),(17),(21),(93)**
H E I C A G

4 013

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			5_{2}				5_{13}		
row2	5_{13}								5_{2}
row3					X				
row4		X							
row5				5		5_{123}			
row6								X	
row7			5	5_{12}		5_{3}	5		
row8	5_{2}							P_{3}	5_{13}
row9			5_{13}	5		5	5_{2P}		

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Due to the pending situation in **I**, subpattern-4 must
start in the same square **(76)** as subpattern-3
include the pending square **(97)**

(76) zaps (56) adding **(54)**
(97) zaps (17) adding **(29)** zaps (21) adding **(13)** zaps (73) & (93) adding **(81)**

Subpattern-4 = **(76),(54),(97),(29),(13),(24)**
H E I C A G

4 013
C7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			5_{24}				5_{13}		
row 2	5_{13}								5_{24}
row 3					X				
row 4		X							
row 5				5_{4}		5_{123}			
row 6								X	
row 7			5	5_{12}		5_{34}	5		
row 8	5_{24}							~~P_3~~	5_{13}
row 9			5_{13}	5		5	5_{24}		

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Subpattern-5 begins in **(94)** zaps (54) adding **(56)**
(94) zaps (97) adding **(77)** and pending ***(89)***
(77) zaps (17) adding **(29)** zaps (21) adding **(13)** zaps (73) & (93) adding **(81)**

Subpattern-5 = **(94),(56),(77),(29),(13),(81)**
H E I C A G

4 013 C7	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			5_{245}				5_{13}		
row 2	5_{13}								5_{245}
row 3					X				
row 4		X							
row 5				5_{34}		5_{125}			
row 6								X	
row 7			5	5_{12}		5_{34}	5_{5}		
row 8	5_{245}								5_{13P}
row 9			5_{13}	5_{5}		5	5_{24}	P_5	

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Due to the pending condition in **I**, subpattern-6 must
start in the same square **(94)** as subpattern-5
include the pending square **(89)**

(94) zaps (54) adding **(56)**
(89) zaps (29) adding **(17)** zaps (13) adding **(21)**
(21) zaps (81) while (94) zaps (93) adding **(73)**

Subpattern-6 = **(94),(89),(56),(17),(21),(73)**
H E I C A G

4 013 C7	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			5_{245}				5_{136}		
row 2	5_{136}								5_{245}
row 3					X				
row 4		X							
row 5				5_{34}		5_{1256}			
row 6								X	
row 7			5_{6}	5_{12}		5_{34}	5_{5}		
row 8	5_{245}								5_{136}
row 9			5_{13}	5_{56}		5	5_{24}	~~P_{5}~~	

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Subpattern-7 starts in **(96)** zaps (56) adding **(54)**
(96) zaps (97) adding **(77)** and pending **(89)**
(77) zaps (17) adding **(29)** zaps (21) adding **(13)** zaps (73) & (93) adding **(83)**

Subpattern-7 = **(96),(54),(77),(29),(13),(83)**
H E I C A G

4 013 C7	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			5_{2457}				5_{136}		
row 2	5_{136}								5_{2457}
row 3					X				
row 4		X							
row 5				5_{347}		5_{1256}			
row 6								X	
row 7			5_{6}	5_{12}		5_{34}	5_{57}		
row 8	5_{2457}								5_{136P}
row 9			5_{13}	5_{56}		5_{7}	5_{24}		P_7

Pattern 4.013, continued.

A		**C**
	E	
G	**H**	**I**

Box order**: H→E→I→C→A→G**

Due to the pending situation in **I**, subpattern-8 must
start in the same square **(96)** as subpattern-7
include the pending square **(89)**
(96) zaps (56) adding **(54)**
(89) zaps (29) adding **(17)** zaps (13) adding **(21)**
(21) zaps (81) while **(96)** zaps (93) adding **(73)**

Subpattern-8 = **(96),(89),(54),(17),(21),(73)**
H E I C A G
Back at the starting box H, nothing is pending and no squares unclaimed, We are done.

4 013 C7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			5_{2457}				5_{1368}		
row 2	5_{1368}								5_{2457}
row 3					X				
row 4		X							
row 5				5_{3478}		5_{1256}			
row 6								X	
row 7			5_{68}	5_{12}		5_{34}	5_{57}		
row 8	5_{2457}								5_{1368}
row 9			5_{13}	5_{56}		5_{78}	5_{24}		~~P_7~~

Pattern 4.001	Orientation	Patterns with the same box code
4 – 3 – 2 **| |** **3 – 2** **|** **2**	**I – F – C** **| |** **G – D** **|** **H**	**009**

		C
D		**F**
G	**H**	**I**

Box order: I→G→H→D→F→C

Subpattern-1 begins in **(77)** zaps (72) adding **(83)** and pending ***(93)***
(83) zaps (86) adding **(96)**
(83) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)**
(77) zaps (17) adding **(18)**

Subpattern-1 = **(77),(83),(96),(62),(59),(18)**
I G H D F C

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1	1_1	
row2	X								
row3				X					
row4					X				
row5			1						1_1
row6		1_1					1	1	
row7		1					1_1	1	
row8	P_1		1_1			1			1
row9			1_p			1_1			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order: I→G→H→D→F→C

Due to the pending condition in **G**, subpattern-2 must
start in the same square **(77)** as subpattern-1
include the pending square **(93)**

(93) zaps (96) adding **(86)**
(93) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)**
(77) zaps (17) adding **(18)**

Subpattern-2 = **(77),(93),(86),(62),(59),(18)**
I G H D F C

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							1	1_{12}	
row 2	X								
row 3				X					
row 4					X				
row 5			1						1_{12}
row 6		1_{12}					1	1	
row 7		1					1_{12}	1	
row 8	~~P_1~~		1_1			1_2			1
row 9			1_2			1_1			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order: I→G→H→D→F→C

Subpattern-3 begins in **(78)** zaps (72) adding **(83)** and pending ***(93)***
(83) zaps (86) adding **(96)**
(83) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)**
(78) zaps (18) adding **(17)**

Subpattern-3 = **(78),(83),(96),(62),(59),(17)**
I G H D F C

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							$1_{\mathbf{3}}$	$1_{\mathbf{12}}$	
row 2	X								
row 3				X					
row 4					X				
row 5			1						$1_{\mathbf{123}}$
row 6		$1_{\mathbf{123}}$					1	1	
row 7		1					$1_{\mathbf{12}}$	$1_{\mathbf{3}}$	
row 8	P_3		$1_{\mathbf{13}}$			$1_{\mathbf{2}}$			1
row 9			$1_{\mathbf{2P}}$			$1_{\mathbf{13}}$			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order: I→G→H→D→F→C

Due to the pending condition in **G**, subpattern-4 must begin in the same square **(78)** as subpattern-3 include the pending square **(93)**

(93) zaps (96) adding **(86)**
(93) zaps (53) adding **(62)** zaps (67) & (68) adding **(59)**
(78) zaps (18) adding **(17)**

Subpattern-4 = **(78),(93),(86),(62),(59),(17)**
I G H D F C

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							$1_{\mathbf{34}}$	$1_{\mathbf{12}}$	
row 2	X								
row 3				X					
row 4					X				
row 5			1						$1_{\mathbf{1234}}$
row 6		$1_{\mathbf{1234}}$					1	1	
row 7		1					$1_{\mathbf{12}}$	$1_{\mathbf{34}}$	
row 8	~~P_3~~		$1_{\mathbf{13}}$			$1_{\mathbf{24}}$			1
row 9			$1_{\mathbf{24}}$			$1_{\mathbf{13}}$			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order is changed to: I→F→C→D→G→H

Subpattern-5 starts in **(89)** zaps (59) adding **(68)** and pending ***(67)***
(68) zaps (18) adding **(17)**
(68) zaps (62) adding **(53)** zaps (83) & (93) adding **(72)**
(89) zaps (86) adding **(96)**

Subpattern-5 = **(89),(68),(17),(53),(72),(96)**
I F C D G H

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							$1_{\mathbf{345}}$	$1_{\mathbf{12}}$	
row 2	X								
row 3				X					
row 4					X		P_5		
row 5			$1_{\mathbf{5}}$						$1_{\mathbf{1234}}$
row 6		$1_{\mathbf{1234}}$					$1_{\mathbf{P}}$	$1_{\mathbf{5}}$	
row 7		$1_{\mathbf{5}}$					$1_{\mathbf{12}}$	$1_{\mathbf{34}}$	
row 8			$1_{\mathbf{13}}$			$1_{\mathbf{24}}$			$1_{\mathbf{5}}$
row 9			$1_{\mathbf{24}}$			$1_{\mathbf{135}}$			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order is: I→F→C→D→G→H

Due to the pending condition in **F**, subpattern-6 must
start in the same square **(89)** as subpattern-5
include the pending square **(67)**

(67) zaps (17) adding **(18)**
(67) zaps (62) adding **(53)** zaps (83) & (93) adding **(72)**
(89) zaps (86) adding **(96)**

Subpattern-6 = **(89),(67),(18),(53),(72),(96)**
I F C D G H

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							$1_{\mathbf{345}}$	$1_{\mathbf{126}}$	
row 2	X								
row 3				X					
row 4					X		~~P_5~~		
row 5			$1_{\mathbf{56}}$						$1_{\mathbf{1234}}$
row 6		$1_{\mathbf{1234}}$					$1_{\mathbf{6}}$	$1_{\mathbf{5}}$	
row 7		$1_{\mathbf{56}}$					$1_{\mathbf{12}}$	$1_{\mathbf{34}}$	
row 8			$1_{\mathbf{13}}$			$1_{\mathbf{24}}$			$1_{\mathbf{56}}$
row 9			$1_{\mathbf{24}}$			$1_{\mathbf{1356}}$			1

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order is: I→F→C→D→G→H

Subpattern-7 begins in **(99)** zaps (59) adding **(67)** and pending ***(68)***
(67) zaps (17) adding **(18)**
(67) zaps (62) adding **(53)** zaps (83) & (93) adding **(72)**
(99) zaps (96) adding **(86)**

Subpattern-7 = **(99),(67),(18),(53),(72),(86)**
I F C D G H

4 001 C8	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							$1_{\mathbf{345}}$	$1_{\mathbf{1267}}$	
row 2	X								
row 3				X					
row 4					X		P_7		
row 5			$1_{\mathbf{567}}$						$1_{\mathbf{1234}}$
row 6		$1_{\mathbf{1234}}$					$1_{\mathbf{67}}$	$1_{\mathbf{5P}}$	
row 7		$1_{\mathbf{567}}$					$1_{\mathbf{12}}$	$1_{\mathbf{34}}$	
row 8			$1_{\mathbf{13}}$			$1_{\mathbf{247}}$			$1_{\mathbf{56}}$
row 9			$1_{\mathbf{24}}$			$1_{\mathbf{1356}}$			$1_{\mathbf{7}}$

Pattern 4.001, continued.

		C
D		**F**
G	**H**	**I**

Box order is: I→F→C→D→G→H
Due to the pending condition in **F,** subpattern-8 must
begin in the same starting square **(99)** as subpattern-7
include the pending square **(68)**
(68) zaps (18) adding **(17)**
(68) zaps (62) adding **(53)** zaps (83) & (93) adding **(72)**
(99) zaps (96) adding **(86)**

Subpattern-8 = **(99),(68),(17),(53),(72),(86)**
I F C D G H

Back at the starting box I, nothing is pending and no squares are unclaimed. Done.

4 001 C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							1_{3458}	1_{1267}	
row 2	X								
row 3				X					
row 4					X		~~P_7~~		
row 5			1_{5678}						1_{1234}
row 6		1_{1234}					1_{67}	1_{58}	
row 7		1_{5678}					1_{12}	1_{34}	
row 8			1_{13}			1_{2478}			1_{56}
row 9			1_{24}			1_{1356}			1_{78}

Pattern 4.007	Orientation	Patterns with the same box code
4 ------3 **| |** **3 – 2 |** **| | |** **3 – 2 – 2**	**H ----- G** **| |** **B – C |** **| | |** **E – F – D**	**none**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→E→F→C→B

Subpattern-1 begins in **(74)** zaps (71) & (72) adding **(91)** zaps (61) adding **(52)**
(52) zaps (54) & (56) adding **(45)** zaps (48) adding **(67)** zaps (17) adding **(28)**
(28) zaps (25) while **(74)** zaps (14) adding **(16)**

Subpattern-1 = **(74),(91),(52),(45),(67),(28),(16)**
H G D E F C B

4 007

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5		5_1	5		
row2					5			5_1	
row3			X						
row4					5_1			5	
row5		5_1		5		5			
row6	5						5_1		
row7	5	5		5_1		5			
row8									X
row9	5_1			5		5			

Pattern 4.007, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→E→F→C→B

Subpattern-2 begins in square **(76)** zaps (71) & (72) adding **(91)** zaps (61) adding **(52)**
(52) zaps (54) & (56) adding **(45)** zaps (48) adding **(67)** zaps (17) adding **(28)**
(28) zaps (25) while **(76)** zaps (16) adding **(14)**

Subpattern-2 = **(76),(91),(52),(45),(67),(28),(14)**
H G D E F C B

4 007 C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{2}		5_{1}	5		
row 2					5			5_{12}	
row 3			X						
row 4					5_{12}			5	
row 5		5_{12}		5		5			
row 6	5						5_{12}		
row 7	5	5		5_{1}		5_{2}			
row 8									X
row 9	5_{12}			5		5			

Pattern 4.007, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→E→F→C→B

Subpattern-3 begins in **(94)** zaps (91) adding **(71)** and pending ***(72)***
(71) zaps (61) adding **(52)** zaps (54) & (56) adding **(45)** zaps (48) adding **(67)**
(67) zaps (17) adding **(28)**
(28) zaps (25) while **(94)** zaps (14) adding **(16)**

Subpattern-3 = **(94),(71),(52),(45),(67),(28),(16)**
H G D E F C B

4 007 C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{2}		5_{13}	5		
row 2					5			5_{123}	
row 3			X						
row 4					5_{123}			5	
row 5		5_{123}		5		5			
row 6	5						5_{123}		
row 7	5_{3}	5_{P}		5_{1}		5_{2}			
row 8			P_{3}						X
row 9	5_{12}			5_{3}		5			

Pattern 4.007, continued.

Box order: H→G→D→E→F→C→B

Due to the pending condition in **G,** subpattern-4 must
begin in the same square **(94)** as subpattern-3
include the pending square **(72)**

(72) zaps (52) adding **(61)**
(94) zaps (54) adding **(45)** and pending ***(56)*** **********
(45) zaps (48) adding (67)

But now, (61) and (67) are BOTH members of subpattern-4, and in the SAME row, so the addition of (45) leads to a contradiction. Therefore we must backtrack two lines to the zapping of (54) by (94), and add (56) instead of (45), removing the pending action. We'll do this on the next page.

4 007

C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{2}		5_{13}	5		
row 2					5			5_{1234}	
row 3			X						
row 4					5_{1234}			5	
row 5		5_{123}		5		5_{P}			
row 6	5_{4}						5_{1234}		
row 7	5_{3}	5_{4}		5_{1}		5_{2}			
row 8			~~P_{3}~~						X
row 9	5_{12}			5_{34}		5			

Pattern 4.007, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→E→F→C→B

Due to the pending condition in **G,** subpattern-4 must
begin in the same square **(94)** as subpattern-3
include the pending square **(72)**
(72) zaps (52) adding **(61)**
(94) zaps (54) adding **(56)** ***(this time, the <u>pending</u> square is added to the subpattern)***
(61) zaps (67) adding **(48)** zaps (28) adding **(17)** zaps <u>(14) & (16)</u> adding **(25)**

Subpattern-4 = **(94),(72),(61),(56),(48),(17),(25)**
H G D E F C B

4 007 C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{2}		5_{13}	5_{4}		
row 2					5_{4}			5_{123}	
row 3			X						
row 4					5_{123}			5_{4}	
row 5		5_{123}		5		5_{4}			
row 6	5_{4}						5_{123}		
row 7	5_{3}	5_{4}		5_{1}		5_{2}			
row 8			~~P_{3}~~						X
row 9	5_{12}			5_{34}		5			

Pattern 4.007, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→E→F→C→B

Subpattern-5 is begun in **(96)** zaps (91) adding **(71)** and pending ***(72)***
(71) zaps (61) adding **(52)** zaps (54) & (64) adding **(45)** zaps (48) adding **(67)**
(67) zaps (17) adding **(28)**
(28) zaps (25) while **(96)** zaps (16) adding **(14)**

Subpattern-5 = **(96),(71),(52),(45),(67),(28),(14)**
H G D E F C B

4 007 C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{25}		5_{13}	5_{4}		
row 2					5_{4}			5_{1235}	
row 3			X						
row 4					5_{1235}			5_{4}	
row 5		5_{1235}		5		5_{4}			
row 6	5_{4}						5_{1235}		
row 7	5_{35}	5_{4P}		5_{1}		5_{2}			
row 8			P_5						X
row 9	5_{12}			5_{34}		5_{5}			

Pattern 4.007, continued.

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Box order: H→G→D→F→E→C→B (note the switch of E & F, which, since it comes after the pending box, is within the rules.**)**
Due to the pending condition in **G,** subpattern-6 must
start in the same square **(96)** as subpattern-5
include the pending square **(72)**
(72) zaps (52) adding **(61)** zaps (67) adding **(48)**
(48) zaps (45) while **(96)** zaps (56) adding **(54)**
(48) zaps (28) adding **(17)** zaps (14) & (16) adding **(25)**
Subpattern-6 = **(96),(72),(61),(48),(54),(17),(25)**
H G D F E C B

Back at the starting box H, nothing is pending & no squares unclaimed. Done.

4 007 C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				5_{25}		5_{13}	5_{46}		
row 2					5_{46}			5_{1235}	
row 3			X						
row 4					5_{1235}			5_{46}	
row 5		5_{1235}		5_{6}		5_{4}			
row 6	5_{46}						5_{1235}		
row 7	5_{35}	5_{46}		5_{1}		5_{2}			
row 8			~~P_5~~						X
row 9	5_{12}			5_{34}		5_{56}			

Pattern 4.010	Orientation	Patterns with the same box code
5 – 3 – 2 | **2 – 2**	**D – F – E** | **C – A**	**none**

A	**B**	**C**
D	**E**	**F**
G	**H**	**I**

Subpattern-1 begins in **(41)** with box order **D→E→F→A→C**

(41) zaps (45) adding **(65)**
(41) zaps (49) while **(65)** zaps (69) adding **(59)**
(41) zaps (11) adding **(33)** zaps (38) adding **(18)**

Subpattern-1 = **(41),(65),(59),(33),(18)**
D E F A C

Since the bottom three rows of this sudoku are free of candidates, we'll omit these rows during the rest of this analysis, then include them on the final page.

4 010

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1							1_1	
row2				X					
row3			1_1					1	
row4	1_1		1		1				1
row5	1								1_1
row6	1		1		1_1				1
row7							X		
row8						X			
row9		X							

Pattern 4.010, continued.

A		**C**
D	**E**	**F**

Subpattern-2 begins in **(51)** with box order **D→F→E→A→C**

(51) zaps (59) adding **(49)** and pending ***(69)***
(49) zaps (45) adding **(65)**
(51) zaps (11) adding **(33)** zaps (38) adding **(18)**

Subpattern-2 = **(51),(49),(65),(33),(18)**
D F E A C

4 010 D1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	1							1_{12}	
row 2				X					
row 3			1_{12}					1	
row 4	1_1		1		1				1_2
row 5	1_2						P		1_1
row 6	1		1		1_{12}				1

Pattern 4.010, continued.

A		**C**
D	**E**	**F**

Box order: **D→F→E→A→C**

Due to the pending condition in **F,** subpattern-3 must
start in the same square **(51)** as subpattern-2
include the pending square **(69)**

(69) zaps (65) adding **(45)**
(51) zaps (11) adding **(33)** zaps (38) adding **(18)**

Subpattern-3 = **(51),(69),(45),(33),(18)**
D F E A C

4 010 D1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	1							1_{123}	
row 2				X					
row 3			1_{123}					1	
row 4	$1_{\mathbf{1}}$		1		$1_{\mathbf{3}}$				$1_{\mathbf{2}}$
row 5	$1_{\mathbf{23}}$						~~P~~		$1_{\mathbf{1}}$
row 6	1		1		$1_{\mathbf{12}}$				$1_{\mathbf{3}}$

Pattern 4.010, continued.

A		**C**
D	**E**	**F**

Subpattern-4 begins in **(61)** with box order **D→E→F→A→C**

(61) zaps (65) adding **(45)**
(61) zaps (69) while **(45)** zaps (49) adding **(59)**
(61) zaps (11) adding **(33)** zaps (38) adding **(18)**

Subpattern-4 = **(61),(45),(59),(33),(18)**
D E F A C

4 010 D1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	1							1_{1234}	
row 2				X					
row 3			1_{1234}					1	
row 4	1_{1}		1		1_{34}				1_{2}
row 5	1_{23}						$\cancel{P}$		1_{1}
row 6	1_{4}		1		1_{12}				1_{3}

Pattern 4.010, continued.

A		**C**
D	**E**	**F**

Box order is D→E→F→A→C

Subpattern-5 starts in **(43)** zaps (45) adding **(65)**
(65) zaps (69) while **(43)** zaps (49) adding **(59)**
(43) zaps (33) adding **(11)** zaps (18) adding **(38)**

Subpattern-5 = **(43),(65),(59),(11),(38)**
D E F A C

4 010 D1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	$1_{\mathbf{5}}$							$1_{\mathbf{1234}}$	
row 2				X					
row 3			$1_{\mathbf{1234}}$					$1_{\mathbf{5}}$	
row 4	$1_{\mathbf{1}}$		$1_{\mathbf{5}}$		$1_{\mathbf{34}}$				$1_{\mathbf{2}}$
row 5	$1_{\mathbf{23}}$						P		1_{145}
row 6	$1_{\mathbf{4}}$		1		$1_{\mathbf{125}}$				$1_{\mathbf{3}}$

Pattern 4.010, continued.

A		**C**
D	**E**	**F**

Box order: D→E→F→A→C

Subpattern-6 starts in **(63)** zaps (65) adding **(45)**
(65) zaps (69) while **(45)** zaps (49) adding **(59)**
(63) zaps (33) adding **(11)** zaps (18) adding **(38)**

Subpattern-6 = **(63),(45),(59),(11),(38)**
D E F A C

Back at the starting box, nothing is pending and no squares unclaimed. We are done.

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	$1_{\mathbf{56}}$							$1_{\mathbf{1234}}$	
row 2				X					
row 3			$1_{\mathbf{1234}}$					$1_{\mathbf{56}}$	
row 4	$1_{\mathbf{1}}$		$1_{\mathbf{5}}$		$1_{\mathbf{346}}$				$1_{\mathbf{2}}$
row 5	$1_{\mathbf{23}}$						$\cancel{P}$		$1_{\mathbf{1456}}$
row 6	$1_{\mathbf{4}}$		$1_{\mathbf{6}}$		$1_{\mathbf{125}}$				$1_{\mathbf{3}}$
row 7							X		
row 8						X			
row 9		X							

Pattern 4.015	Orientation	Patterns with the same box code
5 – 3 – 2 | **2 – 2** | **2**	**G – D – A** | **F – I** | **E**	**none**

A		
D	**E**	**F**
G		**I**

Box order**: G→A→D→I→F→E**

Subpattern-1 begins in **(81)** zaps (11) adding **(12)**
(12) zaps (52) while **(81)** zaps **(51)** adding **(53)**
(81) zaps (87) adding **(98)** zaps (68) adding **(47)** zaps (46) adding **(66)**

Subpattern-1 = **(81),(12),(53).(98),(47),(66)**
G A D I F E

---

4 015 col 1 col 2 col 3 col 4 col 5 col 6 col 7 col 8 col 9
D3

row1	7	7_1						
row2								X
row3				X				
row4					7	7_1		
row5	7	7	7_1					
row6					7_1		7	
row7					X			
row8	7_1	7				7		
row9	7	7	7				7_1	

Pattern 4.015, continued.

A		
D	**E**	**F**
G		**I**

Box order**: G→A→D→I→F→E**

Subpattern-2 begins in **(82)** zaps (12) adding **(11)**
(82) zaps (52) while **(11)** zaps (51) adding **(52)**
(82) zaps (87) adding **(98)** zaps (68) adding **(47)**

Subpattern-2 = **(82),(11),(52),(98),(47),(66)**
G A D I F E

4 D3	015	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
	row1	7_2	7_1							
	row2									X
	row3				X					
	row4						7	7_{12}		
	row5	7	7	7_{12}						
	row6						7_{12}		7	
	row7					X				
	row8	7_1	7_2					7		
	row9	7	7	7					7_{12}	

Pattern 4.015, continued.

A		
D	**E**	**F**
G		**I**

Box order**: G→A→D→I→F→E**

Subpattern-3 begins in **(91)** zaps (11) adding **(12)**
(91) zaps (51) while **(12)** zaps (52) adding **(53)**
(91) zaps (98) adding **(87)** zaps (47) adding **(68)** zaps (66) adding **(46)**

Subpattern-3 = **(91),(12),(53),(87),(68),(46)**
G A D I F E

4
D3

015	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{2}	7_{13}							
row2									X
row3				X					
row4						7	7_{12}		
row5	7	7	7_{123}						
row6						7_{12}		7_{3}	
row7					X				
row8	7_{1}	7_{2}					7_{3}		
row9	7_{3}	7	7					7_{12}	

Pattern 4.015, continued.

A		
D	**E**	**F**
G		**I**

Box order**: G→A→D→I→F→E**

Subpattern-4 begins in **(92)** zaps (12) adding **(11)**
(11) zaps (51) while **(92)** zaps (52) adding **(53)**
(92) zaps (98) adding **(87)** zaps (47) adding **(68)** zaps (66) adding **(46)**

Subpattern-4 = **(92),(11),(53),(87),(68),(46)**
G A D I F E

Subpatten-5 begins in **(93)** zaps (53) adding **(51)** and pending ***(52)***
(51) zaps (11) adding **(12)**
(93) zaps (98) adding **(87)** zaps (47) adding **(68)** zaps (66) adding **(46)**

Subpatten-5 = **(93),(51),(12),(87),(68),(46)**
G A D I F E

4 D3 015

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{24}	7_{135}							
row2									X
row3				X					
row4	*P*					7_{34}	7_{12}		
row5	7_{5}	7_{P}	7_{1234}						
row6						7_{12}		7_{345}	
row7					X				
row8	7_{1}	7_{2}					7_{345}		
row9	7_{3}	7_{4}	7_{5}					7_{12}	

Pattern 4.015, continued.

A		
D	**E**	**F**
G		**I**

Box order**: G→A→D→I→F→E**

Due to the pending condition in **D**, subpattern-6 must
begin in the same square **(93)** as subpattern-5
include the pending square **(52)**

(52) zaps (12) adding **(11)**
(93) zaps (98) adding **(87)** zaps (47) adding **(68)** zaps (66) adding **(46)**

Subpattern-6 = **(93),(52),(11),(87),(68),(46)**
G A D I F E

Back at the starting box G, nothing is pending, and no squares are unclaimed, so the pattern analysis is complete.

4 015
D3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{246}	7_{135}							
row2									X
row3				X					
row4	~~P~~					7_{3456}	7_{12}		
row5	7_{5}	7_{6}	7_{1234}						
row6						7_{12}		7_{3456}	
row7					X				
row8	7_{1}	7_{2}					7_{3456}		
row9	7_{3}	7_{4}	7_{56}					7_{12}	

PATTERN FILE 1

1 001 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1						2_2	
row2	2_2						2_1		
row3				X					
row4		2_2			2_1				
row5	2_1					2_2			
row6									X
row7			X						
row8						2_1	2_2		
row9					2_2			2_1	

1 001 B9

	col 1	col 2	col 5	col 6	col 7	col 8
row1		2_1				2_2
row2	2_2				2_1	
row4		2_2	2_1			
row5	2_1			2_2		
row8				2_1	2_2	
row9			2_2			2_1

1 002 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	4_1			4_2					
row3		4_2			4_1				
row4							X		
row5	4_2			4_1					
row6		4_1			4_2				
row7						X			
row8			X						
row9								X	

1 002 B1

	col 1	col 2	col 4	col 5
row2	4_1		4_2	
row3		4_2		4_1
row5	4_2		4_1	
row6		4_1		4_2

1 003 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_1			2_2		
row2		X							
row3					2_2				2_1
row4	2_1								2_2
row5			2_2				2_1		
row6						X			
row7	2_2				2_1				
row8								X	
row9			2_1	2_2					

1 003 B9

	col 1	col 3	col 4	col 5	col 7	col 9
row1			2_1		2_2	
row3				2_2		2_1
row4	2_1					2_2
row5		2_2			2_1	
row7	2_2			2_1		
row9		2_1	2_2			

1 004 C2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1		3_2		
row2				3_2			3_K		3_1
row3	X								
row4								X	
row5			3_2	3_1					
row6		3_1			3_2				
row7		3_2					3_1		
row8			3_1				3_K		3_2
row9						X			

1 004 C2

	col 2	col 3	col 4	col 5	col 7	col 9
row1				3_1	3_2	
row2			3_2		3_K	3_1
row5		3_2	3_1			
row6	3_1			3_2		
row7	3_2				3_1	
row8		3_1			3_K	3_2

1 005 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_1						4_2	
row2	4_2								4_1
row3				X					
row4					X				
row5							X		
row6			X						
row7		4_2						4_1	
row8	4_1								4_2
row9						X			

1 005 B1

	col 1	col 2	col 8	col 9
row1		4_1	4_2	
row2	4_2			4_1
row7		4_2	4_1	
row8	4_1			4_2

1 006 A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3							X		
row4								3_1	3_2
row5		X							
row6						X			
row7	3_1							3_2	
row8	3_2								3_1
row9				X					

1 006 A2

	col 1	col 8	col 9
row4		3_1	3_2
row7	3_1	3_2	
row8	3_2		3_1

1 007 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			9_1		9_2				
row3	9_2			9_1					
row4		X							
row5				9_2					9_1
row6					9_1		9_2		
row7	9_1								9_2
row8						X			
row9			9_2				9_1		

1 007 B9

	col 1	col 3	col 4	col 5	col 7	col 9
row2		9_1		9_2		
row3	9_2		9_1			
row5			9_2			9_1
row6				9_1	9_2	
row7	9_1					9_2
row9		9_2			9_1	

1 008 B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		1_1					1_2		
row3	1_2								1_1
row4						1_1			1_2
row5		1_2					1_1		
row6	1_1					1_2			
row7			X						
row8				X					
row9								X	

1 008 B2

	col 1	col 2	col 6	col 7	col 9
row2		1_1		1_2	
row3	1_2				1_1
row4			1_1		1_2
row5		1_2		1_1	
row6	1_1		1_2		

1 009 A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			6_1	6_2					
row2	6_2			6_1					
row3							X		
row4						X			
row5		X							
row6								6_2	6_1
row7	6_1								6_2
row8					X				
row9			6_2					6_1	

1 009 A7

	col 1	col 3	col 4	col 8	col 9
row1		6_1	6_2		
row2	6_2		6_1		
row6				6_2	6_1
row7	6_1				6_2
row9		6_2		6_1	

1 010 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		5_1			5_2				
row2			5_2	5_1					
row3							X		
row4	X								
row5				5_2					5_1
row6					5_1			5_2	
row7						X			
row8			5_1						5_2
row9		5_2						5_1	

1 010 B9

	col 2	col 3	col 4	col 5	col 8	col 9
row1	5_1			5_2		
row2		5_2	5_1			
row5			5_2			5_1
row6				5_1	5_2	
row8		5_1				5_2
row9	5_2				5_1	

1 011 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					2_1				2_2
row3				2_2				2_1	
row4						X			
row5		2_1						2_2	
row6			2_2						2_1
row7							X		
row8			2_1		2_2				
row9		2_2		2_1					

1 011 B9

	col 2	col 3	col 4	col 5	col 8	col 9
row2				2_1		2_2
row3			2_2		2_1	
row5	2_1				2_2	
row6		2_2				2_1
row8		2_1		2_2		
row9	2_2		2_1			

1 012 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_1						7_2		
row2					X				
row3		7_2							7_1
row4		7_1				7_2			
row5								X	
row6	7_2			7_1					
row7			X						
row8				7_2			7_1		
row9						7_1			7_2

1 012 B9

	col 1	col 2	col 4	col 6	col 7	col 9
row1	7_1				7_2	
row3		7_2				7_1
row4		7_1		7_2		
row6	7_2		7_1			
row8			7_2		7_1	
row9				7_1		7_2

1 013 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							X		
row3					X				
row4				X					
row5	1_1								1_2
row6		1_2						1_1	
row7						X			
row8	1_2								1_1
row9		1_1						1_2	

1 013 B1

	col 1	col 2	col 8	col 9
row5	1_1			1_2
row6		1_2	1_1	
row8	1_2			1_1
row9		1_1	1_2	

1 014 C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_1					5_2			
row3	5_K	5_2			5_1				
row4		5_1					5_K	5_2	
row5	5_2						5_1		
row6				X					
row7			X						
row8						5_1	5_2		
row9					5_2		5_K	5_1	

1 014 C8

	col 1	col 2	col 5	col 6	col 7	col 8
row2	5_1			5_2		
row3	5_K	5_2	5_1			
row4		5_1			5_K	5_2
row5	5_2				5_1	
row8				5_1	5_2	
row9			5_2		5_K	5_1

1 015 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2	4_1						4_2		
row3		4_2						4_1	
row4			X						
row5						X			
row6									X
row7	4_2						4_1		
row8					X				
row9		4_1						4_2	

1 015 B1

	col 1	col 2	col 7	col 8
row2	4_1		4_2	
row3		4_2		4_1
row7	4_2		4_1	
row9		4_1		4_2

1 016 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						4_1	4_2		
row3				4_2					4_1
row4		4_1							4_2
row5					X				
row6	4_2						4_1		
row7	4_1					4_2			
row8								X	
row9		4_2		4_1					

1 016 B9

	col 1	col 2	col 4	col 6	col 7	col 9
row2				4_1	4_2	
row3			4_2			4_1
row4		4_1				4_2
row6	4_2				4_1	
row7	4_1			4_2		
row9		4_2	4_1			

1 017 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3					X				
row4						X			
row5		X							
row6									X
row7			5_1	5_2					
row8			5_2					5_1	
row9				5_1				5_2	

1 017 A1

	col 3	col 4	col 8
row7	5_1	5_2	
row8	5_2		5_1
row9		5_1	5_2

1 018 C3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8_2		8_1		
row2				8_1			8_K		8_2
row3		X							
row4						X			
row5			8_2				8_K		8_1
row6	8_1						8_2		
row7	8_2				8_1				
row8								X	
row9			8_1	8_2	8_K				

1 018 C3

	col 1	col 3	col 4	col 5	col 7	col 9
row1				8_2	8_1	
row2			8_1		8_K	8_2
row5		8_2			8_K	8_1
row6	8_1				8_2	
row7	8_2			8_1		
row9		8_1	8_2	8_K		

1 019 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					6_1		6_2		
row2						6_2			6_1
row3		X							
row4	X								
row5						6_1			6_2
row6					6_2		6_1		
row7				X					
row8								X	
row9			X						

1 019 B1

	col 5	col 6	col 7	col 9
row1	6_1		6_2	
row2		6_2		6_1
row5		6_1		6_2
row6	6_2		6_1	

1 020 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2			3_1			3_2			
row3			3_2	3_1					
row4	X								
row5					X				
row6							X		
row7		3_2				3_1			
row8								X	
row9		3_1		3_2					

1 020 A4

	col 2	col 3	col 4	col 6
row2		3_1		3_2
row3		3_2	3_1	
row7	3_2			3_1
row9	3_1		3_2	

1 021 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3						X			
row4			2_1	2_2					
row5								X	
row6	2_2				2_1				
row7	2_1				2_2				
row8									X
row9			2_2	2_1					

1 021 B1

	col 1	col 3	col 4	col 5
row4		2_1	2_2	
row6	2_2			2_1
row7	2_1			2_2
row9		2_2	2_1	

1 022 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2		9_1			9_2				
row3	9_2			9_1					
row4									X
row5			X						
row6						X			
row7							X		
row8		9_2			9_1				
row9	9_1			9_2					

1 022 B1

	col 1	col 2	col 4	col 5
row2		9_1		9_2
row3	9_2		9_1	
row8		9_2		9_1
row9	9_1		9_2	

1 023 B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2								X	
row3					3_1	3_2			
row4						3_1			3_2
row5		X							
row6				3_2			3_1		
row7	X								
row8				3_1			3_2		
row9					3_2				3_1

1 023 B2

	col 4	col 5	col 6	col 7	col 9
row3		3_1	3_2		
row4			3_1		3_2
row6	3_2			3_1	
row8	3_1			3_2	
row9		3_2			3_1

1 024 A6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2						4_1	4_2		
row3					4_2			4_1	
row4				X					
row5			X						
row6							4_1	4_2	
row7	X								
row8					4_1	4_2			
row9									X

1 024 A6

	col 5	col 6	col 7	col 8
row2		4_1	4_2	
row3	4_2			4_1
row6			4_1	4_2
row8	4_1	4_2		

1 025 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_1			2_2		
row2		X							
row3					2_2				2_1
row4	2_1								2_2
row5			2_2				2_1		
row6						X			
row7	2_2				2_1				
row8								X	
row9			2_1	2_2					

1 025 B9

	col 1	col 3	col 4	col 5	col 7	col 9
row1			2_1		2_2	
row3				2_2		2_1
row4	2_1					2_2
row5		2_2			2_1	
row7	2_2			2_1		
row9		2_1	2_2			

1 026 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2	6_1						6_2		
row3		6_2							6_1
row4					6_1				6_2
row5				6_2			6_1		
row6			X						
row7	6_2			6_1					
row8								X	
row9		6_1			6_2				

1 026 B9

	col 1	col 2	col 4	col 5	col 7	col 9
row2	6_1				6_2	
row3		6_2				6_1
row4				6_1		6_2
row5			6_2		6_1	
row7	6_2		6_1			
row9		6_1		6_2		

3 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_1			2_2		
row2					2_2			2_1	
row3			X						
row4		X							
row5					2_1			2_2	
row6				2_2			2_1		
row7	X								
row8						X			
row9									X

3 027

	col 4	col 5	col 7	col 8
row1	2_1		2_2	
row2		2_2		2_1
row5		2_1		2_2
row6	2_2		2_1	

1 028 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_1			5_2		
row2						5_2			5_1
row3	X								
row4			5_1						5_2
row5					X				
row6		5_2					5_1		
row7		5_1		5_2					
row8								X	
row9			5_2			5_1			

1 028 B9

	col 2	col 3	col 4	col 6	col 7	col 9
row1			5_1		5_2	
row2				5_2		5_1
row4		5_1				5_2
row6	5_2				5_1	
row7	5_1		5_2			
row9		5_2		5_1		

1 029 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1					2_2		
row2	2_2								2_1
row3					X				
row4						X			
row5	2_1								2_2
row6		2_2					2_1		
row7			X						
row8								X	
row9				X					

1 029 B1

	col 1	col 2	col 7	col 9
row1		2_1	2_2	
row2	2_2			2_1
row5	2_1			2_2
row6		2_2	2_1	

1 030 B2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2			8_2						8_1
row3		8_1						8_2	
row4	X								
row5							8_1		8_2
row6					X				
row7		8_2						8_1	
row8			8_1				8_2		
row9						X			

1 030 B2

	col 2	col 3	col 7	col 8	col 9
row2		8_2			8_1
row3	8_1			8_2	
row5			8_1		8_2
row7	8_2			8_1	
row8		8_1	8_2		

1 031 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						3_1			3_2
row3					3_2			3_1	
row4							X		
row5	3_1					3_2			
row6		3_2			3_1				
row7				X					
row8	3_2								3_1
row9		3_1						3_2	

1 031 B9

	col 1	col 2	col 5	col 6	col 8	col 9
row2				3_1		3_2
row3			3_2		3_1	
row5	3_1			3_2		
row6		3_2	3_1			
row8	3_2					3_1
row9		3_1			3_2	

1 032 A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				X					
row3							X		
row4		8_1							8_2
row5					X				
row6			8_2						8_1
row7								X	
row8		8_2	8_1						
row9				X					

1 032 A2

	col 2	col 3	col 9
row4	8_1		8_2
row6		8_2	8_1
row8	8_2	8_1	

1 033 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_1		3_2						
row2				X					
row3							X		
row4					X				
row5									X
row6		3_2	3_1						
row7						X			
row8	3_2	3_1							
row9								X	

1 033 A1

	col 1	col 2	col 3
row1	3_1		3_2
row6		3_2	3_1
row8	3_2	3_1	

1 034 A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2		X							
row3						X			
row4			7_2	7_1					
row5	7_1			7_2					
row6									X
row7			7_1				7_2		
row8					7_2		7_1		
row9	7_2				7_1				

1 034 A5

	col 1	col 3	col 4	col 5	col 7
row4		7_2	7_1		
row5	7_1		7_2		
row7		7_1			7_2
row8				7_2	7_1
row9	7_2			7_1	

1 035 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1			3_2	
row2				3_2				3_1	
row3		X							
row4									X
row5			3_1		3_2				
row6			3_2	3_1					
row7							X		
row8	X								
row9						X			

1 035 A4

	col 3	col 4	col 5	col 8
row1			3_1	3_2
row2		3_2		3_1
row5	3_1		3_2	
row6	3_2	3_1		

1 036 B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		3_1					3_2		
row2	3_2								3_1
row3					X				
row4						X			
row5			X						
row6								X	
row7	3_1								3_2
row8				X					
row9		3_2					3_1		

1 036 B1

	col 1	col 2	col 7	col 9
row1		3_1	3_2	
row2	3_2			3_1
row7	3_1			3_2
row9		3_2	3_1	

1 037 C0

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				7_{1}	7_{2}		7_{3}		
row2		X							
row3				7_{3}			7_{12}		
row4				7_{2}					7_{13}
row5					7_{13}				7_{2}
row6			X						
row7						X			
row8	X								
row9								X	

1 037 C0

	col 4	col 5	col 7	col 9
row1	7_{1}	7_{2}	7_{3}	
row3	7_{3}		7_{12}	
row4	7_{2}			7_{13}
*2 row5		7_{13}		7_{2}

1 038 B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2									X
row3					3_1	3_2			
row4		3_2						3_1	
row5			3_1				3_2		
row6				X					
row7		3_1						3_2	
row8			3_2			3_1			
row9					3_2		3_1		

1 038 B3

	col 2	col 3	col 5	col 6	col 7	col 8
row3			3_1	3_2		
row4	3_2					3_1
row5		3_1			3_2	
row7	3_1					3_2
row8		3_2		3_1		
row9			3_2		3_1	

1 039 B9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9_1	9_2		
row2		X							
row3				9_2					9_1
row4			9_2	9_1					
row5								X	
row6	9_1					9_2			
row7	9_2						9_1		
row8					X				
row9			9_1						9_2

1 039 B9

	col 1	col 3	col 4	col 6	col 7	col 9
row1				9_1	9_2	
row3			9_2			9_1
row4		9_2	9_1			
row6	9_1			9_2		
row7	9_2				9_1	
row9		9_1				9_2

1 040 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			2_1			2_2			
row2			2_2		2_1				
row3							X		
row4		X							
row5					2_2	2_1			
row6									X
row7	X								
row8				X					
row9								X	

1 040 new

	col 3	col 5	col 6
row1	2_1		2_2
row2	2_2	2_1	
row5		2_2	2_1

1 041 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_1				1_2		
row2						X			
row3	1_2								1_1
row4					X				
row5								X	
row6		X							
row7	1_1								1_2
row8				X					
row9			1_2				1_1		

1 041 new

	col 1	col 3	col 7	col 9
row1		1_1	1_2	
row3	1_2			1_1
row7	1_1			1_2
row9		1_2	1_1	

1 042 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	2_1			2_2					
row3			2_2			2_1			
row4						2_2		2_1	
row5		X							
row6				2_1			2_2		
row7	2_2						2_1		
row8					X				
row9			2_1					2_2	

1 042 new

	col 1	col 3	col 4	col 6	col 7	col 8
row2	2_1		2_2			
row3		2_2		2_1		
row4				2_2		2_1
row6			2_1		2_2	
row7	2_2				2_1	
row9		2_1				2_2

1 043 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_2			5_K	5_1	
row2						5_1		5_2	
row3		X							
row4	5_1						5_2	5_K	
row5			5_2				5_1		
row6					X				
row7			5_1			5_2			
row8	5_2			5_1					
row9									X

1 043 new

	col 1	col 3	col 4	col 6	col 7	col 8
row1			5_2		5_K	5_1
row2				5_1		5_2
row4	5_1				5_2	5_K
row5		5_2			5_1	
row7		5_1		5_2		
row8	5_2		5_1			

1 044 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_1			1_2	
row2						1_2	1_1		
row3	X								
row4		1_1			1_2				
row5			1_2			1_1			
row6									X
row7		1_2						1_1	
row8			1_1				1_2		
row9				X					

1 044 new

	col 2	col 3	col 5	col 6	col 7	col 8
row1			1_1			1_2
row2				1_2	1_1	
row4	1_1		1_2			
row5		1_2		1_1		
row7	1_2					1_1
row8		1_1			1_2	

1 045 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_2							8_1	8_K
row2						X			
row3			8_1						8_2
row4		X							
row5				8_1				8_2	
row6				8_2			8_1		8_K
row7					X				
row8			8_2						8_1
row9	8_1						8_2		

1 045 new

	col 1	col 3	col 4	col 7	col 8	col 9
row1	8_2				8_1	8_K
row3		8_1				8_2
row5			8_1		8_2	
row6			8_2	8_1		8_K
row8		8_2				8_1
row9	8_1			8_2		

1 046 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1						2_2	
row2	2_2						2_1		
row3						X			
row4		2_2			2_1				
row5	2_1			2_2					
row6									X
row7			X						
row8				2_1			2_2		
row9					2_2			2_1	

1 046 new

	col 1	col 2	col 4	col 5	col 7	col 8
row1		2_1				2_2
row2	2_2				2_1	
row4		2_2		2_1		
row5	2_1		2_2			
row8			2_1		2_2	
row9				2_2		2_1

1 047 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	3_1			3_2					
row3			3_2			3_1			
row4						3_2		3_1	
row5		X							
row6				3_1			3_2		
row7	3_2						3_1		
row8					X				
row9			3_1					3_2	

1 047 new

	col 1	col 3	col 4	col 6	col 7	col 8
row2	3_1		3_2			
row3		3_2		3_1		
row4				3_2		3_1
row6			3_1		3_2	
row7	3_2				3_1	
row9		3_1				3_2

1 048 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						3_1	3_2		
row2					3_2				3_1
row3			X						
row4								X	
row5		3_1				3_2			
row6	3_2				3_1				
row7	3_1								3_2
row8				X					
row9		3_2					3_1		

1 048 new

	col 1	col 2	col 3	col 5	col 6	col 7	col 9
row1					3_1	3_2	
row2				3_2			3_1
row5		3_1			3_2		
row6	3_2			3_1			
row7	3_1						3_2
row9		3_2				3_1	

1 049 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2			7_1				7_2		
row3		7_2						7_1	
row4	X								
row5				7_2			7_1		
row6					7_1			7_2	
row7									X
row8			7_2	7_1					
row9		7_1			7_2				

1 049 new

	col 2	col 3	col 4	col 5	col 7	col 8
row2		7_1			7_2	
row3	7_2					7_1
row5			7_2		7_1	
row6				7_1		7_2
row8		7_2	7_1			
row9	7_1			7_2		

1 050 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				X					
row3									X
row4								X	
row5		3_1				3_2			
row6	3_2				3_1				
row7							X		
row8	3_1				3_2				
row9		3_2				3_1			

1 050 new

	col 1	col 2	col 5	col 6
row5		3_1		3_2
row6	3_2		3_1	
row8	3_1		3_2	
row9		3_2		3_1

1 051 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					4_1		4_2		
row3						4_2			4_1
row4			4_1		4_2				
row5		4_2				4_1			
row6								X	
row7		4_1							4_2
row8				X					
row9			4_2				4_1		

1 051 new

	col 2	col 3	col 5	col 6	col 7	col 9
row2			4_1		4_2	
row3				4_2		4_1
row4		4_1	4_2			
row5	4_2			4_1		
row7	4_1					4_2
row9		4_2			4_1	

1 052 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3							X		
row4		1_1				1_2			
row5									X
row6	1_2			1_1					
row7	1_1			1_2					
row8								X	
row9		1_2				1_1			

1 052 new

	col 1	col 2	col 4	col 6
row4		1_1		1_2
row6	1_2		1_1	
row7	1_1		1_2	
row9		1_2		1_1

1 053 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						4_1	4_2		
row3				4_2					4_1
row4		4_1							4_2
row5					X				
row6	4_2						4_1		
row7	4_1					4_2			
row8								X	
row9		4_2		4_1					

1 053 new

	col 1	col 2	col 4	col 6	col 7	col 9
row2				4_1	4_2	
row3			4_2			4_1
row4		4_1				4_2
row6	4_2				4_1	
row7	4_1			4_2		
row9		4_2	4_1			

1 054 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2							9_1	9_2	
row3					X				
row4						X			
row5			9_1				9_2		
row6			9_2					9_1	
row7				X					
row8		X							
row9									X

1 054 new

	col 3	col 7	col 8
row2		9_1	9_2
row5	9_1	9_2	
row6	9_2		9_1

1 055 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1_1	1_2				
row2	X								
row3								X	
row4									X
row5		X							
row6				1_2		1_1			
row7					1_1	1_2			
row8							X		
row9			X						

1 055 new

	col 4	col 5	col 6
row1	1_1	1_2	
row6	1_2		1_1
row7		1_1	1_2

1 056 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2							7_1	7_2	
row3		X							
row4						X			
row5	X								
row6									X
row7			X						
row8					7_2			7_1	
row9					7_1		7_2		

1 056 new

	col 5	col 7	col 8
row2		7_1	7_2
row8	7_2		7_1
row9	7_1	7_2	

1 057 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				7_1			7_2		
row2		X							
row3					7_2				7_1
row4	7_1								7_2
row5			7_2				7_1		
row6						X			
row7	7_2				7_1				
row8								X	
row9			7_1	7_2					

1 057 new

	col 1	col 3	col 4	col 5	col 7	col 9
row1			7_1		7_2	
row3				7_2		7_1
row4	7_1					7_2
row5		7_2			7_1	
row7	7_2			7_1		
row9		7_1	7_2			

1 058 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9_2			9_1		
row2					9_1		9_2		
row3	X								
row4						X			
row5								X	
row6			X						
row7		X							
row8					9_2				9_1
row9				9_1					9_2

1 058 new

	col 4	col 5	col 7	col 9
row1	9_2		9_1	
row2		9_1	9_2	
row8		9_2		9_1
row9	9_1			9_2

1 059 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2			X						
row3					X				
row4		4_1		4_2					
row5							X		
row6		4_2				4_1			
row7	X								
row8				4_1		4_2			
row9								X	

1 059 new

	col 2	col 4	col 6
row4	4_1	4_2	
row6	4_2		4_1
row8		4_1	4_2

1 060 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2						X			
row3		7_2	7_1						
row4	X								
row5				7_1			7_2		
row6				7_2				7_1	
row7					X				
row8			7_2				7_1		
row9		7_1						7_2	

1 060 new

	col 2	col 3	col 4	col 7	col 8
row3	7_2	7_1			
row5			7_1	7_2	
row6			7_2		7_1
row8		7_2		7_1	
row9	7_1				7_2

1 061 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2								X	
row3		9_1	9_2						
row4						X			
row5							X		
row6	X								
row7		9_2							9_1
row8			9_1						9_2
row9				X					

1 061 new

	col 2	col 3	col 9
row3	9_1	9_2	
row7	9_2		9_1
row8		9_1	9_2

1 062 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3									X
row4	4_1			4_2					
row5			4_2	4_1					
row6							X		
row7	4_2		4_1						
row8						X			
row9								X	

1 062 new

	col 1	col 3	col 4
row4	4_1		4_2
row5		4_2	4_1
row7	4_2	4_1	

1 063 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1						2_2	
row2			2_2						2_1
row3				X					
row4						X			
row5	X								
row6							X		
row7		2_2						2_1	
row8			2_1						2_2
row9									

1 063 new

	col 2	col 3	col 8	col 9
row1	2_1		2_2	
row2		2_2		2_1
row7	2_2		2_1	
row8		2_1		2_2

1 064 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				X					
row3									X
row4					9_1		9_2		
row5						9_2	9_1		
row6		X							
row7	X								
row8								X	
row9					9_2	9_1			

1 064 new

	col 5	col 6	col 7
row4	9_1		9_2
row5		9_2	9_1
row9	9_2	9_1	

1 065 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		1_1							1_2
row3			1_2				1_1		
row4						X			
row5		1_2							1_1
row6			1_1				1_2		
row7								X	
row8					X				
row9	X								

1 065 new

	col 2	col 3	col 7	col 9
row2	1_1			1_2
row3		1_2	1_1	
row5	1_2			1_1
row6		1_1	1_2	

1 066 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_{1}				1_{2}		
row2					X				
row3	1_{2}		1_{K}						1_{1}
row4		X							
row5						X			
row6								X	
row7	1_{1}		1_{K}				1_{K}		1_{2}
row8				X					
row9			1_{2}				1_{1}		

1 066 new

	col 1	col 3	col 7	col 9
row1		1_{1}	1_{2}	
row3	1_{2}	1_{K}		1_{1}
row7	1_{1}	1_{K}	1_{K}	1_{2}
row9		1_{2}	1_{1}	

1 067 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			2_1				2_2		
row2				X					
row3	2_2							2_1	
row4		X							
row5						2_1		2_2	
row6					2_2		2_1		
row7	2_1					2_2			
row8			2_2		2_1				
row9									X

1 067 new

	col 1	col 3	col 5	col 6	col 7	col 8
row1		2_1			2_2	
row3	2_2					2_1
row5				2_1		2_2
row6			2_2		2_1	
row7	2_1			2_2		
row8		2_2	2_1			

1 068 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_{1}		1_{23}		
row2		X							
row3				1_{2}	1_{3}				1_{1}
row4						X			
row5							1_{1}		1_{23}
row6			X						
row7	X								
row8								X	
row9				1_{13}	1_{2}				

1 068 new

	col 4	col 5	col 7	col 9
row1		1_{1}	1_{23}	
row3	1_{2}	1_{3}		1_{1}
row5			1_{1}	1_{23}
row9	1_{13}	1_{2}		

1 069 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5_1							5_2	
row2						X			
row3			5_2				5_1		
row4					X				
row5									X
row6		X							
row7				X					
row8			5_1				5_2		
row9	5_2							5_1	

1 069 new

	col 1	col 3	col 7	col 8
row1	5_1			5_2
row3		5_2	5_1	
row8		5_1	5_2	
row9	5_2			5_1

1 070 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1_{1}					
row2									
row3				1_{K}	1_{2}				1_{1}
row4	1_{1}		1_{K}				1_{K}		1_{2}
row5			1_{2}				1_{1}		
row6									
row7	1_{2}			1_{K}	1_{1}				
row8									
row9			1_{1}	1_{2}					

1 070 new

	col 1	col 3	col 4	col 5	col 7	col 9
row1			1_{1}			
row3			1_{K}	1_{2}		1_{1}
row4	1_{1}	1_{K}			1_{K}	1_{2}
row5		1_{2}			1_{1}	
row7	1_{2}		1_{K}	1_{1}		
row9		1_{1}	1_{2}			

1 071 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_1			1_2	
row2						1_2			1_1
row3	X								
row4				X					
row5			1_1						1_2
row6		1_2						1_1	
row7		1_1			1_2				
row8			1_2			1_1			
row9							X		

1 071 new

	col 2	col 3	col 5	col 6	col 8	col 9
row1			1_1		1_2	
row2				1_2		1_1
row5		1_1				1_2
row6	1_2				1_1	
row7	1_1		1_2			
row8		1_2		1_1		

1 072 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			3_1				3_2		
row2				X					
row3	3_2								3_1
row4								X	
row5					X				
row6		X							
row7	3_1								3_2
row8						X			
row9			3_2				3_1		

1 072 new

	col 1	col 3	col 7	col 9
row1		3_1	3_2	
row3	3_2			3_1
row7	3_1			3_2
row9		3_2	3_1	

1 073 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_1					2_2		
row2					X				
row3			2_2						2_1
row4						X			
row5								X	
row6	X								
row7		2_2					2_1		
row8				2_1					2_2
row9			2_1	2_2					

1 073 new

	col 2	col 3	col 4	col 7	col 9
row1	2_1			2_2	
row3		2_2			2_1
row7	2_2			2_1	
row8			2_1		2_2
row9		2_1	2_2		

1 074 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_1					1_2		
row2			1_2						1_1
row3				X					
row4	X								
row5						1_1			1_2
row6					1_2		1_1		
row7		1_2			1_1				
row8								X	
row9			1_1			1_2			

1 074 new

	col 2	col 3	col 5	col 6	col 7	col 9
row1	1_1				1_2	
row2		1_2				1_1
row5				1_1		1_2
row6			1_2		1_1	
row7	1_2		1_1			
row9		1_1		1_2		

1 075 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_1			4_2				
row2							X		
row3	4_2					4_1			
row4	4_1								4_2
row5		4_2						4_1	
row6				X					
row7						4_2			4_1
row8			X						
row9					4_1			4_2	

1 075 new

	col 1	col 2	col 5	col 6	col 8	col 9
row1		4_1	4_2			
row3	4_2			4_1		
row4	4_1					4_2
row5		4_2			4_1	
row7				4_2		4_1
row9			4_1		4_2	

1 076 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						3_1		3_2	
row2						3_2	3_1		
row3	X								
row4		X							
row5					X				
row6							3_2	3_1	
row7									X
row8			X						
row9				X					

1 076 new

	col 6	col 7	col 8
row1	3_1		3_2
row2	3_2	3_1	
row6		3_2	3_1

1 077 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					3_1		3_2		
row3				3_2				3_1	
row4		X							
row5									X
row6						X			
row7			X						
row8					3_2		3_1		
row9				3_1				3_2	

1 077 new

	col 4	col 5	col 7	col 8
row2		3_1	3_2	
row3	3_2			3_1
row8		3_2	3_1	
row9	3_1			3_2

1 078 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_1						1_2	
row2	1_2						1_1		
row3				X					
row4					1_2			1_1	
row5						1_1	1_2		
row6			X						
row7									X
row8	1_1					1_2			
row9		1_2			1_1				

1 078 new

	col 1	col 2	col 5	col 6	col 7	col 8
row1		1_1				1_2
row2	1_2				1_1	
row4			1_2			1_1
row5				1_1	1_2	
row8	1_1			1_2		
row9		1_2	1_1			

1 079 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	2_{2}			2_{1}		2_{K}			
row3		2_{1}				2_{2}			
row4		2_{2}						2_{1}	
row5					X				
row6	2_{1}						2_{2}	2_{K}	
row7			X						
row8				2_{2}		2_{K}	2_{1}		
row9						2_{1}		2_{2}	

1 079 new

	col 1	col 2	col 4	col 6	col 7	col 8
row2	2_{2}		2_{1}	2_{K}		
row3		2_{1}		2_{2}		
row4		2_{2}				2_{1}
row6	2_{1}				2_{2}	2_{K}
row8			2_{2}	2_{K}	2_{1}	
row9				2_{1}		2_{2}

1 080 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2								X	
row3				X					
row4					X				
row5			2_1				2_2		
row6	2_2								2_1
row7	2_1								2_2
row8			2_2				2_1		
row9						X			

1 080 new

	col 1	col 3	col 7	col 9
row5		2_1	2_2	
row6	2_2			2_1
row7	2_1			2_2
row8		2_2	2_1	

1 081 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2		8_1	8_2						
row3						X			
row4					X				
row5							8_1	8_2	
row6	X								
row7				X					
row8			8_1				8_2		
row9		8_2						8_1	

1 081 new

	col 2	col 3	col 7	col 8
row2	8_1	8_2		
row5			8_1	8_2
row8		8_1	8_2	
row9	8_2			8_1

1 082 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				4_{1}		4_{2}			4_{3}
row3				4_{3}					4_{12}
row4		X							
row5							X		
row6					X				
row7									
row8				4_{2}		4_{13}			
row9								X	

1 082 new

	col 4	col 6	col 9
row2	4_{1}	4_{2}	4_{3}
row3	4_{3}		4_{12}
row8	4_{2}	4_{13}	

1 083 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2			X						
row3							X		
row4				X					
row5		2_1						2_2	
row6	2_2								2_1
row7		2_2						2_1	
row8	2_1								2_2
row9					X				

1 083 new

	col 1	col 2	col 8	col 9
row5		2_1	2_2	
row6	2_2			2_1
row7		2_2	2_1	
row8	2_1			2_2

1 084 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		7_1					7_2		
row2			7_2						7_1
row3				X					
row4			7_1			7_2			
row5								X	
row6		7_2			7_1				
row7					7_2		7_1		
row8						7_1			7_2
row9	X								

1 084 new

	col 2	col 3	col 5	col 6	col 7	col 9
row1	7_1				7_2	
row2		7_2				7_1
row4		7_1		7_2		
row6	7_2		7_1			
row7			7_2		7_1	
row8				7_1		7_2

1 085 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					6_1				6_2
row3				6_2				6_1	
row4					6_2				6_1
row5				6_1				6_2	
row6		X							
row7							X		
row8						X			
row9			X						

1 085 new

	col 4	col 5	col 8	col 9
row2		6_1		6_2
row3	6_2		6_1	
row4		6_2		6_1
row5	6_1		6_2	

1 086 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2								X	
row3	1_1	1_2							
row4									X
row5				X					
row6	1_2		1_1						
row7							X		
row8		1_1	1_2						
row9						X			

1 086 new

	col 1	col 2	col 3
row3	1_1	1_2	
row6	1_2		1_1
row8		1_1	1_2

1 087 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2									X
row3				7_1	7_2				
row4				7_2			7_1		
row5					7_1		7_2		
row6		X							
row7	X								
row8						X			
row9								X	

1 087 new

	col 4	col 5	col 7
row3	7_1	7_2	
row4	7_2		7_1
row5		7_1	7_2

1 088 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_1		3_2		
row2				3_2					3_1
row3	X								
row4				3_1					3_2
row5		X							
row6					3_2		3_1		
row7								X	
row8			X						
row9						X			

1 088 new

	col 4	col 5	col 7	col 9
row1		3_1	3_2	
row2	3_2			3_1
row4	3_1			3_2
row6		3_2	3_1	

1 089 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2									X
row3	X								
row4							X		
row5			3_1	3_2					
row6		3_2				3_1			
row7		3_1				3_2			
row8								X	
row9			3_2	3_1					

1 089 new

	col 2	col 3	col 4	col 6
row5		3_1	3_2	
row6	3_2			3_1
row7	3_1			3_2
row9		3_2	3_1	

1 090 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_1			7_2	
row2	7_1			7_2					
row3		7_2						7_1	
row4						X			
row5			X						
row6									X
row7							X		
row8	7_2			7_1					
row9		7_1			7_2				

1 090 new

	col 1	col 2	col 4	col 5	col 8
row1				7_1	7_2
row2	7_1		7_2		
row3		7_2			7_1
row8	7_2		7_1		
row9		7_1		7_2	

1 091 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						X			
row3							X		
row4					X				
row5	2_1								2_2
row6		2_2							2_1
row7				X					
row8								X	
row9	2_2	2_1							

1 091 new

	col 1	col 2	col 9
row5	2_1		2_2
row6		2_2	2_1
row9	2_2	2_1	

1 092 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2						X			
row3								X	
row4				5_1			5_2		
row5					5_2				5_1
row6		X							
row7							5_1		5_2
row8			X						
row9				5_2	5_1				

1 092 new

	col 4	col 5	col 7	col 8	col 9
row4	5_1		5_2		
row5		5_2			5_1
row7			5_1		5_2
row9	5_2	5_1			

1 093 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			5_1				5_2		
row2						X			
row3	5_2							5_1	
row4		X							
row5									X
row6				X					
row7	5_1							5_2	
row8			5_2				5_1		
row9					X				

1 093 new

	col 1	col 3	col 7	col 8
row1		5_1	5_2	
row3	5_2			5_1
row7	5_1			5_2
row8		5_2	5_1	

1 094 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2					X				
row3	X								
row4									X
row5			4_1			4_2			
row6		4_2		4_1					
row7		4_1		4_2					
row8			4_2			4_1			
row9							X		

1 094 new

	col 2	col 3	col 4	col 6
row5		4_1		4_2
row6	4_2		4_1	
row7	4_1		4_2	
row8		4_2		4_1

1 095 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			2_1				2_2		
row2		2_2							2_1
row3					X				
row4						X			
row5		2_1							2_2
row6			2_2				2_1		
row7								X	
row8	X								
row9				X					

1 095 new

	col 2	col 3	col 7	col 9
row1		2_1	2_2	
row2	2_2			2_1
row5	2_1			2_2
row6		2_2	2_1	

1 096 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	X								
row3				X					
row4					1_1			1_2	
row5						1_2	1_1		
row6			X						
row7						1_1	1_2		
row8		X							
row9					1_2			1_1	

1 096 new

	col 5	col 6	col 7	col 8
row4	1_1			1_2
row5		1_2	1_1	
row7		1_1	1_2	
row9	1_2			1_1

1 097 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3									X
row4	X								
row5					1_1	1_2			
row6								X	
row7			1_2			1_1			
row8			1_1		1_2				
row9							X		

1 097 new

	col 3	col 5	col 6
row5		1_1	1_2
row7	1_2		1_1
row8	1_1	1_2	

1 098 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2			4_2						4_1
row3		4_1						4_2	
row4	X								
row5							4_1		4_2
row6					X				
row7		4_2						4_1	
row8			4_1				4_2		
row9						X			

1 098 new

	col 2	col 3	col 7	col 8	col 9
row2		4_2			4_1
row3	4_1			4_2	
row5			4_1		4_2
row7	4_2			4_1	
row8		4_1	4_2		

1 099 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2			9_1			9_2			
row3			9_2	9_1					
row4	X								
row5					X				
row6							X		
row7		9_2				9_1			
row8								X	
row9		9_1		9_2					

1 099 new

	col 2	col 3	col 4	col 6
row2		9_1		9_2
row3		9_2	9_1	
row7	9_2			9_1
row9	9_1		9_2	

1 100 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_1						1_2	
row2	1_2								1_1
row3				X					
row4			X						
row5							X		
row6						X			
row7		1_2						1_1	
row8	1_1								1_2
row9					X				

1 100 new

	col 1	col 2	col 8	col 9
row1		1_1	1_2	
row2	1_2			1_1
row7		1_2	1_1	
row8	1_1			1_2

1 101 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			$7_{\mathbf{1}}$					$7_{\mathbf{2}}$	
row2						X			
row3	$7_{\mathbf{2}}$								$7_{\mathbf{1}}$
row4	$7_{\mathbf{1}}$								$7_{\mathbf{2}}$
row5			$7_{\mathbf{2}}$					$7_{\mathbf{1}}$	
row6				X					
row7							X		
row8		X							
row9					X				

1 101 new

	col 1	col 3	col 8	col 9
row1		$7_{\mathbf{1}}$	$7_{\mathbf{2}}$	
row3	$7_{\mathbf{2}}$			$7_{\mathbf{1}}$
row4	$7_{\mathbf{1}}$			$7_{\mathbf{2}}$
row5		$7_{\mathbf{2}}$	$7_{\mathbf{1}}$	

1 102 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_1						1_2		
row2					X				
row3		1_2							1_1
row4		1_1				1_2			
row5								X	
row6	1_2			1_1					
row7			X						
row8				1_2			1_1		
row9						1_1			1_2

1 102 new

	col 1	col 2	col 4	col 6	col 7	col 9
row1	1_1				1_2	
row3		1_2				1_1
row4		1_1		1_2		
row6	1_2		1_1			
row8			1_2		1_1	
row9				1_1		1_2

1 103 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	5_1		5_2						
row3						X			
row4				X					
row5		5_2	5_1						
row6								X	
row7	5_2	5_1							
row8							X		
row9					X				

1 103 new

	col 1	col 2	col 3
row2	5_1		5_2
row5		5_2	5_1
row7	5_2	5_1	

1 104 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				X					
row3	X								
row4								X	
row5		X							
row6						X			
row7					1_1		1_2		
row8			1_2				1_1		
row9			1_1		1_2				

1 104 new

	col 3	col 5	col 7
row7		1_1	1_2
row8	1_2		1_1
row9	1_1	1_2	

1 105

new	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2							X		
row3	X								
row4									X
row5			2_1	2_2					
row6		2_2			2_1				
row7					2_2			2_1	
row8			2_2	2_1					
row9		2_1						2_2	

1 105

col 2	col 3	col 4	col 5	col 8
	2_1	2_2		
2_2			2_1	
			2_2	2_1
	2_2	2_1		
2_1				2_2

PATTERN FILE 2

2 001 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				6_{1}		6_{2}	6_{34}		
row3					6_{34}			6_{12}	
row4		X							
row5				6_{23}		6_{14}			
row6									X
row7					6_{12}			6_{34}	
row8				6_{4}		6_{3}	6_{12}		
row9			X						

2 001 ML

	col 4	col 5	col 6	col 7	col 8
row2	6_{1}		6_{2}	6_{34}	
row3		6_{34}			6_{12}
row5	6_{23}		6_{14}		
row7		6_{12}			6_{34}
row8	6_{4}		6_{3}	6_{12}	

2 002 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				1_{1}			1_{23}		
row3				1_{2}	1_{3}			1_{1}	
row4									
row5									
row6							1_{1}	1_{23}	
row7									
row8									
row9				1_{3}	1_{12}				

2 002 D

	col 4	col 5	col 7	col 8
row2	1_{1}		1_{23}	
row3	1_{2}	1_{3}		1_{1}
row6			1_{1}	1_{23}
row9	1_{3}	1_{12}		

2 003 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							5_{3}	5_{12}	
row3				5_{23}		5_{1}			
row4									
row5		X							
row6									X
row7				5_{1}		5_{2}		5_{3}	
row8	X								
row9						5_{3}	5_{12}		

2 003 D

	col 4	col 6	col 7	col 8
row2			5_{3}	5_{12}
row3	5_{23}	5_{1}		
row7	5_{1}	5_{2}		5_{3}
row9		5_{3}	5_{12}	

2 004 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							9_{1}	9_{23}	
row2				X					
row3			X						
row4					9_{1}		9_{23}		
row5					9_{2}	9_{3}		9_{1}	
row6		X							
row7	9_{3}					9_{12}			
row8	9_{12}				9_{3}				
row9									X

2 004 E

	col 1	col 5	col 6	col 7	col 8
row1				9_{1}	9_{23}
row4		9_{1}		9_{23}	
row5		9_{2}	9_{3}		9_{1}
row7	9_{3}		9_{12}		
row8	9_{12}	9_{3}			

2 005 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{34}								1_{12}
row2		1_{12}					1_{3}	1_{4}	
row3				X					
row4					X				
row5							1_{24}	1_{13}	
row6			X						
row7						X			
row8		1_{34}					1_{1}	1_{2}	
row9	1_{12}								1_{34}

2 005 ML

	col 1	col 2	col 7	col 8	col 9
row1	1_{34}				1_{12}
row2		1_{12}	1_{3}	1_{4}	
row5			1_{24}	1_{13}	
row8		1_{34}	1_{1}	1_{2}	
row9	1_{12}				1_{34}

2 006 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							1_{12}		1_{3}
row3				X					
row4						X			
row5								X	
row6	1_{23}	1_{1}							
row7	1_{1}	1_{2}					1_{3}		
row8					X				
row9		1_{3}							1_{12}

2 006 D

	col 1	col 2	col 7	col 9
row2			1_{12}	1_{3}
row6	1_{23}	1_{1}		
row7	1_{1}	1_{2}	1_{3}	
row9		1_{3}		1_{12}

2 007 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2									X
row3				X					
row4	6_{12}						6_{3}		
row5		6_{3}						6_{12}	
row6					X				
row7		6_{1}				6_{2}		6_{3}	
row8	6_{3}						6_{12}		
row9		6_{2}				6_{13}			

2 007 G2 L

	col 1	col 2	col 6	col 7	col 8
row4	6_{12}			6_{3}	
row5		6_{3}			6_{12}
row7		6_{1}	6_{2}		6_{3}
row8	6_{3}			6_{12}	
row9		6_{2}	6_{13}		

2 008 F

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5_{3}				5_{1}	5_{2}			
row2	5_{12}					5_{3}			
row3								5_{1}	5_{23}
row4							X		
row5		X							
row6				X					
row7			X						
row8						5_{1}		5_{23}	
row9					5_{23}				5_{1}

2 008 F

	col 1	col 5	col 6	col 8	col 9
row1	5_{3}	5_{1}	5_{2}		
row2	5_{12}		5_{3}		
row3				5_{1}	5_{23}
row8			5_{1}	5_{23}	
row9		5_{23}			5_{1}

2 009 X9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}	8_{23}	8_{4}						
row3				X					
row4									X
row5	8_{2}	8_{14}	8_{3}						
row6					X				
row7			8_{12}					8_{34}	
row8	8_{34}							8_{12}	
row9						X			

2 009 X9

	col 1	col 2	col 3	col 8
row2	8_{1}	8_{23}	8_{4}	
row5	8_{2}	8_{14}	8_{3}	
row7			8_{12}	8_{34}
row8	8_{34}			8_{12}

2 010 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2								X	
row3					9_{23}	9_{1}			
row4				X					
row5							9_{12}		9_{3}
row6		X							
row7						9_{23}			9_{1}
row8					9_{1}		9_{3}		9_{2}
row9	X								

2 010 D

	col 5	col 6	col 7	col 9
row3	9_{23}	9_{1}		
row5			9_{12}	9_{3}
row7		9_{23}		9_{1}
row8	9_{1}		9_{3}	9_{2}

2 011 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		6_{3}	6_{12}						
row4							X		
row5			6_{3}	6_{1}		6_{2}			
row6		6_{12}				6_{3}			
row7								X	
row8				6_{23}		6_{1}			
row9	X								

2 011 D

	col 2	col 3	col 4	col 6
row3	6_{3}	6_{12}		
row5		6_{3}	6_{1}	6_{2}
row6	6_{12}			6_{3}
row8			6_{23}	6_{1}

2 012 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				2_{23}			2_{1}		
row3					2_{1}				2_{23}
row4						X			
row5			2_{13}				2_{2}		
row6		2_{2}						2_{13}	
row7					2_{23}				2_{1}
row8		2_{13}						2_{2}	
row9			2_{2}	2_{1}			2_{3}		

2 012 W6

	col 2	col 3	col 4	col 5	col 7	col 8	col 9
row2			2_{23}		2_{1}		
row3				2_{1}			2_{23}
row5		2_{13}			2_{2}		
row6	2_{2}					2_{13}	
row7				2_{23}			2_{1}
row8	2_{13}					2_{2}	
row9		2_{2}	2_{1}		2_{3}		

2 013 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3							3_{24}		3_{13}
row4	3_{34}						3_{1}		3_{2}
row5					X				
row6	3_{12}						3_{3}		3_{4}
row7						X			
row8			X						
row9								X	

2 013 P

	col 1	col 7	col 9
row3		3_{24}	3_{13}
row4	3_{34}	3_{1}	3_{2}
row6	3_{12}	3_{3}	3_{4}

2 014 U3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}		8_{3}	8_{24}		8_{K}			
row3			8_{24}			8_{13}			
row4			8_{1}			8_{2}		8_{34}	
row5	8_{2}		8_{K}	8_{13}		8_{4}			
row6	8_{34}							8_{12}	
row7									X
row8		X							
row9					X				

2 014 U3

	col 1	col 3	col 4	col 6	col 8
row2	8_{1}	8_{3}	8_{24}	8_{K}	
row3		8_{24}		8_{13}	
row4		8_{1}		8_{2}	8_{34}
row5	8_{2}	8_{K}	8_{13}	8_{4}	
row6	8_{34}				8_{12}

2 015 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3	2_{13}		2_{2}						
row4		2_{1}						2_{23}	
row5	2_{2}		2_{3}				2_{1}		
row6				X					
row7		2_{23}				2_{1}			
row8			2_{1}				2_{23}		
row9						2_{23}		2_{1}	

2 015 G2 L

	col 1	col 2	col 3	col 6	col 7	col 8
row3	2_{13}		2_{2}			
row4		2_{1}				2_{23}
row5	2_{2}		2_{3}		2_{1}	
row7		2_{23}		2_{1}		
row8			2_{1}		2_{23}	
row9				2_{23}		2_{1}

2 016 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4			5_{12}					5_{34}	
row5	5_{3}			5_{24}			5_{1}		
row6	5_{4}			5_{13}			5_{2}		
row7						X			
row8	5_{12}						5_{34}		
row9			5_{34}					5_{12}	

2 016 ML

	col 1	col 3	col 4	col 7	col 8
row4		5_{12}			5_{34}
row5	5_{3}		5_{24}	5_{1}	
row6	5_{4}		5_{13}	5_{2}	
row8	5_{12}			5_{34}	
row9		5_{34}			5_{12}

2 017 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					5_{1}			5_{23}	
row2				5_{2}		5_{3}	5_{1}		
row3	X								
row4				5_{3}		5_{12}			
row5		X							
row6									X
row7			X						
row8				5_{1}			5_{23}		
row9					5_{23}			5_{1}	

2 017 G2 L

	col 4	col 5	col 6	col 7	col 8
row1		5_{1}			5_{23}
row2	5_{2}		5_{3}	5_{1}	
row4	5_{3}		5_{12}		
row8	5_{1}			5_{23}	
row9		5_{23}			5_{1}

2 018 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3			X						
row4	6_{34}						6_{1}		6_{2}
row5					X				
row6	6_{12}						6_{3}		6_{4}
row7		6_{24}							6_{13}
row8				X					
row9		6_{13}					6_{24}		

2 018 Q

	col 1	col 2	col 7	col 9
row4	6_{34}		6_{1}	6_{2}
row6	6_{12}		6_{3}	6_{4}
row7		6_{24}		6_{13}
row9		6_{13}	6_{24}	

2 019 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2	6_{12}								6_{3}
row3		6_{3}						6_{12}	
row4		6_{1}		6_{23}					
row5	6_{3}								6_{12}
row6		6_{2}		6_{1}				6_{3}	
row7			X						
row8					X				
row9							X		

2 019 G2 L

	col 1	col 2	col 4	col 8	col 9
row2	6_{12}				6_{3}
row3		6_{3}		6_{12}	
row4		6_{1}	6_{23}		
row5	6_{3}				6_{12}
row6		6_{2}	6_{1}	6_{3}	

2 020 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{3}			1_{1}	1_{2}				
row2	1_{12}					1_{3}			
row3									X
row4							X		
row5		X							
row6				1_{23}	1_{1}				
row7			X						
row8								X	
row9					1_{3}	1_{12}			

2 020 D

	col 1	col 4	col 5	col 6
row1	1_{3}	1_{1}	1_{2}	
row2	1_{12}			1_{3}
row6		1_{23}	1_{1}	
row9			1_{3}	1_{12}

2 021 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				2_{3}		2_{12}			
row3	X								
row4					2_{1}			2_{23}	
row5				2_{2}		2_{3}	2_{1}		
row6			X						
row7		X							
row8				2_{1}			2_{23}		
row9					2_{23}			2_{1}	

2 021 G2 L

	col 4	col 5	col 6	col 7	col 8
row2	2_{3}		2_{12}		
row4		2_{1}			2_{23}
row5	2_{2}		2_{3}	2_{1}	
row8	2_{1}			2_{23}	
row9		2_{23}			2_{1}

2 022 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	$1_{\mathbf{1}}$			$1_{\mathbf{23}}$			$1_{\mathbf{4}}$		
row2	$1_{\mathbf{2}}$			$1_{\mathbf{14}}$			$1_{\mathbf{3}}$		
row3			$1_{\mathbf{34}}$					$1_{\mathbf{12}}$	
row4						X			
row5		X							
row6									X
row7	$1_{\mathbf{34}}$						$1_{\mathbf{12}}$		
row8					X				
row9			$1_{\mathbf{12}}$					$1_{\mathbf{34}}$	

2 022 ML

	col 1	col 3	col 4	col 7	col 8
row1	$1_{\mathbf{1}}$		$1_{\mathbf{23}}$	$1_{\mathbf{4}}$	
row2	$1_{\mathbf{2}}$		$1_{\mathbf{14}}$	$1_{\mathbf{3}}$	
row3		$1_{\mathbf{34}}$			$1_{\mathbf{12}}$
row7	$1_{\mathbf{34}}$			$1_{\mathbf{12}}$	
row9		$1_{\mathbf{12}}$			$1_{\mathbf{34}}$

2 023 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3						X			
row4			3_{3}	3_{1}	3_{2}				
row5			3_{12}	3_{3}					
row6									X
row7							X		
row8		X							
row9				3_{2}	3_{13}				

2 023 A1

	col 3	col 4	col 5
row4	3_{3}	3_{1}	3_{2}
row5	3_{12}	3_{3}	
row9		3_{2}	3_{13}

2 024 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9_{34}			9_{1}			9_{2}	
row2				9_{23}					9_{14}
row3		9_{12}			9_{4}			9_{3}	
row4					9_{23}			9_{14}	
row5				9_{14}					9_{23}
row6	X								
row7						X			
row8			X						
row9							X		

2 024 ML

	col 2	col 4	col 5	col 8	col 9
row1	9_{34}		9_{1}	9_{2}	
row2		9_{23}			9_{14}
row3	9_{12}		9_{4}	9_{3}	
row4			9_{23}	9_{14}	
row5		9_{14}			9_{23}

2 025 U2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					8_{24}	8_{13}			
row2		8_{1}	8_{2}				8_{34}		
row3		8_{3}	8_{4}			8_{K}	8_{12}		
row4			8_{13}			8_{24}			
row5		8_{24}			8_{13}				
row6								X	
row7	X								
row8				X					
row9									X

2 025 U2

	col 2	col 3	col 5	col 6	col 7
row1			8_{24}	8_{13}	
row2	8_{1}	8_{2}			8_{34}
row3	8_{3}	8_{4}		8_{K}	8_{12}
row4		8_{13}		8_{24}	
row5	8_{24}		8_{13}		

2 026 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								1_{12}	1_{3}
row2			1_{13}			1_{2}			
row3		1_{2}				1_{13}			
row4	X								
row5				X					
row6							X		
row7					X				
row8		1_{1}	1_{2}					1_{3}	
row9		1_{3}							1_{12}

2 026 E

	col 2	col 3	col 6	col 8	col 9
row1				1_{12}	1_{3}
row2		1_{13}	1_{2}		
row3	1_{2}		1_{13}		
row8	1_{1}	1_{2}		1_{3}	
row9	1_{3}				1_{12}

2 027 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		9_{13}					9_{2}		
row3	9_{2}								9_{13}
row4								X	
row5			X						
row6						X			
row7	9_{1}			9_{3}					9_{2}
row8		9_{2}					9_{13}		
row9	9_{3}			9_{12}					

2 027 G2 L

	col 1	col 2	col 4	col 7	col 9
row2		9_{13}		9_{2}	
row3	9_{2}				9_{13}
row7	9_{1}		9_{3}		9_{2}
row8		9_{2}		9_{13}	
row9	9_{3}		9_{12}		

2 028 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}	1_{2}					1_{34}	
row2		1_{3}	1_{4}					1_{12}	
row3					X				
row4				X					
row5	X								
row6									X
row7							X		
row8		1_{24}	1_{13}						
row9						X			

2 028 P

	col 2	col 3	col 8
row1	1_{1}	1_{2}	1_{34}
row2	1_{3}	1_{4}	1_{12}
row8	1_{24}	1_{13}	

2 029 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_{2}		1_{3}		1_{1}		
row2			1_{13}				1_{2}		
row3						1_{12}			1_{3}
row4	X								
row5						1_{3}			1_{12}
row6					1_{12}		1_{3}		
row7								X	
row8		X							
row9				X					

2 029 G2 L

	col 3	col 5	col 6	col 7	col 9
row1	1_{2}	1_{3}		1_{1}	
row2	1_{13}			1_{2}	
row3			1_{12}		1_{3}
row5			1_{3}		1_{12}
row6		1_{12}		1_{3}	

2 030 A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2							X		
row3	3_{1}	3_{2}	3_{3}						
row4	3_{2}	3_{13}							
row5								X	
row6					X				
row7						X			
row8	3_{3}		3_{12}						
row9									X

2 030 A3

	col 1	col 2	col 3
row3	3_{1}	3_{2}	3_{3}
row4	3_{2}	3_{13}	
row8	3_{3}		3_{12}

2 031 H

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				2_{3}		2_{12}			
row3	X								
row4					2_{1}			2_{23}	
row5				2_{2}		2_{3}	2_{1}		
row6			X						
row7		X							
row8				2_{1}			2_{23}		
row9					2_{23}			2_{1}	

2 031 H

	col 4	col 5	col 6	col 7	col 8
row2	2_{3}		2_{12}		
row4		2_{1}			2_{23}
row5	2_{2}		2_{3}	2_{1}	
row8	2_{1}			2_{23}	
row9		2_{23}			2_{1}

2 032 W6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				5_{23}			5_{1}		
row3					5_{1}			5_{K}	5_{23}
row4						X			
row5			5_{13}				5_{2}		
row6		5_{2}						5_{13}	
row7		5_{K}			5_{23}				5_{1}
row8		5_{13}						5_{2}	
row9			5_{2}	5_{1}			5_{3}		

2 032 W6

	col 2	col 3	col 4	col 5	col 7	col 8	col 9
row2			5_{23}		5_{1}		
row3				5_{1}		5_{K}	5_{23}
row5		5_{13}			5_{2}		
row6	5_{2}					5_{13}	
row7	5_{K}			5_{23}			5_{1}
row8	5_{13}					5_{2}	
row9		5_{2}	5_{1}		5_{3}		

2 033 W8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}			1_{23}				
row2	1_{2}		1_{K}	1_{1}			1_{3}		
row3			1_{3}					1_{12}	
row4			1_{12}					1_{3}	
row5	1_{3}		1_{K}				1_{12}		
row6						X			
row7									X
row8	1_{1}			1_{23}					
row9		1_{23}			1_{1}				

2 033 W8

	col 1	col 2	col 3	col 4	col 5	col 7	col 8
row1		1_{1}			1_{23}		
row2	1_{2}		1_{K}	1_{1}		1_{3}	
row3			1_{3}				1_{12}
row4			1_{12}				1_{3}
row5	1_{3}		1_{K}			1_{12}	
row8	1_{1}			1_{23}			
row9		1_{23}			1_{1}		

2 034 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2									X
row3	X								
row4							X		
row5			1_{14}			1_{23}			
row6		1_{23}			1_{14}				
row7		1_{1}			1_{2}			1_{34}	
row8			1_{23}			1_{14}			
row9		1_{4}			1_{3}			1_{12}	

2 034 ML

	col 2	col 3	col 5	col 6	col 8
row5		1_{14}		1_{23}	
row6	1_{23}		1_{14}		
row7	1_{1}		1_{2}		1_{34}
row8		1_{23}		1_{14}	
row9	1_{4}		1_{3}		1_{12}

2 035 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_{34}			3_{12}	
row2						3_{12}	3_{3}		3_{4}
row3	X								
row4		X							
row5							3_{24}		3_{13}
row6				X					
row7			X						
row8						3_{34}	3_{1}		3_{2}
row9					3_{12}			3_{34}	

2 035 ML

	col 5	col 6	col 7	col 8	col 9
row1	3_{34}			3_{12}	
row2		3_{12}	3_{3}		3_{4}
row5			3_{24}		3_{13}
row8		3_{34}	3_{1}		3_{2}
row9	3_{12}			3_{34}	

2 036 G4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9_{3}	9_{12}						
row2						X			
row3							X		
row4								X	
row5		9_{12}		9_{3}					
row6	9_{3}				9_{12}				
row7	9_{1}								9_{23}
row8	9_{2}				9_{3}				9_{1}
row9			9_{3}	9_{12}					

2 036 G4 L

	col 1	col 2	col 3	col 4	col 5	col 9
row1		9_{3}	9_{12}			
row5		9_{12}		9_{3}		
row6	9_{3}				9_{12}	
row7	9_{1}					9_{23}
row8	9_{2}				9_{3}	9_{1}
row9			9_{3}	9_{12}		

2 037 U3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{34}			2_{1}	2_{2}	
row2		X							
row3						2_{12}		2_{34}	
row4			2_{24}			2_{3}		2_{1}	
row5			2_{13}			2_{4}	2_{2}		
row6				2_{12}			2_{34}	2_{K}	
row7									X
row8					X				
row9	X								

2 037 U3

	col 3	col 4	col 6	col 7	col 8
row1		2_{34}		2_{1}	2_{2}
row3			2_{12}		2_{34}
row4	2_{24}		2_{3}		2_{1}
row5	2_{13}		2_{4}	2_{2}	
row6		2_{12}		2_{34}	2_{K}

2 038 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2								X	
row3					8_{13}	8_{2}			
row4	X								
row5						8_{1}	8_{23}		
row6					8_{2}	8_{3}	8_{1}		
row7									X
row8		X							
row9				X					

2 038 A1

	col 5	col 6	col 7
row3	8_{13}	8_{2}	
row5		8_{1}	8_{23}
row6	8_{2}	8_{3}	8_{1}

2 039

A4 L	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{1}		7_{2}						7_{3}
row2					X				
row3		7_{3}							7_{12}
row4							X		
row5		7_{12}	7_{3}						
row6				X					
row7						X			
row8								X	
row9	7_{23}		7_{1}						

2 039

A4 L	col 1	col 2	col 3	col 9
row1	7_{1}		7_{2}	7_{3}
row3		7_{3}		7_{12}
row5		7_{12}	7_{3}	
row9	7_{23}		7_{1}	

2 040 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2	X								
row3							X		
row4					5_{14}			5_{23}	
row5						5_{23}			5_{14}
row6			X						
row7		5_{34}			5_{2}			5_{1}	
row8						5_{14}			5_{23}
row9		5_{12}			5_{3}			5_{4}	

2 040 ML

	col 2	col 5	col 6	col 8	col 9
row4		5_{14}		5_{23}	
row5			5_{23}		5_{14}
row7	5_{34}	5_{2}		5_{1}	
row8			5_{14}		5_{23}
row9	5_{12}	5_{3}		5_{4}	

2 041 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3				X					
row4			7_{34}				7_{1}		7_{2}
row5						X			
row6			7_{12}				7_{3}		7_{4}
row7		X							
row8					7_{24}				7_{13}
row9					7_{13}		7_{24}		

2 041 Q

	col 3	col 5	col 7	col 9
row4	7_{34}		7_{1}	7_{2}
row6	7_{12}		7_{3}	7_{4}
row8		7_{24}		7_{13}
row9		7_{13}	7_{24}	

2 042 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9_{34}			9_{1}			9_{2}	
row2				9_{23}					9_{14}
row3		9_{12}			9_{4}			9_{3}	
row4					9_{23}			9_{14}	
row5				9_{14}					9_{23}
row6	X								
row7						X			
row8			X						
row9							X		

2 042 ML

	col 2	col 4	col 5	col 8	col 9
row1	9_{34}		9_{1}	9_{2}	
row2		9_{23}			9_{14}
row3	9_{12}		9_{4}	9_{3}	
row4			9_{23}	9_{14}	
row5		9_{14}			9_{23}

2 043 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}					4_{23}	4_{4}		
row2	4_{2}					4_{14}	4_{3}		
row3			4_{34}					4_{12}	
row4				X					
row5		X							
row6									X
row7	4_{34}						4_{12}		
row8					X				
row9			4_{12}					4_{34}	

2 043 ML

	col 1	col 3	col 6	col 7	col 8
row1	4_{1}		4_{23}	4_{4}	
row2	4_{2}		4_{14}	4_{3}	
row3		4_{34}			4_{12}
row7	4_{34}			4_{12}	
row9		4_{12}			4_{34}

2 044 F

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					3_{3}			3_{12}	
row2						3_{12}	3_{3}		
row3	X								
row4		3_{23}			3_{1}				
row5		3_{1}			3_{2}	3_{3}			
row6									X
row7			X						
row8							3_{12}	3_{3}	
row9				X					

2 044 F

	col 2	col 5	col 6	col 7	col 8
row1		3_{3}			3_{12}
row2			3_{12}	3_{3}	
row4	3_{23}	3_{1}			
row5	3_{1}	3_{2}	3_{3}		
row8				3_{12}	3_{3}

2 045 G5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{23}						1_{1}	
row2				1_{13}					1_{2}
row3		1_{1}			1_{2}			1_{3}	
row4				1_{2}		1_{13}			
row5			X						
row6							X		
row7					1_{13}			1_{2}	
row8						1_{2}			1_{13}
row9	X								

2 045 G5 L

	col 2	col 4	col 5	col 6	col 8	col 9
row1	1_{23}				1_{1}	
row2		1_{13}				1_{2}
row3	1_{1}		1_{2}		1_{3}	
row4		1_{2}		1_{13}		
row7			1_{13}		1_{2}	
row8				1_{2}		1_{13}

2 046 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				6_{2}					6_{13}
row3					6_{13}			6_{2}	
row4		6_{3}			6_{2}			6_{1}	
row5				6_{13}					6_{2}
row6		6_{12}						6_{3}	
row7							X		
row8			X						
row9						X			

2 046 G2 L

	col 2	col 4	col 5	col 8	col 9
row2		6_{2}			6_{13}
row3			6_{13}	6_{2}	
row4	6_{3}		6_{2}	6_{1}	
row5		6_{13}			6_{2}
row6	6_{12}			6_{3}	

2 047 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_{1}	1_{2}			1_{3}
row2	X								
row3					1_{3}				1_{12}
row4								X	
row5					1_{2}	1_{13}			
row6		X							
row7				X					
row8							X		
row9			X						

2 047 A1

	col 5	col 6	col 9
row1	1_{1}	1_{2}	1_{3}
row3	1_{3}		1_{12}
row5	1_{2}	1_{13}	

2 048 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{1}	2_{2}		2_{3}		
row2					2_{3}		2_{12}		
row3			X						
row4									X
row5						X			
row6		X							
row7				2_{23}	2_{1}				
row8								X	
row9	X								

2 048 A1

	col 4	col 5	col 7
row1	2_{1}	2_{2}	2_{3}
row2		2_{3}	2_{12}
row7	2_{23}	2_{1}	

2 049 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2						X			
row3									X
row4	1_{1}				1_{2}		1_{3}		
row5				1_{13}				1_{2}	
row6	1_{23}						1_{1}		
row7				1_{2}				1_{13}	
row8					1_{13}		1_{2}		
row9			X						

2 049 G2 L

	col 1	col 4	col 5	col 7	col 8
row4	1_{1}		1_{2}	1_{3}	
row5		1_{13}			1_{2}
row6	1_{23}			1_{1}	
row7		1_{2}			1_{13}
row8			1_{13}	1_{2}	

2 050 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{1}				2_{23}			
row2							X		
row3	2_{23}					2_{1}			
row4									X
row5			X						
row6				X					
row7					X				
row8	2_{1}	2_{2}						2_{3}	
row9		2_{3}						2_{12}	

2 050 D

	col 1	col 2	col 6	col 8
row1		2_{1}	2_{23}	
row3	2_{23}		2_{1}	
row8	2_{1}	2_{2}		2_{3}
row9		2_{3}		2_{12}

2 051 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{3}			1_{1}	1_{2}				
row2	1_{12}					1_{3}			
row3									X
row4							X		
row5		X							
row6				1_{23}	1_{1}				
row7			X						
row8								X	
row9					1_{3}	1_{12}			

2 051 A4 L

	col 1	col 4	col 5	col 6
row1	1_{3}	1_{1}	1_{2}	
row2	1_{12}			1_{3}
row6		1_{23}	1_{1}	
row9			1_{3}	1_{12}

2 052 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2	7_{34}			7_{1}		7_{2}			
row3	7_{12}			7_{3}		7_{4}			
row4			X						
row5					X				
row6							X		
row7				7_{24}		7_{13}			
row8		X							
row9									X

2 052 P

	col 1	col 4	col 6
row2	7_{34}	7_{1}	7_{2}
row3	7_{12}	7_{3}	7_{4}
row7		7_{24}	7_{13}

2 053 L2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2					3_{1}			3_{23}	
row3				3_{2}	3_{3}				3_{1}
row4			X						
row5						X			
row6							X		
row7				3_{3}	3_{2}			3_{1}	
row8	X								
row9				3_{1}					3_{23}

2 053 L2

	col 4	col 5	col 8	col 9
row2		3_{1}	3_{23}	
row3	3_{2}	3_{3}		3_{1}
row7	3_{3}	3_{2}	3_{1}	
row9	3_{1}			3_{23}

2 054 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		5_{12}			5_{3}			5_{4}	
row2				5_{14}					5_{23}
row3		5_{34}			5_{2}			5_{1}	
row4	X								
row5				5_{23}					5_{14}
row6					5_{14}			5_{23}	
row7						X			
row8			X						
row9							X		

2 054 ML

	col 2	col 4	col 5	col 8	col 9
row1	5_{12}		5_{3}	5_{4}	
row2		5_{14}			5_{23}
row3	5_{34}		5_{2}	5_{1}	
row5		5_{23}			5_{14}
row6			5_{14}	5_{23}	

2 055 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		5_{23}			5_{4}			5_{1}	
row2		5_{14}			5_{3}			5_{2}	
row3						5_{12}			5_{34}
row4	X								
row5							X		
row6				X					
row7						5_{34}			5_{12}
row8			X						
row9					5_{12}			5_{34}	

2 055 ML

	col 2	col 5	col 6	col 8	col 9
row1	5_{23}	5_{4}		5_{1}	
row2	5_{14}	5_{3}		5_{2}	
row3			5_{12}		5_{34}
row7			5_{34}		5_{12}
row9		5_{12}		5_{34}	

2 056 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_{1}	3_{2}			3_{3}				
row2		3_{3}			3_{12}				
row3							X		
row4	3_{23}	3_{1}							
row5				X					
row6								X	
row7						X			
row8									
row9			X						X

2 056 A1

	col 1	col 2	col 5
row1	3_{1}	3_{2}	3_{3}
row2		3_{3}	3_{12}
row4	3_{23}	3_{1}	

2 057 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				1_{34}			1_{1}		1_{2}
row3					1_{12}		1_{3}		1_{4}
row4	X								
row5								X	
row6				1_{12}	1_{34}				
row7						X			
row8							1_{24}		1_{13}
row9		X							

2 057 Q

	col 4	col 5	col 7	col 9
row2	1_{34}		1_{1}	1_{2}
row3		1_{12}	1_{3}	1_{4}
row6	1_{12}	1_{34}		
row8			1_{24}	1_{13}

2 058 R

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				X					
row3	2_{24}	2_{13}							
row4	2_{1}		2_{2}		2_{34}				
row5							X		
row6	2_{3}		2_{4}		2_{12}				
row7								X	
row8						X			
row9		2_{24}	2_{13}						

2 058 R

	col 1	col 2	col 3	col 5
row3	2_{24}	2_{13}		
row4	2_{1}		2_{2}	2_{34}
row6	2_{3}		2_{4}	2_{12}
row9		2_{24}	2_{13}	

2 059 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				2_{3}		2_{12}			
row3	X								
row4					2_{1}			2_{23}	
row5				2_{2}		2_{3}	2_{1}		
row6			X						
row7		X							
row8				2_{1}			2_{23}		
row9					2_{23}			2_{1}	

2 059 G2 L

	col 4	col 5	col 6	col 7	col 8
row2	2_{3}		2_{12}		
row4		2_{1}			2_{23}
row5	2_{2}		2_{3}	2_{1}	
row8	2_{1}			2_{23}	
row9		2_{23}			2_{1}

2 060 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	6_{12}						6_{34}		
row2					X				
row3		6_{34}							6_{12}
row4						X			
row5								X	
row6			X						
row7	6_{3}			6_{24}			6_{1}		
row8	6_{4}			6_{13}			6_{2}		
row9		6_{12}							6_{34}

2 060 ML

	col 1	col 2	col 4	col 7	col 9
row1	6_{12}			6_{34}	
row3		6_{34}			6_{12}
row7	6_{3}		6_{24}	6_{1}	
row8	6_{4}		6_{13}	6_{2}	
row9		6_{12}			6_{34}

2 061 W4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						6_{2}		6_{13}	
row2		X							
row3					6_{13}			6_{2}	
row4				6_{1}	6_{2}	6_{3}			
row5	X								
row6							X		
row7									X
row8			X						
row9				6_{23}		6_{1}			

2 061 W4

	col 4	col 5	col 6	col 8
row1			6_{2}	6_{13}
row3		6_{13}		6_{2}
row4	6_{1}	6_{2}	6_{3}	
row9	6_{23}		6_{1}	

2 062 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		6_3		6_1		6_2			
row2			6_{12}		6_3				
row3							X		
row4								X	
row5		6_{12}		6_3					
row6			6_3		6_{12}				
row7				6_2		6_{13}			
row8									X
row9	X								

2 062 G2 L

	col 2	col 3	col 4	col 5	col 6
row1	6_3		6_1		6_2
row2		6_{12}		6_3	
row5	6_{12}		6_3		
row6		6_3		6_{12}	
row7			6_2		6_{13}

2 063 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3							X		
row4								X	
row5			1_{12}		1_{3}				
row6	1_{3}					1_{12}			
row7	1_{1}								1_{23}
row8			1_{3}		1_{12}				
row9	1_{2}					1_{3}			1_{1}

2 063 G2 L

	col 1	col 3	col 5	col 6	col 9
row5		1_{12}	1_{3}		
row6	1_{3}			1_{12}	
row7	1_{1}				1_{23}
row8		1_{3}	1_{12}		
row9	1_{2}			1_{3}	1_{1}

2 064 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2		X							
row3						X			
row4									X
row5				2_{34}	2_{12}				
row6	2_{24}		2_{13}						
row7							X		
row8	2_{1}		2_{2}		2_{34}				
row9	2_{3}		2_{4}	2_{12}					

2 064 Q

	col 1	col 3	col 4	col 5
row5			2_{34}	2_{12}
row6	2_{24}	2_{13}		
row8	2_{1}	2_{2}		2_{34}
row9	2_{3}	2_{4}	2_{12}	

2 065
U

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{34}		2_{1}		2_{2}			
row2								X	
row3	2_{2}	2_{1}		2_{3}	2_{4}				
row4			X						
row5				2_{4}	2_{123}				
row6							X		
row7		2_{2}				2_{134}			
row8									X
row9	2_{134}			2_{2}					

2 065
U

	col 1	col 2	col 4	col 5	col 6
row1		2_{34}	2_{1}		2_{2}
row3	2_{2}	2_{1}	2_{3}	2_{4}	
row5			2_{4}	2_{123}	
row7		2_{2}			2_{134}
row9	2_{134}		2_{2}		

2 066 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{23}				4_{1}				
row2	4_{1}				4_{2}	4_{3}			
row3									X
row4		X							
row5							X		
row6				X					
row7					4_{3}	4_{12}			
row8								X	
row9			X						

2 066 A1

	col 1	col 5	col 6
row1	4_{23}	4_{1}	
row2	4_{1}	4_{2}	4_{3}
row7		4_{3}	4_{12}

2 067 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	6_{1}	6_{2}							6_{3}
row2			6_{3}				6_{12}		
row3				X					
row4					X				
row5			6_{12}				6_{3}		
row6	6_{3}								6_{12}
row7						X			
row8								X	
row9	6_{2}	6_{13}							

2 067 G2 L

	col 1	col 2	col 3	col 7	col 9
row1	6_{1}	6_{2}			6_{3}
row2			6_{3}	6_{12}	
row5			6_{12}	6_{3}	
row6	6_{3}				6_{12}
row9	6_{2}	6_{13}			

2 068 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	4_{1}		4_{2}		4_{3}				
row3			4_{3}		4_{12}				
row4						X			
row5	4_{23}		4_{1}						
row6								X	
row7							X		
row8		X							
row9				X					

2 068 A1

	col 1	col 3	col 5
row2	4_{1}	4_{2}	4_{3}
row3		4_{3}	4_{12}
row5	4_{23}	4_{1}	

2 069 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{1}		1_{2}				1_{34}		
row2				X					
row3		1_{34}						1_{12}	
row4	1_{24}		1_{13}						
row5									X
row6					X				
row7		1_{12}						1_{34}	
row8						X			
row9	1_{3}		1_{4}				1_{12}		

2 069 ML

	col 1	col 2	col 3	col 7	col 8
row1	1_{1}		1_{2}	1_{34}	
row3		1_{34}			1_{12}
row4	1_{24}		1_{13}		
row7		1_{12}			1_{34}
row9	1_{3}		1_{4}	1_{12}	

2 070 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2						X			
row3		X							
row4				4_{2}	4_{13}				
row5	X								
row6								X	
row7				4_{1}					4_{23}
row8			4_{3}		4_{2}				4_{1}
row9			4_{12}	4_{3}					

2 070 A4 L

	col 3	col 4	col 5	col 9
row4		4_{2}	4_{13}	
row7		4_{1}		4_{23}
row8	4_{3}		4_{2}	4_{1}
row9	4_{12}	4_{3}		

2 071 F

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2_{23}		2_{1}		
row2						2_{1}	2_{2}		2_{3}
row3	X								
row4		2_{1}				2_{23}			
row5								X	
row6		2_{23}			2_{1}				
row7			X						
row8							2_{3}		2_{12}
row9				X					

2 071 F

	col 2	col 5	col 6	col 7	col 9
row1		2_{23}		2_{1}	
row2			2_{1}	2_{2}	2_{3}
row4	2_{1}		2_{23}		
row6	2_{23}	2_{1}			
row8				2_{3}	2_{12}

2 072 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				3_{2}		3_{13}			
row3							X		
row4		3_{3}			3_{1}	3_{2}			
row5								X	
row6		3_{12}		3_{3}					
row7				3_{1}	3_{23}				
row8									X
row9	X								

2 072 A4 L

	col 2	col 4	col 5	col 6
row2		3_{2}		3_{13}
row4	3_{3}		3_{1}	3_{2}
row6	3_{12}	3_{3}		
row7		3_{1}	3_{23}	

2 073 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{3}		2_{12}			
row2									X
row3			X						
row4	2_{1}	2_{2}				2_{3}			
row5							X		
row6	2_{3}			2_{12}					
row7					X				
row8	2_{2}							2_{13}	
row9		2_{13}						2_{2}	

2 073 E

	col 1	col 2	col 4	col 6	col 8
row1			2_{3}	2_{12}	
row4	2_{1}	2_{2}		2_{3}	
row6	2_{3}		2_{12}		
row8	2_{2}				2_{13}
row9		2_{13}			2_{2}

2 074 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_{3}			1_{1}	1_{2}		
row2					1_{2}				1_{13}
row3			1_{12}			1_{3}			
row4		X							
row5				X					
row6								X	
row7						1_{2}	1_{13}		
row8					1_{13}				1_{2}
row9	X								

2 074 G2 L

	col 3	col 5	col 6	col 7	col 9
row1	1_{3}		1_{1}	1_{2}	
row2		1_{2}			1_{13}
row3	1_{12}		1_{3}		
row7			1_{2}	1_{13}	
row8		1_{13}			1_{2}

2 075 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_{13}			1_{2}	
row2				1_{2}					1_{13}
row3			X						
row4		1_{23}						1_{1}	
row5				1_{13}					1_{2}
row6		1_{1}			1_{2}			1_{3}	
row7							X		
row8	X								
row9						X			

2 075 G2 L

	col 2	col 4	col 5	col 8	col 9
row1			1_{13}	1_{2}	
row2		1_{2}			1_{13}
row4	1_{23}			1_{1}	
row5		1_{13}			1_{2}
row6	1_{1}		1_{2}	1_{3}	

2 076 G3 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2								X	
row3						X			
row4					3_{23}		3_{1}		
row5	3_{13}								3_{2}
row6			3_{2}		3_{1}		3_{3}		
row7	3_{2}								3_{13}
row8			3_{13}				3_{2}		
row9				X					

2 077 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		3_{3}						3_{12}	
row2					X				
row3	3_{12}								3_{3}
row4							X		
row5				X					
row6			X						
row7	3_{3}					3_{2}			3_{1}
row8						3_{13}			3_{2}
row9		3_{12}						3_{3}	

2 078 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{1}				2_{23}			
row2							X		
row3	2_{23}					2_{1}			
row4									X
row5			X						
row6				X					
row7					X				
row8	2_{1}	2_{2}						2_{3}	
row9		2_{3}						2_{12}	

2 078 D

	col 1	col 2	col 6	col 8
row1		2_{1}	2_{23}	
row3	2_{23}		2_{1}	
row8	2_{1}	2_{2}		2_{3}
row9		2_{3}		2_{12}

2 079 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3									X
row4		3_{1}				3_{23}			
row5	3_{2}					3_{1}	3_{3}		
row6		3_{3}					3_{12}		
row7	3_{13}	3_{2}							
row8								X	
row9				X					

2 080 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{1}	2_{2}	2_{3}					
row2			2_{3}	2_{12}					
row3								X	
row4	X								
row5					X				
row6									X
row7						X			
row8			2_{1}				2_{23}		
row9		2_{23}					2_{1}		

2 080 D

	col 2	col 3	col 4	col 7
row1	2_{1}	2_{2}	2_{3}	
row2		2_{3}	2_{12}	
row8		2_{1}		2_{23}
row9	2_{23}			2_{1}

2 081 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2			X						
row3						X			
row4	$2_{\mathbf{1}}$				$2_{\mathbf{2}}$				$2_{\mathbf{34}}$
row5	$2_{\mathbf{23}}$				$2_{\mathbf{14}}$				
row6	$2_{\mathbf{4}}$				$2_{\mathbf{3}}$				$2_{\mathbf{12}}$
row7				X					
row8		X							
row9								X	

2 081 X1

	col 1	col 5	col 9
row4	$2_{\mathbf{1}}$	$2_{\mathbf{2}}$	$2_{\mathbf{34}}$
row5	$2_{\mathbf{23}}$	$2_{\mathbf{14}}$	
row6	$2_{\mathbf{4}}$	$2_{\mathbf{3}}$	$2_{\mathbf{12}}$

2 082 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2						X			
row3									X
row4	2_{3}				2_{2}		2_{1}		
row5				2_{13}				2_{2}	
row6	2_{12}						2_{3}		
row7				2_{2}				2_{13}	
row8					2_{13}		2_{2}		
row9			X						

2 082 G2 L

	col 1	col 4	col 5	col 7	col 8
row4	2_{3}		2_{2}	2_{1}	
row5		2_{13}			2_{2}
row6	2_{12}			2_{3}	
row7		2_{2}			2_{13}
row8			2_{13}	2_{2}	

2 083 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{1}			8_{23}				
row2			8_{2}				8_{13}		
row3		8_{3}			8_{1}			8_{2}	
row4	X								
row5						X			
row6									X
row7				X					
row8			8_{13}				8_{2}		
row9		8_{2}						8_{13}	

2 083 G2 L

	col 2	col 3	col 5	col 7	col 8
row1	8_{1}		8_{23}		
row2		8_{2}		8_{13}	
row3	8_{3}		8_{1}		8_{2}
row8		8_{13}		8_{2}	
row9	8_{2}				8_{13}

2 084 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2				X					
row3			X						
row4		5_{1}			5_{34}			5_{2}	
row5	5_{23}						5_{14}		
row6		5_{4}			5_{12}			5_{3}	
row7						X			
row8	5_{14}						5_{23}		
row9		5_{23}						5_{14}	

2 084 ML

	col 1	col 2	col 5	col 7	col 8
row4		5_{1}	5_{34}		5_{2}
row5	5_{23}			5_{14}	
row6		5_{4}	5_{12}		5_{3}
row8	5_{14}			5_{23}	
row9		5_{23}			5_{14}

2 085 N

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2					X				
row3							X		
row4				8_{3}				8_{4}	8_{12}
row5		X							
row6						8_{124}		8_{3}	
row7				8_{24}		8_{3}		8_{1}	
row8			X						
row9				8_{1}				8_{2}	8_{34}

equivalent to 3.006

2 085 N

	col 4	col 6	col 8	col 9
row4	8_{3}		8_{4}	8_{12}
row6		8_{124}	8_{3}	
row7	8_{24}	8_{3}	8_{1}	
row9	8_{1}		8_{2}	8_{34}

2 086 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		3_{1}			3_{34}			3_{2}	
row2	3_{23}								3_{14}
row3		3_{4}			3_{12}			3_{3}	
row4							X		
row5						X			
row6			X						
row7				X					
row8	3_{14}								3_{23}
row9		3_{23}						3_{14}	

2 086 ML

	col 1	col 2	col 5	col 8	col 9
row1		3_{1}	3_{34}	3_{2}	
row2	3_{23}				3_{14}
row3		3_{4}	3_{12}	3_{3}	
row8	3_{14}				3_{23}
row9		3_{23}		3_{14}	

2 087 N

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						3_{23}			3_{1}
row3					3_{1}			3_{2}	3_{3}
row4					3_{3}			3_{1}	3_{2}
row5		X							
row6					3_{2}	3_{1}		3_{3}	
row7				X					
row8	X								
row9							X		

2 087 N

	col 5	col 6	col 8	col 9
row2		3_{23}		3_{1}
row3	3_{1}		3_{2}	3_{3}
row4	3_{3}		3_{1}	3_{2}
row6	3_{2}	3_{1}	3_{3}	

2 088 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		5_{3}				5_{2}	5_{1}		
row2						5_{13}	5_{2}		
row3	5_{12}								5_{3}
row4								X	
row5					X				
row6			X						
row7				X					
row8	5_{3}								5_{12}
row9		5_{12}					5_{3}		

2 088 G2 L

	col 1	col 2	col 6	col 7	col 9
row1		5_{3}	5_{2}	5_{1}	
row2			5_{13}	5_{2}	
row3	5_{12}				5_{3}
row8	5_{3}				5_{12}
row9		5_{12}		5_{3}	

2 089 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				8_{1}				8_{23}	
row2			X						
row3				8_{2}		8_{3}	8_{1}		
row4				8_{3}		8_{12}			
row5									X
row6		X							
row7							8_{23}	8_{1}	
row8	X								
row9					X				

2 089 D

	col 4	col 6	col 7	col 8
row1	8_{1}			8_{23}
row3	8_{2}	8_{3}	8_{1}	
row4	8_{3}	8_{12}		
row7			8_{23}	8_{1}

2 090 W5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						2_{23}			2_{1}
row2	2_{12}								2_{3}
row3	2_{3}				2_{1}				2_{2}
row4		X							
row5								X	
row6				X					
row7			2_{1}		2_{23}				
row8							X		
row9			2_{23}			2_{1}			

2 090 W5

	col 1	col 3	col 5	col 6	col 9
row1				2_{23}	2_{1}
row2	2_{12}				2_{3}
row3	2_{3}		2_{1}		2_{2}
row7		2_{1}	2_{23}		
row9		2_{23}		2_{1}	

2 091 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2						2_{1}	2_{2}		2_{3}
row3						2_{23}			2_{1}
row4							2_{13}		2_{2}
row5		X							
row6					X				
row7			X						
row8				X					
row9								X	

2 091 A1

	col 6	col 7	col 9
row2	2_{1}	2_{2}	2_{3}
row3	2_{23}		2_{1}
row4		2_{13}	2_{2}

2 092 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3							X		
row4								X	
row5				6_{2}		6_{13}			
row6	X								
row7				6_{1}		6_{2}			6_{3}
row8		X							
row9				6_{3}					6_{12}

2 092 A1

	col 4	col 6	col 9
row5	6_{2}	6_{13}	
row7	6_{1}	6_{2}	6_{3}
row9	6_{3}		6_{12}

2 093 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				X					
row3							X		
row4					8_{1}	8_{23}			
row5								X	
row6		X							
row7									X
row8	8_{3}				8_{2}	8_{1}			
row9	8_{12}				8_{3}				

2 093 A1

	col 1	col 5	col 6
row4		8_{1}	8_{23}
row8	8_{3}	8_{2}	8_{1}
row9	8_{12}	8_{3}	

2 094 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	X								
row3							X		
row4								X	
row5		5_{1}		5_{2}		5_{3}			
row6		5_{23}		5_{1}					
row7									X
row8			X						
row9				5_{3}		5_{12}			

2 094 A1

	col 2	col 4	col 6
row5	5_{1}	5_{2}	5_{3}
row6	5_{23}	5_{1}	
row9		5_{3}	5_{12}

2 095 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				7_{1}		7_{2}	7_{3}		
row3					7_{3}		7_{12}		
row4			X						
row5									X
row6					7_{12}	7_{3}			
row7		X							
row8								X	
row9				7_{23}		7_{1}			

2 095 A4 L

	col 4	col 5	col 6	col 7
row2	7_{1}		7_{2}	7_{3}
row3		7_{3}		7_{12}
row6		7_{12}	7_{3}	
row9	7_{23}		7_{1}	

2 096 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2_{23}				2_{1}
row2					2_{1}			2_{2}	2_{3}
row3			X						
row4							X		
row5						X			
row6	X								
row7				X					
row8								2_{13}	2_{2}
row9		X							

2 096 A1

	col 5	col 8	col 9
row1	2_{23}		2_{1}
row2	2_{1}	2_{2}	2_{3}
row8		2_{13}	2_{2}

2 097 A5 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4			2_{1}	2_{2}			2_{3}		
row5				2_{13}				2_{2}	
row6			2_{23}				2_{1}		
row7						2_{13}	2_{2}		
row8	X								
row9						2_{2}		2_{13}	

2 097 A5 L

	col 3	col 4	col 6	col 7	col 8
row4	2_{1}	2_{2}		2_{3}	
row5		2_{13}			2_{2}
row6	2_{23}			2_{1}	
row7			2_{13}	2_{2}	
row9			2_{2}		2_{13}

2 098 G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2				X					
row3							X		
row4			1_{1}			1_{23}			
row5								X	
row6	1_{23}					1_{1}			
row7	1_{1}		1_{2}		1_{3}				
row8			1_{3}		1_{12}				
row9									X

2 098 G1

	col 1	col 3	col 5	col 6
row4		1_{1}		1_{23}
row6	1_{23}			1_{1}
row7	1_{1}	1_{2}	1_{3}	
row8		1_{3}	1_{12}	

2 099 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2								X	
row3					X				
row4			1_{1}			1_{23}			
row5			1_{23}	1_{1}					
row6							X		
row7	X								
row8				1_{2}		1_{1}			1_{3}
row9				1_{3}					1_{12}

2 099 D

	col 3	col 4	col 6	col 9
row4	1_{1}		1_{23}	
row5	1_{23}	1_{1}		
row8		1_{2}	1_{1}	1_{3}
row9		1_{3}		1_{12}

2 100 W1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3	X								
row4		X							
row5							X		
row6					X				
row7			3_{23}						3_{1}
row8				3_{13}					3_{2}
row9			3_{1}	3_{2}					3_{3}

2 100 W1

	col 3	col 4	col 9
row7	3_{23}		3_{1}
row8		3_{13}	3_{2}
row9	3_{1}	3_{2}	3_{3}

2 101 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2			X						
row3					X				
row4							2_{12}		2_{34}
row5	X								
row6						X			
row7		X							
row8				2_{24}			2_{3}		2_{1}
row9				2_{13}			2_{4}		2_{2}

2 101 P

	col 4	col 7	col 9
row4		2_{12}	2_{34}
row8	2_{24}	2_{3}	2_{1}
row9	2_{13}	2_{4}	2_{2}

2 102 A3

	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X		
row2				7_{13}	7_{2}			
row3		X						
row4	X							
row5			7_{23}		7_{1}			
row6								X
row7	X							
row8							X	
row9			7_{1}	7_{2}	7_{3}			

2 102 A3

	col 4	col 5	col 6
row2		7_{13}	7_{2}
row5	7_{23}		7_{1}
row9	7_{1}	7_{2}	7_{3}

2 103 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2_{13}				2_{2}
row2					2_{2}		2_{13}		
row3	X								
row4				X					
row5		2_{23}							2_{1}
row6		2_{1}					2_{2}		2_{3}
row7			X						
row8								X	
row9						X			

2 103 D

	col 2	col 5	col 7	col 9
row1		2_{13}		2_{2}
row2		2_{2}	2_{13}	
row5	2_{23}			2_{1}
row6	2_{1}		2_{2}	2_{3}

2 104 A6 X

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			9_{12}						9_{3}
row2		9_{3}							9_{12}
row3						X			
row4				X					
row5	9_{2}	9_{1}	9_{3}						
row6								X	
row7					X				
row8	9_{13}	9_{2}							
row9							X		

2 104 A6 X

	col 1	col 2	col 3	col 9
row1			9_{12}	9_{3}
row2		9_{3}		9_{12}
row5	9_{2}	9_{1}	9_{3}	
row8	9_{13}	9_{2}		

2 105 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					2_{3}			2_{1}	2_{2}
row3					2_{12}			2_{3}	
row4							X		
row5						X			
row6	X								
row7				X					
row8								2_{2}	2_{13}
row9		X							

2 105 A1

	col 5	col 8	col 9
row2	2_{3}	2_{1}	2_{2}
row3	2_{12}	2_{3}	
row8		2_{2}	2_{13}

2 106 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			9_{12}			9_{3}			
row2			9_{3}		9_{12}				
row3									X
row4	X								
row5				X					
row6							X		
row7						9_{1}		9_{23}	
row8		X							
row9					9_{3}	9_{2}		9_{1}	

2 106 D

	col 3	col 5	col 6	col 8
row1	9_{12}		9_{3}	
row2	9_{3}	9_{12}		
row7			9_{1}	9_{23}
row9		9_{3}	9_{2}	9_{1}

2 107 A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2			X						
row3									X
row4		9_{1}			9_{2}			9_{3}	
row5					9_{13}		9_{2}		
row6		9_{23}						9_{1}	
row7							9_{13}	9_{2}	
row8	X								
row9				X					

2 107 A4

	col 2	col 5	col 7	col 8
row4	9_{1}	9_{2}		9_{3}
row5		9_{13}	9_{2}	
row6	9_{23}			9_{1}
row7			9_{13}	9_{2}

2 108 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				6_{13}					6_{2}
row3					6_{2}			6_{13}	
row4			6_{1}	6_{2}					6_{3}
row5			6_{23}						6_{1}
row6					6_{13}			6_{2}	
row7						X			
row8		X							
row9							X		

2 108 G2 L

	col 3	col 4	col 5	col 8	col 9
row2		6_{13}			6_{2}
row3			6_{2}	6_{13}	
row4	6_{1}	6_{2}			6_{3}
row5	6_{23}				6_{1}
row6			6_{13}	6_{2}	

2 109 L2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2						9_{12}			9_{3}
row3					9_{3}			9_{1}	9_{2}
row4	X								
row5					9_{12}			9_{3}	
row6						9_{3}		9_{2}	9_{1}
row7			X						
row8							X		
row9				X					

2 109 L2

	col 5	col 6	col 8	col 9
row2		9_{12}		9_{3}
row3	9_{3}		9_{1}	9_{2}
row5	9_{12}		9_{3}	
row6		9_{3}	9_{2}	9_{1}

2 110 A4s

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3						X			
row4									X
row5			X						
row6				4_{23}	4_{1}				
row7					4_{2}			4_{13}	
row8		4_{2}		4_{1}	4_{3}				
row9		4_{13}						4_{2}	

2 110 A4s

	col 2	col 4	col 5	col 8
row6		4_{23}	4_{1}	
row7			4_{2}	4_{13}
row8	4_{2}	4_{1}	4_{3}	
row9	4_{13}			4_{2}

2 111 A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2							X		
row3			X						
row4		7_{3}							7_{12}
row5		7_{12}						7_{3}	
row6				X					
row7					7_{1}			7_{2}	7_{3}
row8	7_{1}				7_{23}				
row9	7_{23}							7_{1}	

2 111 E

	col 1	col 2	col 5	col 8	col 9
row4		7_{3}			7_{12}
row5		7_{12}		7_{3}	
row7			7_{1}	7_{2}	7_{3}
row8	7_{1}		7_{23}		
row9	7_{23}			7_{1}	

2 112 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2							X		
row3				X					
row4		9_{1}	9_{2}					9_{34}	
row5						X			
row6		9_{3}	9_{4}					9_{12}	
row7									X
row8		9_{24}			9_{13}				
row9			9_{13}		9_{24}				

2 112 Q

	col 2	col 3	col 5	col 8
row4	9_{1}	9_{2}		9_{34}
row6	9_{3}	9_{4}		9_{12}
row8	9_{24}		9_{13}	
row9		9_{13}	9_{24}	

2 113 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	2_{1}	2_{23}							
row3					X				
row4	2_{2}	2_{1}		2_{3}					
row5				2_{12}			2_{3}		
row6	2_{3}						2_{12}		
row7								X	
row8						X			
row9									

2 113 D

	col 1	col 2	col 4	col 7
row2	2_{1}	2_{23}		
row4	2_{2}	2_{1}	2_{3}	
row5			2_{12}	2_{3}
row6	2_{3}			2_{12}

2 114 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							1_{13}		1_{2}
row3					X				
row4				1_{23}				1_{1}	
row5			X						
row6				1_{1}			1_{2}	1_{3}	
row7	X								
row8								1_{2}	1_{13}
row9						X			

2 114 D

	col 4	col 7	col 8	col 9
row2		1_{13}		1_{2}
row4	1_{23}		1_{1}	
row6	1_{1}	1_{2}	1_{3}	
row8			1_{2}	1_{13}

2 115 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}	1_{2}		1_{3}				
row2			1_{3}		1_{12}				
row3							X		
row4				X					
row5			1_{1}						1_{23}
row6		1_{23}							1_{1}
row7						X			
row8	X								
row9								X	

2 115 D

	col 2	col 3	col 5	col 9
row1	1_{1}	1_{2}	1_{3}	
row2		1_{3}	1_{12}	
row5		1_{1}		1_{23}
row6	1_{23}			1_{1}

2 116 W2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{12}		2_{3}			
row2	X								
row3								X	
row4				2_{3}	2_{1}	2_{2}			
row5		X							
row6							X		
row7					2_{23}				2_{1}
row8						2_{1}			2_{23}
row9			X						

2 116 W2

	col 4	col 5	col 6	col 9
row1	2_{12}		2_{3}	
row4	2_{3}	2_{1}	2_{2}	
row7		2_{23}		2_{1}
row8			2_{1}	2_{23}

2 117 G2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	X								
row3						X			
row4					1_{12}			1_{3}	
row5				1_{3}					1_{12}
row6			X						
row7		1_{23}		1_{1}					
row8								1_{12}	1_{3}
row9		1_{1}		1_{2}	1_{3}				

2 117 G2

	col 2	col 4	col 5	col 8	col 9
row4			1_{12}	1_{3}	
row5		1_{3}			1_{12}
row7	1_{23}	1_{1}			
row8				1_{12}	1_{3}
row9	1_{1}	1_{2}	1_{3}		

2 118 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2								X	
row3			X						
row4					4_{12}	4_{3}			
row5							4_{2}		4_{13}
row6		X							
row7					4_{3}	4_{1}			4_{2}
row8						4_{2}	4_{13}		
row9	X								

2 118 D

	col 5	col 6	col 7	col 9
row4	4_{12}	4_{3}		
row5			4_{2}	4_{13}
row7	4_{3}	4_{1}		4_{2}
row8		4_{2}	4_{13}	

2 119 E

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_{1}			9_{23}					
row2			9_{23}	9_{1}					
row3								X	
row4						X			
row5									X
row6		X							
row7					9_{3}		9_{12}		
row8	9_{2}		9_{1}				9_{3}		
row9	9_{3}				9_{12}				

2 119 E

	col 1	col 3	col 4	col 5	col 7
row1	9_{1}		9_{23}		
row2		9_{23}	9_{1}		
row7				9_{3}	9_{12}
row8	9_{2}	9_{1}			9_{3}
row9	9_{3}			9_{12}	

2 120 A4 S

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	5_{1}	5_{23}							
row3							X		
row4	5_{23}		5_{1}						
row5				X					
row6								X	
row7		5_{1}	5_{2}						5_{3}
row8			5_{3}						5_{12}
row9						X			

2 120 A4 S

	col 1	col 2	col 3	col 9
row2	5_{1}	5_{23}		
row4	5_{23}		5_{1}	
row7		5_{1}	5_{2}	5_{3}
row8			5_{3}	5_{12}

2 121 W2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2				9_{1}	9_{2}	9_{3}			
row3									
row4						9_{12}	9_{3}		
row5									
row6				9_{3}			9_{12}		
row7									
row8									
row9				9_{2}	9_{13}				

2 121 W2

	col 4	col 5	col 6	col 7
row2	9_{1}	9_{2}	9_{3}	
row4			9_{12}	9_{3}
row6	9_{3}			9_{12}
row9	9_{2}	9_{13}		

2 122 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{12}			1_{3}				
row2		1_{3}		1_{1}	1_{2}				
row3									
row4	1_{1}			1_{23}					
row5	1_{23}				1_{1}				
row6									
row7									
row8									
row9									

2 122 D

	col 1	col 2	col 4	col 5
row1		1_{12}		1_{3}
row2		1_{3}	1_{1}	1_{2}
row4	1_{1}		1_{23}	
row5	1_{23}			1_{1}

2 123 A4 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					2_{1}	2_{23}			
row3									X
row4	X								
row5				2_{12}	2_{3}				
row6							X		
row7				2_{3}		2_{1}		2_{2}	
row8					2_{2}			2_{13}	
row9		X							

2 123 A4 L

	col 4	col 5	col 6	col 8
row2		2_{1}	2_{23}	
row5	2_{12}	2_{3}		
row7	2_{3}		2_{1}	2_{2}
row8		2_{2}		2_{13}

2 124 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			4_{23}		4_{1}				
row3	4_{1}				4_{23}				
row4	4_{2}		4_{1}			4_{3}			
row5	4_{3}					4_{12}			
row6									X
row7				X					
row8							X		
row9		X							

2 124 D

	col 1	col 3	col 5	col 6
row2		4_{23}	4_{1}	
row3	4_{1}		4_{23}	
row4	4_{2}	4_{1}		4_{3}
row5	4_{3}			4_{12}

2 125 R

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2						9_{12}			9_{34}
row3						9_{34}	9_{12}		
row4					9_{24}		9_{3}		9_{1}
row5			X						
row6					9_{13}		9_{4}		9_{2}
row7				X					
row8								X	
row9		X							

2 125 R

	col 5	col 6	col 7	col 9
row2		9_{12}		9_{34}
row3		9_{34}	9_{12}	
row4	9_{24}		9_{3}	9_{1}
row6	9_{13}		9_{4}	9_{2}

2 126 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2							X		
row3					X				
row4									X
row5				1_{12}		1_{34}			
row6			X						
row7								X	
row8		1_{24}		1_{3}		1_{1}			
row9		1_{13}		1_{4}		1_{2}			

2 126 A1

	col 2	col 4	col 6
row5		1_{12}	1_{34}
row8	1_{24}	1_{3}	1_{1}
row9	1_{13}	1_{4}	1_{2}

2 127 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							1_{13}		1_{2}
row3					X				
row4				1_{23}				1_{1}	
row5			X						
row6				1_{1}			1_{2}	1_{3}	
row7	X								
row8								1_{2}	1_{13}
row9						X			

2 127 D

	col 4	col 7	col 8	col 9
row2		1_{13}		1_{2}
row4	1_{23}		1_{1}	
row6	1_{1}	1_{2}	1_{3}	
row8			1_{2}	1_{13}

2 128 Y1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				5_{12}	5_{34}	5_{56}			
row2		X							
row3									X
row4	X								
row5								X	
row6				5_{35}	5_{16}	5_{24}			
row7							X		
row8			X						
row9				5_{46}	5_{25}	5_{13}			

2 128 Y1

	col 4	col 5	col 6
row1	5_{12}	5_{34}	5_{56}
row6	5_{35}	5_{16}	5_{24}
row9	5_{46}	5_{25}	5_{13}

2 129 W3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						8_{2}			8_{13}
row2			8_{2}			8_{13}			
row3		8_{13}							8_{2}
row4					X				
row5	8_{23}		8_{1}						
row6							X		
row7				X					
row8	8_{1}	8_{2}	8_{3}						
row9								X	

2 129 W3

	col 1	col 2	col 3	col 6	col 9
row1				8_{2}	8_{13}
row2			8_{2}	8_{13}	
row3		8_{13}			8_{2}
row5	8_{23}		8_{1}		
row8	8_{1}	8_{2}	8_{3}		

2 130 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2							X		
row3			X						
row4								X	
row5				8_{24}	8_{13}				
row6	X								
row7									X
row8		8_{34}		8_{1}	8_{2}				
row9		8_{12}		8_{3}	8_{4}				

2 130 P

	col 2	col 4	col 5
row5		8_{24}	8_{13}
row8	8_{34}	8_{1}	8_{2}
row9	8_{12}	8_{3}	8_{4}

2 131 X3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{1}				1_{23}	1_{4}		
row2		1_{2}				1_{14}	1_{3}		
row3			1_{34}				1_{12}		
row4		1_{34}	1_{12}						
row5				X					
row6									X
row7					X				
row8								X	
row9	X								

2 131 X3

	col 2	col 3	col 6	col 7
row1	1_{1}		1_{23}	1_{4}
row2	1_{2}		1_{14}	1_{3}
row3		1_{34}		1_{12}
row4	1_{34}	1_{12}		

2 132 P

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		7_{12}	7_{34}						
row2					X				
row3									X
row4	X								
row5								X	
row6						X			
row7		7_{3}	7_{1}				7_{24}		
row8		7_{4}	7_{2}				7_{13}		
row9				X					

2 132 P

	col 2	col 3	col 7
row1	7_{12}	7_{34}	
row7	7_{3}	7_{1}	7_{24}
row8	7_{4}	7_{2}	7_{13}

2 133 Q1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{12}	1_{34}						
row2						X			
row3								1_{13}	1_{24}
row4		1_{3}	1_{1}					1_{24}	
row5					X				
row6		1_{4}	1_{2}						1_{13}
row7				X					
row8	X								
row9							X		

2 133 Q1

	col 2	col 3	col 8	col 9
row1	1_{12}	1_{34}		
row3			1_{13}	1_{24}
row4	1_{3}	1_{1}	1_{24}	
row6	1_{4}	1_{2}		1_{13}

2 134 S

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2								5_{24}	5_{13}
row3		X							
row4	5_{34}			5_{1}		5_{2}			
row5	5_{12}			5_{3}		5_{4}			
row6							X		
row7			X						
row8						5_{13}			5_{24}
row9				5_{24}				5_{13}	

2 134 S

	col 1	col 4	col 6	col 8	col 9
row2				5_{24}	5_{13}
row4	5_{34}	5_{1}	5_{2}		
row5	5_{12}	5_{3}	5_{4}		
row8			5_{13}		5_{24}
row9		5_{24}		5_{13}	

2 135 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{12}								8_{34}
row2	8_{34}						8_{12}		
row3				X					
row4					X				
row5		X							
row6								X	
row7			8_{24}				8_{3}		8_{1}
row8			8_{13}				8_{4}		8_{2}
row9						X			

2 135 Q

	col 1	col 3	col 7	col 9
row1	8_{12}			8_{34}
row2	8_{34}		8_{12}	
row7		8_{24}	8_{3}	8_{1}
row8		8_{13}	8_{4}	8_{2}

2 136 O

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}		1_{3}					1_{4}	
row2				X					
row3			1_{4}				1_{1}	1_{23}	
row4		X							
row5					X				
row6									X
row7			1_{12}				1_{34}		
row8	1_{34}					1_{12}			
row9						1_{34}	1_{2}	1_{1}	

2 136 O

	col 1	col 3	col 6	col 7	col 8
row1	1_{12}	1_{3}			1_{4}
row3		1_{4}		1_{1}	1_{23}
row7		1_{12}		1_{34}	
row8	1_{34}		1_{12}		
row9			1_{34}	1_{2}	1_{1}

2 137 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5_{12}								5_{34}
row2					X				
row3	5_{34}							5_{12}	
row4							X		
row5				X					
row6			X						
row7		5_{24}						5_{3}	5_{1}
row8		5_{13}						5_{4}	5_{2}
row9						X			

2 137 Q

	col 1	col 2	col 8	col 9
row1	5_{12}			5_{34}
row3	5_{34}		5_{12}	
row7		5_{24}	5_{3}	5_{1}
row8		5_{13}	5_{4}	5_{2}

2 138 L3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_{12}	7_{34}			
row2	X								
row3							X		
row4			7_{23}			7_{1}		7_{4}	
row5					7_{34}			7_{12}	
row6			7_{14}			7_{2}		7_{3}	
row7		X							
row8				X					
row9									X

2 138 L3

	col 3	col 5	col 6	col 8
row1		7_{12}	7_{34}	
row4	7_{23}		7_{1}	7_{4}
row5		7_{34}		7_{12}
row6	7_{14}		7_{2}	7_{3}

2 139 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		3_{1}			3_{34}			3_{2}	
row2	3_{23}								3_{14}
row3		3_{4}			3_{12}			3_{3}	
row4				X					
row5							X		
row6			X						
row7		3_{23}						3_{14}	
row8						X			
row9	3_{14}								3_{23}

2 139 ML

	col 1	col 2	col 5	col 8	col 9
row1		3_{1}	3_{34}	3_{2}	
row2	3_{23}				3_{14}
row3		3_{4}	3_{12}	3_{3}	
row7		3_{23}		3_{14}	
row9	3_{14}				3_{23}

2 140 X4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{12}						2_{34}		
row2	2_{3}				2_{24}			2_{1}	
row3	2_{4}				2_{13}			2_{2}	
row4							2_{12}		2_{34}
row5						X			
row6			X						
row7		X							
row8								2_{34}	2_{12}
row9				X					

2 140 X4

	col 1	col 5	col 7	col 8	col 9
row1	2_{12}		2_{34}		
row2	2_{3}	2_{24}		2_{1}	
row3	2_{4}	2_{13}		2_{2}	
row4			2_{12}		2_{34}
row8				2_{34}	2_{12}

2 141 Q

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4							7_{24}	7_{13}	
row5				X					
row6	7_{12}		7_{34}						
row7			7_{12}				7_{3}	7_{4}	
row8	7_{34}						7_{1}	7_{2}	
row9						X			

2 141 Q

	col 1	col 3	col 7	col 8
row4			7_{24}	7_{13}
row6	7_{12}	7_{34}		
row7		7_{12}	7_{3}	7_{4}
row8	7_{34}		7_{1}	7_{2}

2 142 X1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		X							
row4			5_{1}		5_{3}		5_{24}		
row5			5_{2}		5_{4}		5_{13}		
row6			5_{34}		5_{12}				
row7	X								
row8									X
row9				X					

2 142 X1

	col 3	col 5	col 7
row4	5_{1}	5_{3}	5_{24}
row5	5_{2}	5_{4}	5_{13}
row6	5_{34}	5_{12}	

2 143 G6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2	5_{3}						5_{12}		
row3	5_{12}								5_{3}
row4				5_{3}					5_{12}
row5		5_{1}	5_{2}				5_{3}		
row6		5_{3}				5_{12}			
row7				5_{12}		5_{3}			
row8		5_{2}	5_{13}						
row9								X	

2 143 G6

	col 1	col 2	col 3	col 4	col 6	col 7	col 9
row2	5_{3}					5_{12}	
row3	5_{12}						5_{3}
row4				5_{3}			5_{12}
row5		5_{1}	5_{2}			5_{3}	
row6		5_{3}			5_{12}		
row7				5_{12}	5_{3}		
row8		5_{2}	5_{13}				

2 144 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		3_{34}		3_{12}					
row2							X		
row3			3_{12}			3_{34}			
row4			3_{3}			3_{1}			3_{24}
row5			3_{4}			3_{2}			3_{13}
row6		3_{12}		3_{34}					
row7								X	
row8					X				
row9	X								

2 144 ML

	col 2	col 3	col 4	col 6	col 9
row1	3_{34}		3_{12}		
row3		3_{12}		3_{34}	
row4		3_{3}		3_{1}	3_{24}
row5		3_{4}		3_{2}	3_{13}
row6	3_{12}		3_{34}		

2 145 A1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_{23}				1_{1}		
row2				X					
row3			1_{1}				1_{2}		1_{3}
row4								X	
row5						X			
row6		X							
row7							1_{3}		1_{12}
row8					X				
row9	X								

2 145 A1

	col 3	col 7	col 9
row1	1_{23}	1_{1}	
row3	1_{1}	1_{2}	1_{3}
row7		1_{3}	1_{12}

2 146 A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2_{3}	2_{12}			
row2							2_{2}		2_{13}
row3		X							
row4				2_{3}	2_{12}				
row5								X	
row6	X								
row7			X						
row8				2_{1}		2_{3}			2_{2}
row9				2_{2}			2_{13}		

2 146 E

	col 4	col 5	col 6	col 7	col 9
row1		2_{3}	2_{12}		
row2				2_{2}	2_{13}
row4	2_{3}	2_{12}			
row8	2_{1}		2_{3}		2_{2}
row9	2_{2}			2_{13}	

2 147 ML

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			2_{34}				2_{1}		2_{2}
row2				X					
row3		2_{12}						2_{34}	
row4							2_{24}		2_{13}
row5	X								
row6					X				
row7		2_{34}						2_{12}	
row8						X			
row9			2_{12}				2_{3}		2_{4}

2 147 ML

	col 2	col 3	col 7	col 8	col 9
row1		2_{34}	2_{1}		2_{2}
row3	2_{12}			2_{34}	
row4			2_{24}		2_{13}
row7	2_{34}			2_{12}	
row9		2_{12}	2_{3}		2_{4}

2 148 T

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2	9_{1}		9_{2}						9_{34}
row3		9_{3}	9_{4}						9_{12}
row4		9_{24}	9_{13}						
row5								X	
row6						X			
row7	9_{234}	9_{1}							
row8					X				
row9							X		

2 148 T

	col 1	col 2	col 3	col 9
row2	9_{1}		9_{2}	9_{34}
row3		9_{3}	9_{4}	9_{12}
row4		9_{24}	9_{13}	
row7	9_{234}	9_{1}		

2 149 T

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						X			
row3								1_{23}	1_{14}
row4							1_{124}		1_{3}
row5	X								
row6				X					
row7					1_{34}			1_{1}	1_{2}
row8					1_{12}		1_{3}	1_{4}	
row9		X							

2 149 T

	col 5	col 7	col 8	col 9
row3			1_{23}	1_{14}
row4		1_{124}		1_{3}
row7	1_{34}		1_{1}	1_{2}
row8	1_{12}	1_{3}	1_{4}	

2 150 G2 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2					X				
row3							X		
row4				4_{23}				4_{1}	
row5	4_{13}								4_{2}
row6		4_{2}		4_{1}				4_{3}	
row7		4_{13}						4_{2}	
row8	4_{2}								4_{13}
row9						X			

2 150 G2 L

	col 1	col 2	col 4	col 8	col 9
row4			4_{23}	4_{1}	
row5	4_{13}				4_{2}
row6		4_{2}	4_{1}	4_{3}	
row7		4_{13}		4_{2}	
row8	4_{2}				4_{13}

2 151 G3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			8_{2}				8_{13}		
row2						X			
row3	8_{13}								8_{2}
row4	8_{2}		8_{13}						
row5				X					
row6								X	
row7		8_{23}							8_{1}
row8		8_{1}					8_{2}		8_{3}
row9					X				

2 151 G3

	col 1	col 2	col 3	col 7	col 9
row1			8_{2}	8_{13}	
row3	8_{13}				8_{2}
row4	8_{2}		8_{13}		
row7		8_{23}			8_{1}
row8		8_{1}		8_{2}	8_{3}

2 152 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					1_{1}	1_{2}		1_{3}	
row2		X							
row3						1_{3}			1_{12}
row4				X					
row5			X						
row6								1_{12}	1_{3}
row7							X		
row8					1_{23}	1_{1}			
row9	X								

2 152 D

	col 5	col 6	col 8	col 9
row1	1_{1}	1_{2}	1_{3}	
row3		1_{3}		1_{12}
row6			1_{12}	1_{3}
row8	1_{23}	1_{1}		

2 153 M

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2							X		
row3	X								
row4		1_{1}			1_{2}			1_{34}	
row5			1_{23}			1_{14}			
row6		1_{4}			1_{3}			1_{12}	
row7									X
row8			1_{14}			1_{23}			
row9		1_{23}			1_{14}				

2 153 M

	col 2	col 3	col 5	col 6	col 8
row4	1_{1}		1_{2}		1_{34}
row5		1_{23}		1_{14}	
row6	1_{4}		1_{3}		1_{12}
row8		1_{14}		1_{23}	
row9	1_{23}		1_{14}		

2 154 D

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{3}				1_{12}			
row2			1_{12}			1_{3}			
row3							X		
row4	X								
row5									X
row6				X					
row7		1_{1}						1_{23}	
row8					X				
row9		1_{2}	1_{3}					1_{1}	

2 154 D

	col 2	col 3	col 6	col 8
row1	1_{3}		1_{12}	
row2		1_{12}	1_{3}	
row7	1_{1}			1_{23}
row9	1_{2}	1_{3}		1_{1}

2 155 L3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				4_{3}	4_{12}	4_{4}			
row2								X	
row3			X						
row4	4_{34}			4_{1}		4_{2}			
row5	4_{12}				4_{34}				
row6							X		
row7									X
row8		X							
row9				4_{24}		4_{13}			

2 155 L3

	col 1	col 4	col 5	col 6
row1		4_{3}	4_{12}	4_{4}
row4	4_{34}	4_{1}		4_{2}
row5	4_{12}		4_{34}	
row9		4_{24}		4_{13}

2 156 G7 L

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{23}			1_{1}				
row2			1_{1}	1_{2}		1_{3}			
row3							X		
row4		1_{1}						1_{23}	
row5			1_{23}			1_{1}			
row6					1_{23}			1_{1}	
row7									X
row8				1_{13}		1_{2}			
row9	X								

2 156 G7 L

	col 2	col 3	col 4	col 5	col 6	col 8
row1	1_{23}			1_{1}		
row2		1_{1}	1_{2}		1_{3}	
row4	1_{1}					1_{23}
row5		1_{23}			1_{1}	
row6				1_{23}		1_{1}
row8			1_{13}		1_{2}	

2 157 C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	3_{1}				3_{34}				
row3		3_{34}		3_{12}					
row4						X			
row5								X	
row6	3_{23}		3_{14}						
row7							X		
row8	3_{4}		3_{3}		3_{12}				
row9		3_{12}							

2 157 C9

	col 1	col 2	col 3	col 4	col 5
row2	3_{1}				3_{34}
row3		3_{34}		3_{12}	
row6	3_{23}		3_{14}		
row8	3_{4}		3_{3}		3_{12}
row9		3_{12}			

2 158 new	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1								X	
row 2			2_{24}		2_{13}				
row 3	2_{13}	2_{K}			2_{24}	2_{K}			
row 4						2_{12}			2_{34}
row 5		X			2_{K}				
row 6	2_{K}					2_{34}			2_{12}
row 7							X		
row 8				X					
row 9	2_{24}		2_{13}						

	col 1	col 3	col 5	col 6	col 9
row2		2_{24}	2_{13}		
row3	2_{13}		2_{24}	2_{K}	
row4				2_{12}	2_{34}
row6	2_{K}			2_{34}	2_{12}
row9	2_{24}	2_{13}			

2 159 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2						1_{12}	1_{34}		
row3					1_{34}				1_{12}
row4		X							
row5								X	
row6				X					
row7	1_{24}					1_{3}	1_{1}		
row8	1_{13}					1_{4}	1_{2}		
row9					1_{12}				1_{34}

2 159 new

	col 1	col 5	col 6	col 7	col 9
row2			1_{12}	1_{34}	
row3		1_{34}			1_{12}
row7	1_{24}		1_{3}	1_{1}	
row8	1_{13}		1_{4}	1_{2}	
row9		1_{12}			1_{34}

2 160 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	3_{1}		3_{2}		3_{34}				
row3		3_{34}		3_{12}					
row4						X			
row5								X	
row6	3_{23}		3_{14}						
row7							X		
row8	3_{4}		3_{3}		3_{12}				
row9		3_{12}		3_{34}					

2 160 new

	col 1	col 2	col 3	col 4	col 5
row2	3_{1}		3_{2}		3_{34}
row3		3_{34}		3_{12}	
row6	3_{23}		3_{14}		
row8	3_{4}		3_{3}		3_{12}
row9		3_{12}		3_{34}	

2 161 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2						X			
row3			X						
row4	4_{34}								4_{12}
row5		4_{12}					4_{34}		
row6				X					
row7	4_{1}				4_{24}				4_{3}
row8	4_{2}				4_{13}				4_{4}
row9		4_{34}					4_{12}		

2 161 new

	col 1	col 2	col 5	col 7	col 9
row4	4_{34}				4_{12}
row5		4_{12}		4_{34}	
row7	4_{1}		4_{24}		4_{3}
row8	4_{2}		4_{13}		4_{4}
row9		4_{34}		4_{12}	

2 162 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			3_{1}	3_{2}	3_{3}				
row2							X		
row3	3_{23}				3_{1}				
row4						X			
row5			3_{23}					3_{1}	
row6	3_{1}							3_{23}	
row7		X							
row8									X
row9				3_{13}	3_{2}				

2 162 new

	col 1	col 3	col 4	col 5	col 8
row1		3_{1}	3_{2}	3_{3}	
row3	3_{23}			3_{1}	
row5		3_{23}			3_{1}
row6	3_{1}				3_{23}
row9			3_{13}	3_{2}	

2 163 new

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2			1_{3}					1_{12}	
row3		1_{1}	1_{2}				1_{3}		
row4	X								
row5						X			
row6									X
row7					X				
row8		1_{23}					1_{1}		
row9			1_{1}				1_{2}	1_{3}	

2 163 new

	col 2	col 3	col 7	col 8
row2		1_{3}		1_{12}
row3	1_{1}	1_{2}	1_{3}	
row8	1_{23}		1_{1}	
row9		1_{1}	1_{2}	1_{3}

PATTERN FILE 3

3 001
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		6_{4}		6_{1}	6_{2}		6_{3}		
row2				6_{3}			6_{124}		
row3		6_{123}			6_{4}				
row4						X			
row5			X						
row6								X	
row7									X
row8	X								
row9				6_{24}	6_{13}				

3 001
E1

	col 2	col 4	col 5	col 7
row1	6_{4}	6_{1}	6_{2}	6_{3}
row2		6_{3}		6_{124}
row3	6_{123}		6_{4}	
row9		6_{24}	6_{13}	

3 002
F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2			X						
row3					3_{35}	3_{124}			
row4							3_{123}		3_{45}
row5	X								
row6				X					
row7		3_{23}			3_{1}		3_{45}		
row8		3_{145}			3_{2}	3_{3}			
row9					3_{4}	3_{5}			3_{123}

3 002

	col 2	col 5	col 6	col 7	col 9
row3		3_{35}	3_{124}		
row4				3_{123}	3_{45}
row7	3_{23}	3_{1}		3_{45}	
row8	3_{145}	3_{2}	3_{3}		
row9		3_{4}	3_{5}		3_{123}

3 003
G1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{25}							2_{14}	2_{3}
row2						X			
row3			2_{134}					2_{25}	
row4				X					
row5	2_{1}		2_{2}					2_{3}	2_{45}
row6	2_{34}		2_{5}						2_{12}
row7					X				
row8		X							
row9							X		

3 003
G1

	col 1	col 3	col 8	col 9
row1	2_{25}		2_{14}	2_{3}
row3		2_{134}	2_{25}	
row5	2_{1}	2_{2}	2_{3}	2_{45}
row6	2_{34}	2_{5}		2_{12}

3 004
C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{234}	2_{1}	
row2					X				
row3	X								
row4				X					
row5			2_{12}						2_{34}
row6		2_{34}					2_{1}	2_{2}	
row7		2_{12}						2_{34}	
row8			2_{3}			2_{4}			2_{12}
row9			2_{4}			2_{123}			

3 004
C8

	col 2	col 3	col 6	col 7	col 8	col 9
row1				2_{234}	2_{1}	
row5		2_{12}				2_{34}
row6	2_{34}			2_{1}	2_{2}	
row7	2_{12}				2_{34}	
row8		2_{3}	2_{4}			2_{12}
row9		2_{4}	2_{123}			

3 005
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2			X						
row3							5_{1}		5_{234}
row4				5_{1}			5_{234}		
row5	X								
row6				5_{2}		5_{34}			5_{1}
row7		5_{4}		5_{3}		5_{12}			
row8		5_{123}		5_{4}					
row9								X	

3 005

	col 2	col 4	col 6	col 7	col 9
row3				5_{1}	5_{234}
row4		5_{1}		5_{234}	
row6		5_{2}	5_{34}		5_{1}
row7	5_{4}	5_{3}	5_{12}		
row8	5_{123}	5_{4}			

3 006
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					X				
row3		X							
row4	X								
row5				1_{12}		1_{3}	1_{4}		
row6				1_{4}			1_{13}	1_{2}	
row7			X						
row8				1_{3}		1_{14}	1_{2}		
row9						1_{2}		1_{134}	

equivalent to 2.085

3 006

	col 4	col 6	col 7	col 8
row5	1_{12}	1_{3}	1_{4}	
row6	1_{4}		1_{13}	1_{2}
row8	1_{3}	1_{14}	1_{2}	
row9		1_{2}		1_{134}

3 007
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						$7_{\mathbf{34}}$	$7_{\mathbf{1}}$	$7_{\mathbf{2}}$	
row2		X							
row3						$7_{\mathbf{12}}$		$7_{\mathbf{3}}$	$7_{\mathbf{4}}$
row4							$7_{\mathbf{234}}$	$7_{\mathbf{1}}$	
row5			X						
row6					X				
row7								$7_{\mathbf{4}}$	7_{123}
row8				X					
row9	X								

3 007
E1

	col 6	col 7	col 8	col 9
row1	$7_{\mathbf{34}}$	$7_{\mathbf{1}}$	$7_{\mathbf{2}}$	
row3	$7_{\mathbf{12}}$		$7_{\mathbf{3}}$	$7_{\mathbf{4}}$
row4		$7_{\mathbf{234}}$	$7_{\mathbf{1}}$	
row7			$7_{\mathbf{4}}$	7_{123}

3 008
A2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9_{23}					9_{1}
row2		X							
row3				9_{1}			9_{23}		
row4					X				
row5								X	
row6			X						
row7						X			
row8	9_{3}						9_{1}		9_{2}
row9	9_{12}								9_{3}

3 008
A2

	col 1	col 4	col 7	col 9
row1		9_{23}		9_{1}
row3		9_{1}	9_{23}	
row8	9_{3}		9_{1}	9_{2}
row9	9_{12}			9_{3}

3 B4 009

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				1_{45}	1_{123}				
row2	X								
row3								X	
row4							1_{35}		1_{124}
row5						X			
row6		X							
row7				1_{1}			1_{24}		1_{35}
row8			X						
row9				1_{23}	1_{45}		1_{1}		

3 B4 009

	col 4	col 5	col 7	col 9
row1	1_{45}	1_{123}		
row4			1_{35}	1_{124}
row7	1_{1}		1_{24}	1_{35}
row9	1_{23}	1_{45}	1_{1}	

3 010
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			1_{12}		1_{345}				
row2		1_{3}	1_{45}		1_{12}				
row3							X		
row4	X								
row5						X			
row6									X
row7		1_{14}						1_{235}	
row8		1_{25}	1_{3}					1_{14}	
row9				X					

3 010
B4

	col 2	col 3	col 5	col 8
row1		1_{12}	1_{345}	
row2	1_{3}	1_{45}	1_{12}	
row7	1_{14}			1_{235}
row8	1_{25}	1_{3}		1_{14}

3 A4 011

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{2}								8_{134}
row2						X			
row3		8_{134}							8_{2}
row4	8_{3}		8_{12}	8_{4}					
row5	8_{4}			8_{123}					
row6								X	
row7					X				
row8							X		
row9	8_{1}	8_{2}	8_{34}						

3 A4 011

	col 1	col 2	col 3	col 4	col 9
row1	8_{2}				8_{134}
row3		8_{134}			8_{2}
row4	8_{3}		8_{12}	8_{4}	
row5	8_{4}			8_{123}	
row9	8_{1}	8_{2}	8_{34}		

3 A6 012

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				8_{34}					8_{125}
row3						8_{125}		8_{34}	
row4							X		
row5	8_{5}			8_{12}		8_{34}			
row6	8_{13}	8_{24}		8_{5}					
row7	8_{24}	8_{135}							
row8					X				
row9								8_{125}	8_{34}

3 012

	col 1	col 2	col 4	col 6	col 8	col 9
row2			8_{34}			8_{125}
row3				8_{125}	8_{34}	
row5	8_{5}		8_{12}	8_{34}		
row6	8_{13}	8_{24}	8_{5}			
row7	8_{24}	8_{135}				

3 013 F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			4_{13}	4_{245}					
row2	4_{245}			4_{13}					
row3								X	
row4						X			
row5	4_{1}	4_{2}							4_{345}
row6	4_{3}	4_{4}	4_{5}						4_{12}
row7									
row8							X		
row9		4_{135}	4_{24}						

3 013 F2

	col 1	col 2	col 3	col 4	col 9
row1			4_{13}	4_{245}	
row2	4_{245}			4_{13}	
row5	4_{1}	4_{2}			4_{345}
row6	4_{3}	4_{4}	4_{5}		4_{12}
row9		4_{135}	4_{24}		

3 014
E7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{123}					8_{K}	8_{4}	
row2						X			
row3	8_{4}								8_{123}
row4					X				
row5		8_{4}					8_{3}	8_{12}	
row6	8_{123}						8_{4}		
row7				8_{23}			8_{1}		8_{4}
row8			X						
row9				8_{14}			8_{2}	8_{3}	

3 014
E7

	col 1	col 2	col 4	col 7	col 8	col 9
row1		8_{123}		8_{K}	8_{4}	
row3	8_{4}					8_{123}
row5		8_{4}		8_{3}	8_{12}	
row6	8_{123}			8_{4}		
row7			8_{23}	8_{1}		8_{4}
row9			8_{14}	8_{2}	8_{3}	

3 B4 015

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2									
row3							8_{245}	8_{13}	
row4		8_{34}	8_{125}						
row5									
row6									
row7									
row8		8_{12}	8_{34}					8_{5}	
row9		8_{5}					8_{13}	8_{24}	

3 015

	col 2	col 3	col 7	col 8
row3			8_{245}	8_{13}
row4	8_{34}	8_{125}		
row8	8_{12}	8_{34}		8_{5}
row9	8_{5}		8_{13}	8_{24}

3 016
F2

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			4_{12}	4_{345}					
row2	4_{345}			4_{12}					
row3								X	
row4						X			
row5	4_{1}	4_{3}							4_{245}
row6	4_{2}	4_{4}	4_{5}						4_{13}
row7							X		
row8					X				
row9		4_{125}	4_{34}						

3 016
F2

	col 1	col 2	col 3	col 4	col 9
row1			4_{12}	4_{345}	
row2	4_{345}			4_{12}	
row5	4_{1}	4_{3}			4_{245}
row6	4_{2}	4_{4}	4_{5}		4_{13}
row9		4_{125}	4_{34}		

3 017
C9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2								X	
row3		2_{4}	2_{123}						
row4		2_{12}							2_{34}
row5				2_{234}			2_{1}		
row6	2_{34}			2_{1}			2_{2}		
row7	2_{12}						2_{34}		
row8					X				
row9		2_{3}	2_{4}						2_{12}

3 017

	col 1	col 2	col 3	col 4	col 7	col 9
row3		2_{4}	2_{123}			
row4		2_{12}				2_{34}
row5				2_{234}	2_{1}	
row6	2_{34}			2_{1}	2_{2}	
row7	2_{12}				2_{34}	
row9		2_{3}	2_{4}			2_{12}

3 018
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2						X			
row3							8_{245}	8_{13}	
row4		8_{34}	8_{125}						
row5				X					
row6									X
row7					X				
row8		8_{12}	8_{34}					8_{5}	
row9		8_{5}					8_{13}	8_{24}	

3 018

	col 2	col 3	col 7	col 8
row3			8_{245}	8_{13}
row4	8_{34}	8_{125}		
row8	8_{12}	8_{34}		8_{5}
row9	8_{5}		8_{13}	8_{24}

3 019
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2				X					
row3			X						
row4		X							
row5						3_{12}			3_{34}
row6					3_{3}	3_{4}	3_{1}		3_{2}
row7	X								
row8					3_{1}		3_{234}		
row9					3_{24}	3_{3}			3_{1}

3 019

	col 5	col 6	col 7	col 9
row5		3_{12}		3_{34}
row6	3_{3}	3_{4}	3_{1}	3_{2}
row8	3_{1}		3_{234}	
row9	3_{24}	3_{3}		3_{1}

3 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2			X						
row3							9_{12}	9_{3}	9_{4}
row4						X			
row5	9_{14}								9_{23}
row6	9_{23}							9_{14}	
row7					9_{23}				9_{1}
row8		X							
row9					9_{1}		9_{34}	9_{2}	

3 020

	col 1	col 5	col 7	col 8	col 9
row3			9_{12}	9_{3}	9_{4}
row5	9_{14}				9_{23}
row6	9_{23}			9_{14}	
row7		9_{23}			9_{1}
row9		9_{1}	9_{34}	9_{2}	

3 D1 021

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2		X							
row3						X			
row4	1_{2}		1_{34}				1_{1}		
row5			1_{1}				1_{23}	1_{4}	
row6					X				
row7	1_{134}							1_{2}	
row8				X					
row9			1_{2}				1_{4}	1_{13}	

3 021

	col 1	col 3	col 7	col 8
row4	1_{2}	1_{34}	1_{1}	
row5		1_{1}	1_{23}	1_{4}
row7	1_{134}			1_{2}
row9		1_{2}	1_{4}	1_{13}

3 022
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				9_{24}	9_{13}				
row2								X	
row3			X						
row4					9_{4}	9_{123}			
row5		X							
row6									X
row7				9_{1}	9_{2}		9_{34}		
row8				9_{3}		9_{4}	9_{12}		
row9	X								

3 022
E1

	col 4	col 5	col 6	col 7
row1	9_{24}	9_{13}		
row4		9_{4}	9_{123}	
row7	9_{1}	9_{2}		9_{34}
row8	9_{3}		9_{4}	9_{12}

3 D1 023

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_{1}			4_{24}	4_{3}			
row2									X
row3		4_{23}	4_{4}		4_{1}				
row4	X								
row5								X	
row6				X					
row7		4_{4}			4_{3}	4_{12}			
row8			4_{123}			4_{4}			
row9							X		

3 D1 023

	col 2	col 3	col 5	col 6
row1	4_{1}		4_{24}	4_{3}
row3	4_{23}	4_{4}	4_{1}	
row7	4_{4}		4_{3}	4_{12}
row8		4_{123}		4_{4}

3 C8 024

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								1_{2}	1_{134}
row2			X						
row3						X			
row4				X					
row5	1_{12}						1_{34}		
row6		1_{34}						1_{1}	1_{2}
row7	1_{3}				1_{4}		1_{12}		
row8		1_{12}						1_{34}	
row9	1_{4}				1_{123}				

3 C8 024

	col 1	col 2	col 5	col 7	col 8	col 9
row1					1_{2}	1_{134}
row5	1_{12}			1_{34}		
row6		1_{34}			1_{1}	1_{2}
row7	1_{3}		1_{4}	1_{12}		
row8		1_{12}			1_{34}	
row9	1_{4}		1_{123}			

3 D2 025

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{12}						1_{345}		
row2						X			
row3	1_{34}	1_{5}							1_{12}
row4								X	
row5			1_{13}		1_{245}				
row6	1_{5}		1_{24}		1_{13}				
row7		1_{12}							1_{345}
row8		1_{34}	1_{5}				1_{12}		
row9				X					

3 D2 025

	col 1	col 2	col 3	col 5	col 7	col 8	col 9
row1	1_{12}				1_{345}		
row3	1_{34}	1_{5}					1_{12}
row5			1_{13}	1_{245}			
row6	1_{5}		1_{24}	1_{13}			
row7		1_{12}					1_{345}
row8		1_{34}	1_{5}		1_{12}		

3 026
D3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		1_{12}		1_{5}				1_{34}	
row2	1_{3}			1_{14}					1_{25}
row3		1_{45}		1_{23}					1_{1}
row4						X			
row5							X		
row6			X						
row7	1_{4}	1_{3}						1_{125}	
row8	1_{125}								1_{34}
row9					X				

3 026
D3

	col 1	col 2	col 4	col 8	col 9
row1		1_{12}	1_{5}	1_{34}	
row2	1_{3}		1_{14}		1_{25}
row3		1_{45}	1_{23}		1_{1}
row7	1_{4}	1_{3}		1_{125}	
row8	1_{125}				1_{34}

3 027
E8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						9_{3}	9_{2}	9_{14}	
row2		X							
row3				9_{124}				9_{3}	
row4			9_{34}					9_{K}	9_{12}
row5					X				
row6	9_{12}						9_{34}		
row7	9_{34}						9_{1}	9_{2}	
row8						9_{124}			9_{3}
row9			9_{12}	9_{3}					9_{4}

3 027
E8

	col 1	col 3	col 4	col 6	col 7	col 8	col 9
row1				9_{3}	9_{2}	9_{14}	
row3			9_{124}			9_{3}	
row4		9_{34}				9_{K}	9_{12}
row6	9_{12}				9_{34}		
row7	9_{34}				9_{1}	9_{2}	
row8				9_{124}			9_{3}
row9		9_{12}	9_{3}				9_{4}

3 028
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2		X							
row3						X			
row4	1_{2}		1_{34}				1_{1}		
row5			1_{1}				1_{23}	1_{4}	
row6					X				
row7	1_{134}							1_{2}	
row8				X					
row9			1_{2}				1_{4}	1_{13}	

3 028

	col 1	col 3	col 7	col 8
row4	1_{2}	1_{34}	1_{1}	
row5		1_{1}	1_{23}	1_{4}
row7	1_{134}			1_{2}
row9		1_{2}	1_{4}	1_{13}

3 029
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			$2_{\mathbf{1}}$		$2_{\mathbf{24}}$				$2_{\mathbf{3}}$
row2			$2_{\mathbf{2}}$		$2_{\mathbf{13}}$			$2_{\mathbf{4}}$	
row3			$2_{\mathbf{34}}$					$2_{\mathbf{12}}$	
row4							X		
row5				X					
row6		X							
row7								$2_{\mathbf{3}}$	$2_{\mathbf{124}}$
row8	X								
row9						X			

3 029
B3

	col 3	col 5	col 8	col 9
row1	$2_{\mathbf{1}}$	$2_{\mathbf{24}}$		$2_{\mathbf{3}}$
row2	$2_{\mathbf{2}}$	$2_{\mathbf{13}}$	$2_{\mathbf{4}}$	
row3	$2_{\mathbf{34}}$		$2_{\mathbf{12}}$	
row7			$2_{\mathbf{3}}$	$2_{\mathbf{124}}$

3 030
A7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		X							
row3							1_{4}		1_{123}
row4	1_{1}		1_{2}			1_{34}			
row5			1_{34}				1_{12}		
row6				1_{12}			1_{3}		1_{4}
row7	1_{234}		1_{1}						
row8				1_{34}		1_{12}			
row9								X	

3 030

	col 1	col 3	col 4	col 6	col 7	col 9
row3					1_{4}	1_{123}
row4	1_{1}	1_{2}		1_{34}		
row5		1_{34}			1_{12}	
row6			1_{12}		1_{3}	1_{4}
row7	1_{234}	1_{1}				
row8			1_{34}	1_{12}		

3 031
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2				X					
row3			X						
row4	1_{34}					1_{12}			
row5	1_{1}	1_{2}				1_{3}			1_{4}
row6						1_{4}			1_{123}
row7					X				
row8	1_{2}	1_{134}							
row9								X	

3 031

	col 1	col 2	col 6	col 9
row4	1_{34}		1_{12}	
row5	1_{1}	1_{2}	1_{3}	1_{4}
row6			1_{4}	1_{123}
row8	1_{2}	1_{134}		

3 032
A9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	5_{234}				5_{1}				
row2	5_{1}			5_{34}	5_{2}				
row3									X
row4						X			
row5		X							
row6								X	
row7					5_{3}		5_{124}		
row8				5_{12}	5_{4}		5_{3}		
row9			X						

3 032
A9

	col 1	col 4	col 5	col 7
row1	5_{234}		5_{1}	
row2	5_{1}	5_{34}	5_{2}	
row7			5_{3}	5_{124}
row8		5_{12}	5_{4}	5_{3}

3 G3 033

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		8_{2}					8_{1}		8_{34}
row3		8_{134}						8_{2}	
row4					8_{124}			8_{3}	
row5			X						
row6					8_{3}		8_{4}		8_{12}
row7	X								
row8						X			
row9							8_{23}	8_{14}	

3 033

	col 2	col 5	col 7	col 8	col 9
row2	8_{2}		8_{1}		8_{34}
row3	8_{134}			8_{2}	
row4		8_{124}		8_{3}	
row6		8_{3}	8_{4}		8_{12}
row9			8_{23}	8_{14}	

3 034
F1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{35}		2_{124}			
row2			X						
row3							X		
row4				2_{1}	2_{2}	2_{3}		2_{45}	
row5					2_{4}	2_{5}		2_{123}	
row6		X							
row7				2_{24}	2_{135}				
row8									X
row9	X								

3 034
F1

	col 4	col 5	col 6	col 8
row1	2_{35}		2_{124}	
row4	2_{1}	2_{2}	2_{3}	2_{45}
row5		2_{4}	2_{5}	2_{123}
row7	2_{24}	2_{135}		

3 B4 035

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{124}		2_{3}
row2	X								
row3				X					
row4					2_{1}	2_{2}	2_{3}		2_{4}
row5			X						
row6					2_{34}				2_{12}
row7								X	
row8					2_{2}	2_{134}			
row9		X							

3 B4 035

	col 5	col 6	col 7	col 9
row1			2_{124}	2_{3}
row4	2_{1}	2_{2}	2_{3}	2_{4}
row6	2_{34}			2_{12}
row8	2_{2}	2_{134}		

3 036
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2							X		
row3			X						
row4		X							
row5				2_{12}		2_{3}		2_{4}	
row6				2_{4}					2_{123}
row7						2_{24}		2_{13}	
row8	X								
row9				2_{3}		2_{1}		2_{2}	2_{4}

3 036

	col 4	col 6	col 8	col 9
row5	2_{12}	2_{3}	2_{4}	
row6	2_{4}			2_{123}
row7		2_{24}	2_{13}	
row9	2_{3}	2_{1}	2_{2}	2_{4}

3 037
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					2_{1}		2_{23}		2_{4}
row2		X							
row3					2_{234}				2_{1}
row4			X						
row5				X					
row6								X	
row7						X			
row8	2_{134}								2_{2}
row9	2_{2}						2_{14}		2_{3}

3 037
B4

	col 1	col 5	col 7	col 9
row1		2_{1}	2_{23}	2_{4}
row3		2_{234}		2_{1}
row8	2_{134}			2_{2}
row9	2_{2}		2_{14}	2_{3}

3 G4 038

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}				4_{2}			4_{3}	4_{4}
row2	4_{234}				4_{1}				
row3					4_{34}				4_{12}
row4				X					
row5		X							
row6							X		
row7						4_{124}			4_{3}
row8			X						
row9						4_{3}		4_{124}	

3 G4 038

	col 1	col 5	col 6	col 8	col 9
row1	4_{1}	4_{2}		4_{3}	4_{4}
row2	4_{234}	4_{1}			
row3		4_{34}			4_{12}
row7			4_{124}		4_{3}
row9			4_{3}	4_{124}	

3 039
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						X			
row2	1_{12}	1_{3}							1_{45}
row3	1_{45}								1_{123}
row4								X	
row5					X				
row6			X						
row7				X					
row8	1_{3}	1_{14}					1_{25}		
row9		1_{25}					1_{134}		

3 039

	col 1	col 2	col 7	col 9
row2	1_{12}	1_{3}		1_{45}
row3	1_{45}			1_{123}
row8	1_{3}	1_{14}	1_{25}	
row9		1_{25}	1_{134}	

3 040
G5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2							X		
row3				X					
row4						7_{134}		7_{2}	
row5			7_{12}					7_{3}	7_{4}
row6			7_{34}			7_{2}			7_{1}
row7					7_{14}				7_{23}
row8					7_{23}			7_{14}	
row9	X								

3 040

	col 3	col 5	col 6	col 8	col 9
row4			7_{134}	7_{2}	
row5	7_{12}			7_{3}	7_{4}
row6	7_{34}		7_{2}		7_{1}
row7		7_{14}			7_{23}
row8		7_{23}		7_{14}	

3 041
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							X		
row3				X					
row4									
row5								1_{4}	1_{123}
row6	1_{1}	1_{234}							
row7					X				
row8	1_{2}	1_{1}						1_{3}	1_{4}
row9	1_{34}							1_{12}	

3 041

	col 1	col 2	col 8	col 9
row5			1_{4}	1_{123}
row6	1_{1}	1_{234}		
row8	1_{2}	1_{1}	1_{3}	1_{4}
row9	1_{34}		1_{12}	

3 G6 042

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{123}								7_{4}
row2						X			
row3			7_{4}				7_{12}		7_{3}
row4				X					
row5								7_{234}	7_{1}
row6	7_{4}		7_{123}						
row7					X				
row8							7_{34}	7_{1}	7_{2}
row9		X							

3 G6 042

	col 1	col 3	col 7	col 8	col 9
row1	7_{123}				7_{4}
row3		7_{4}	7_{12}		7_{3}
row5				7_{234}	7_{1}
row6	7_{4}	7_{123}			
row8			7_{34}	7_{1}	7_{2}

3 043
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2				$2_{\mathbf{1}}$			$2_{\mathbf{234}}$		
row3					$2_{\mathbf{2}}$	$2_{\mathbf{34}}$	$2_{\mathbf{1}}$		
row4				$2_{\mathbf{3}}$	$2_{\mathbf{4}}$	$2_{\mathbf{12}}$			
row5									X
row6		X							
row7				$2_{\mathbf{24}}$	$2_{\mathbf{13}}$				
row8	X								
row9								X	

3 043

	col 4	col 5	col 6	col 7
row2	$2_{\mathbf{1}}$			$2_{\mathbf{234}}$
row3		$2_{\mathbf{2}}$	$2_{\mathbf{34}}$	$2_{\mathbf{1}}$
row4	$2_{\mathbf{3}}$	$2_{\mathbf{4}}$	$2_{\mathbf{12}}$	
row7	$2_{\mathbf{24}}$	$2_{\mathbf{13}}$		

3 044
B3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_{123}		4_{4}					
row2							X		
row3		4_{4}		4_{1}	4_{23}				
row4			X						
row5								X	
row6				4_{2}	4_{14}	4_{3}			
row7									X
row8				4_{3}		4_{124}			
row9	X								

3 044
B3

	col 2	col 4	col 5	col 6
row1	4_{123}	4_{4}		
row3	4_{4}	4_{1}	4_{23}	
row6		4_{2}	4_{14}	4_{3}
row8		4_{3}		4_{124}

3 045
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2		X							
row3				4_{123}	4_{4}				
row4					4_{12}			4_{34}	
row5				4_{4}		4_{3}		4_{1}	4_{2}
row6			X						
row7								4_{2}	4_{134}
row8					4_{3}	4_{124}			
row9	X								

3 045

	col 4	col 5	col 6	col 8	col 9
row3	4_{123}	4_{4}			
row4		4_{12}		4_{34}	
row5	4_{4}		4_{3}	4_{1}	4_{2}
row7				4_{2}	4_{134}
row8		4_{3}	4_{124}		

3 046
B5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2					9_{24}	9_{135}			
row3	9_{12}	9_{345}							
row4			X						
row5								X	
row6				9_{245}	9_{13}				
row7									X
row8	9_{34}	9_{12}			9_{5}				
row9	9_{5}			9_{13}		9_{24}			

3 046

	col 1	col 2	col 4	col 5	col 6
row2				9_{24}	9_{135}
row3	9_{12}	9_{345}			
row6			9_{245}	9_{13}	
row8	9_{34}	9_{12}		9_{5}	
row9	9_{5}		9_{13}		9_{24}

3 047
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2							X		
row3			X						
row4									X
row5	1_{12}			1_{3}		1_{45}			
row6	1_{345}					1_{12}			
row7				1_{14}		1_{3}		1_{25}	
row8		X							
row9				1_{25}				1_{134}	

3 047

	col 1	col 4	col 6	col 8
row5	1_{12}	1_{3}	1_{45}	
row6	1_{345}		1_{12}	
row7		1_{14}	1_{3}	1_{25}
row9		1_{25}		1_{134}

3 048

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		9_{12}						9_{34}	
row2	9_{3}					9_{24}	9_{1}		
row3		9_{4}				9_{13}	9_{2}		
row4							9_{34}	9_{12}	
row5	9_{124}	9_{3}							
row6					X				
row7			X						
row8									X
row9				X					

3 048

	col 1	col 2	col 6	col 7	col 8
row1		9_{12}			9_{34}
row2	9_{3}		9_{24}	9_{1}	
row3		9_{4}	9_{13}	9_{2}	
row4				9_{34}	9_{12}
row5	9_{124}	9_{3}			

3 049
E1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		X							
row2								X	
row3					3_{124}	3_{3}			
row4	3_{2}					3_{1}	3_{34}		
row5	3_{134}					3_{2}			
row6					3_{3}	3_{4}	3_{12}		
row7				X					
row8			X						
row9									X

3 049

	col 1	col 5	col 6	col 7
row3		3_{124}	3_{3}	
row4	3_{2}		3_{1}	3_{34}
row5	3_{134}		3_{2}	
row6		3_{3}	3_{4}	3_{12}

3 050
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2						X			
row3			X						
row4									X
row5	3_{12}			3_{34}	3_{5}				
row6	3_{345}			3_{12}					
row7		3_{245}			3_{13}				
row8		3_{13}		3_{5}	3_{24}				
row9								X	

3 050

	col 1	col 2	col 4	col 5
row5	3_{12}		3_{34}	3_{5}
row6	3_{345}		3_{12}	
row7		3_{245}		3_{13}
row8		3_{13}	3_{5}	3_{24}

3 051
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2						X			
row3			X						
row4		X							
row5				5_{12}	5_{34}		5_{5}		
row6				5_{5}			5_{13}		5_{24}
row7							5_{24}		5_{135}
row8	X								
row9				5_{34}	5_{125}				

3 051

	col 4	col 5	col 7	col 9
row5	5_{12}	5_{34}	5_{5}	
row6	5_{5}		5_{13}	5_{24}
row7			5_{24}	5_{135}
row9	5_{34}	5_{125}		

3 052
E9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			3_{14}				3_{2356}		
row2						X			
row3	3_{36}		3_{25}				3_{14}		
row4								X	
row5	3_{12}		3_{3}	3_{456}					
row6	3_{45}		3_{6}		3_{123}				
row7				3_{123}	3_{456}				
row8									X
row9		X							

3 052
E9

	col 1	col 3	col 4	col 5	col 7
row1		3_{14}			3_{2356}
row3	3_{36}	3_{25}			3_{14}
row5	3_{12}	3_{3}	3_{456}		
row6	3_{45}	3_{6}		3_{123}	
row7			3_{123}	3_{456}	

3 G1 053

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}	4_{34}							4_{5}
row2					X				
row3		4_{5}					4_{13}		4_{24}
row4								X	
row5			X						
row6						X			
row7	4_{3}	4_{1}					4_{245}		
row8				X					
row9	4_{45}	4_{2}							4_{13}

3 G1 053

	col 1	col 2	col 7	col 9
row1	4_{12}	4_{34}		4_{5}
row3		4_{5}	4_{13}	4_{24}
row7	4_{3}	4_{1}	4_{245}	
row9	4_{45}	4_{2}		4_{13}

3 B8 054

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			8_{12}					8_{345}	
row2		8_{34}				8_{5}		8_{12}	
row3		8_{5}		8_{13}		8_{24}			
row4					X				
row5		8_{12}	8_{345}						
row6							X		
row7				8_{245}		8_{13}			
row8									X
row9	X								

3 B8 054

	col 2	col 3	col 4	col 6	col 8
row1		8_{12}			8_{345}
row2	8_{34}			8_{5}	8_{12}
row3	8_{5}		8_{13}	8_{24}	
row5	8_{12}	8_{345}			
row7			8_{245}	8_{13}	

3 055
E9

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			3_{14}				3_{2356}		
row2						X			
row3	3_{36}		3_{25}				3_{14}		
row4								X	
row5	3_{12}		3_{3}	3_{456}					
row6	3_{45}		3_{6}		3_{123}				
row7				3_{123}	3_{456}				
row8									X
row9		X							

3 055
E9

	col 1	col 3	col 4	col 5	col 7
row1		3_{14}			3_{2356}
row3	3_{36}	3_{25}			3_{14}
row5	3_{12}	3_{3}	3_{456}		
row6	3_{45}	3_{6}		3_{123}	
row7			3_{123}	3_{456}	

3 056
E4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		X							
row3								4_{256}	4_{134}
row4	4_{235}				4_{46}			4_{1}	
row5	4_{146}				4_{35}				4_{2}
row6					4_{12}			4_{34}	4_{56}
row7							X		
row8						X			
row9			X						

3 056

	col 1	col 5	col 8	col 9
row3			4_{256}	4_{134}
row4	4_{235}	4_{46}	4_{1}	
row5	4_{146}	4_{35}		4_{2}
row6		4_{12}	4_{34}	4_{56}

3 057
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							X		
row2	8_{1}		8_{3}	8_{25}		8_{4}			
row3			8_{245}			8_{13}			
row4			8_{1}			8_{2}		8_{345}	
row5	8_{2}		8_{K}	8_{134}		8_{5}			
row6	8_{345}							8_{12}	
row7									X
row8		X							
row9					X				

3 057

	col 1	col 3	col 4	col 6	col 8
row2	8_{1}	8_{3}	8_{25}	8_{4}	
row3		8_{245}		8_{13}	
row4		8_{1}		8_{2}	8_{345}
row5	8_{2}	8_{K}	8_{134}	8_{5}	
row6	8_{345}				8_{12}

3 058
E6

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2	8_{1}		8_{2}	8_{34}		8_{5}			
row3			8_{345}			8_{12}			
row4			8_{1}			8_{3}		8_{245}	
row5	8_{3}		8_{K}	8_{125}		8_{4}			
row6	8_{245}							8_{13}	
row7					X				
row8		X							
row9							X		

3 058

	col 1	col 3	col 4	col 6	col 8
row2	8_{1}	8_{2}	8_{34}	8_{5}	
row3		8_{345}		8_{12}	
row4		8_{1}		8_{3}	8_{245}
row5	8_{3}	8_{K}	8_{125}	8_{4}	
row6	8_{245}				8_{13}

3 C9 059

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_{124}	1_{3}	
row2		X							
row3						X			
row4			1_{1}	1_{2}					1_{34}
row5			1_{2}	1_{134}					
row6	1_{34}							1_{12}	
row7	1_{12}						1_{3}	1_{4}	
row8					X				
row9			1_{34}						1_{12}

3 C9 059

	col 1	col 3	col 4	col 7	col 8	col 9
row1				1_{124}	1_{3}	
row4		1_{1}	1_{2}			1_{34}
row5		1_{2}	1_{134}			
row6	1_{34}				1_{12}	
row7	1_{12}			1_{3}	1_{4}	
row9		1_{34}				1_{12}

3 060
G8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{34}			2_{1}	2_{2}	
row2	2_{4}				2_{12}				2_{3}
row3	2_{123}								2_{4}
row4		X							
row5				2_{12}				2_{34}	
row6					2_{34}				2_{12}
row7			X						
row8						X			
row9							2_{234}	2_{1}	

3 060
G8

	col 1	col 4	col 5	col 7	col 8	col 9
row1		2_{34}		2_{1}	2_{2}	
row2	2_{4}		2_{12}			2_{3}
row3	2_{123}					2_{4}
row5		2_{12}			2_{34}	
row6			2_{34}			2_{12}
row9				2_{234}	2_{1}	

3 061
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{1}			8_{34}		8_{2}		
row2		8_{23}					8_{14}		
row3	8_{4}				8_{12}				8_{3}
row4	8_{123}	8_{4}							
row5								X	
row6				X					
row7			X						
row8						8_{3}			8_{124}
row9						8_{124}	8_{3}		

3 061
A3

	col 1	col 2	col 5	col 6	col 7	col 9
row1		8_{1}	8_{34}		8_{2}	
row2		8_{23}			8_{14}	
row3	8_{4}		8_{12}			8_{3}
row4	8_{123}	8_{4}				
row8				8_{3}		8_{124}
row9				8_{124}	8_{3}	

3 062
E5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{36}		2_{14}		2_{25}	
row2						2_{25}		2_{1346}	
row3	X								
row4					X				
row5			X						
row6									X
row7		2_{456}		2_{12}		2_{3}			
row8		2_{123}		2_{45}		2_{6}			
row9							X		

3 062
E5

	col 2	col 4	col 6	col 8
row1		2_{36}	2_{14}	2_{25}
row2			2_{25}	2_{1346}
row7	2_{456}	2_{12}	2_{3}	
row8	2_{123}	2_{45}	2_{6}	

PATTERN FILE 4

4 001 C8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							1_{3458}	1_{1267}	
row 2	X								
row 3				X					
row 4					X				
row 5			1_{5678}						1_{1234}
row 6		1_{1234}					1_{67}	1_{58}	
row 7		1_{5678}					1_{12}	1_{34}	
row 8			1_{13}			1_{2478}			1_{56}
row 9			1_{24}			1_{1356}			1_{78}

4 001 C8	col 2	col 3	col 6	col 7	col 8	col 9
row 1				1_{3458}	1_{1267}	
row 5		1_{5678}				1_{1234}
row 6	1_{1234}			1_{67}	1_{58}	
row 7	1_{5678}			1_{12}	1_{34}	
row 8		1_{13}	1_{2478}			1_{56}
row 9		1_{24}	1_{1356}			1_{78}

4 002 C0	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		X							
row 2									X
row 3				4_{1456}		4_{23}			
row 4			4_{356}		4_{1}		4_{24}		
row 5				4_{23}		4_{45}		4_{16}	
row 6			4_{124}		4_{6}		4_{35}		
row 7						4_{16}		4_{2345}	
row 8	X								
row 9					4_{2345}		4_{16}		

4 002

	col 3	col 4	col 5	col 6	col 7	col 8
row 3		4_{1456}		4_{23}		
row 4	4_{356}		4_{1}		4_{24}	
row 5		4_{23}		4_{45}		4_{16}
row 6	4_{124}		4_{6}		4_{35}	
row 7				4_{16}		4_{2345}
row 9			4_{2345}		4_{16}	

4 003 B1	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1					2_{2456}	2_{13}			
row 2		X							
row 3									X
row 4			X						
row 5								X	
row 6				2_{56}	2_{13}	2_{24}			
row 7				$2_{\mathbf{12}}$		2_{5}	2_{346}		
row 8				2_{34}		2_{6}	2_{125}		
row 9	X								

4 003 B1	col 4	col 5	col 6	col 7
row 1		2_{2456}	2_{13}	
row 6	2_{56}	2_{13}	2_{24}	
row 7	$2_{\mathbf{12}}$		2_{5}	2_{346}
row 8	2_{34}		2_{6}	2_{125}

4 004 A6	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2			5_{5}	5_{123}		5_{4}			
row 3			5_{1234}			5_{5}			
row 4				5_{45}			5_{12}	5_{3}	
row 5	X								
row 6						5_{123}		5_{45}	
row 7		5_{2}					5_{345}	5_{1}	
row 8					X				
row 9		5_{1345}						5_{2}	

4 004	col 2	col 3	col 4	col 6	col 7	col 8
row 2		5_{5}	5_{123}	5_{4}		
row 3		5_{1234}		5_{5}		
row 4			5_{45}		5_{12}	5_{3}
row 6				5_{123}		5_{45}
row 7	5_{2}				5_{345}	5_{1}
row 9	5_{1345}					5_{2}

4 005 C4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	2_{3}							2_{15}	2_{24}
row 2	2_{45}		2_{12}						2_{3}
row 3					X				
row 4		X							
row 5				X					
row 6							2_{2345}		2_{1}
row 7			2_{345}				2_{1}	2_{2}	
row 8						X			
row 9	2_{12}							2_{34}	2_{5}

4 005 C4

	col 1	col 3	col 7	col 8	col 9
row1	2_{3}			2_{15}	2_{24}
row2	2_{45}	2_{12}			2_{3}
row6			2_{2345}		2_{1}
row7		2_{345}	2_{1}	2_{2}	
row9	2_{12}			2_{34}	2_{5}

4 006

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					5_{23}			5_{145}	
row2						5_{145}		5_{23}	
row3		X							
row4							X		
row5	5_{1235}		5_{4}						
row6				X					
row7			5_{5}		5_{1}	5_{2}			5_{34}
row8	5_{4}					5_{3}			5_{125}
row9			5_{123}		5_{45}				

	col 1	col 3	col 5	col 6	col 8	col 9
row1			5_{23}		5_{145}	
row2				5_{145}	5_{23}	
row5	5_{1235}	5_{4}				
row7		5_{5}	5_{1}	5_{2}		5_{34}
row8	5_{4}			5_{3}		5_{125}
row9		5_{123}	5_{45}			

4 007 C9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1				$5_{\mathbf{25}}$		$5_{\mathbf{13}}$	$5_{\mathbf{46}}$		
row 2					$5_{\mathbf{46}}$			$5_{\mathbf{1235}}$	
row 3			X						
row 4					$5_{\mathbf{1235}}$			$5_{\mathbf{46}}$	
row 5		$5_{\mathbf{1235}}$		$5_{\mathbf{6}}$		$5_{\mathbf{4}}$			
row 6	$5_{\mathbf{46}}$						$5_{\mathbf{1235}}$		
row 7	$5_{\mathbf{35}}$	$5_{\mathbf{46}}$		$5_{\mathbf{1}}$		$5_{\mathbf{2}}$			
row 8									X
row 9	$5_{\mathbf{12}}$			$5_{\mathbf{34}}$		$5_{\mathbf{56}}$			

4 007 C9

	col 1	col 2	col 4	col 5	col 6	col 7	col 8
row 1			5_{25}		5_{13}	5_{46}	
row 2				5_{46}			5_{1235}
row 4				5_{1235}			5_{46}
row 5		5_{1235}	5_{6}		5_{4}		
row 6	5_{46}					5_{1235}	
row 7	5_{35}	5_{46}	5_{1}		5_{2}		
row 9	5_{12}		5_{34}		5_{56}		

4 008
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1		4_{1}					4_{2345}		
row 2					X				
row 3		4_{23}	4_{45}						4_{1}
row 4	X								
row 5								X	
row 6				X					
row 7		4_{5}				4_{234}	4_{1}		
row 8						4_{15}			4_{234}
row 9		4_{4}	4_{123}						4_{5}

4 008
A8

	col 2	col 3	col 6	col 7	col 9
row1	4_{1}			4_{2345}	
row3	4_{23}	4_{45}			4_{1}
row7	4_{5}		4_{234}	4_{1}	
row8			4_{15}		4_{234}
row9	4_{4}	4_{123}			4_{5}

4 009

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	2_{12}			2_{57}			2_{3468}		
row2	2_{34}			2_{68}			2_{1257}		
row3		2_{56}	2_{78}			2_{1234}			
row4		2_{13}	2_{24}			2_{5678}			
row5								X	
row6	2_{5678}			2_{1234}					
row7									X
row8					X				
row9		2_{2478}	2_{1356}						

4 009
C8

	col 1	col 2	col 3	col 4	col 6	col 7
row1	2_{12}			2_{57}		2_{3468}
row2	2_{34}			2_{68}		2_{1257}
row3		2_{56}	2_{78}		2_{1234}	
row4		2_{13}	2_{24}		2_{5678}	
row6	2_{5678}			2_{1234}		
row9		2_{2478}	2_{1356}			

4 010
D1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{26}							1_{1345}	
row2				X					
row3			1_{1345}					1_{26}	
row4	1_{1}		1_{2}		1_{456}				1_{3}
row5	1_{34}								1_{1256}
row6	1_{5}		1_{6}		1_{123}				1_{4}
row7							X		
row8						X			
row9		X							

4 010
D1

	col 1	col 3	col 5	col 8	col 9
row 1	1_{26}			1_{1345}	
row 3		1_{1345}		1_{26}	
row 4	1_{1}	1_{2}	1_{456}		1_{3}
row 5	1_{34}				1_{1256}
row 6	1_{5}	1_{6}	1_{123}		1_{4}

4 011
A8

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		4_{1}					4_{2345}		
row2					X				
row3		4_{23}	4_{45}						4_{1}
row4				X					
row5								X	
row6	X								
row7		4_{5}				4_{234}	4_{1}		
row8						4_{15}			4_{234}
row9		4_{4}	4_{123}						4_{5}

4 011
A8

	col 2	col 3	col 6	col 7	col 9
row 1	4_{1}			4_{2345}	
row 3	4_{23}	4_{45}			4_{1}
row 7	4_{5}		4_{234}	4_{1}	
row 8			4_{15}		4_{234}
row 9	4_{4}	4_{123}			4_{5}

4 C3 012

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	8_{12}	8_{3}			8_{45}				
row2								X	
row3		8_{4}	8_{5}		8_{123}				
row4		8_{125}	8_{34}						
row5							X		
row6						X			
row7									X
row8	8_{345}		8_{1}	8_{2}					
row9			8_{2}	8_{1345}					

4 C3 012

	col 1	col 2	col 3	col 4	col 5
row1	8_{12}	8_{3}			8_{45}
row3		8_{4}	8_{5}		8_{123}
row4		8_{125}	8_{34}		
row8	8_{345}		8_{1}	8_{2}	
row9			8_{2}	8_{1345}	

4 013 C7	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			$5_{\mathbf{2457}}$				$5_{\mathbf{1368}}$		
row 2	$5_{\mathbf{1368}}$								$5_{\mathbf{2457}}$
row 3					X				
row 4		X							
row 5				$5_{\mathbf{3478}}$		$5_{\mathbf{1256}}$			
row 6								X	
row 7			$5_{\mathbf{68}}$	$5_{\mathbf{12}}$		$5_{\mathbf{34}}$	$5_{\mathbf{57}}$		
row 8	$5_{\mathbf{2457}}$								$5_{\mathbf{1368}}$
row 9			$5_{\mathbf{13}}$	$5_{\mathbf{56}}$		$5_{\mathbf{78}}$	$5_{\mathbf{24}}$		

4 013 C7

	col 1	col 3	col 4	col 6	col 7	col 9
row 1		5_{2457}			5_{1368}	
row 2	5_{1368}					5_{2457}
row 5			5_{3478}	5_{1256}		
row 7		5_{68}	5_{12}	5_{34}	5_{57}	
row 8	5_{2457}					5_{1368}
row 9		5_{13}	5_{56}	5_{78}	5_{24}	

4 014 C7	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1						X			
row 2	6_{12}		6_{34}				6_{5678}		
row 3		6_{5678}						6_{1234}	
row 4	6_{37}		6_{15}		6_{2468}				
row 5									X
row 6	6_{48}		6_{26}		6_{1357}				
row 7				X					
row 8	6_{56}		6_{78}				6_{1234}		
row 9		6_{1234}						6_{5678}	

4 014	col 1	col 2	col 3	col 5	col 7	col 8
row 2	$6_{\mathbf{12}}$		$6_{\mathbf{34}}$		$6_{\mathbf{5678}}$	
row 3		$6_{\mathbf{5678}}$				$6_{\mathbf{1234}}$
row 4	$6_{\mathbf{37}}$		$6_{\mathbf{15}}$	$6_{\mathbf{2468}}$		
row 6	$6_{\mathbf{48}}$		$6_{\mathbf{26}}$	$6_{\mathbf{1357}}$		
row 8	$6_{\mathbf{56}}$		$6_{\mathbf{78}}$		$6_{\mathbf{1234}}$	
row 9		$6_{\mathbf{1234}}$				$6_{\mathbf{5678}}$

4 D3 015

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{246}	7_{135}							
row2									X
row3				X					
row4						7_{3456}	7_{12}		
row5	7_{5}	7_{6}	7_{1234}						
row6						7_{12}		7_{3456}	
row7					X				
row8	7_{1}	7_{2}					7_{3456}		
row9	7_{3}	7_{4}	7_{56}					7_{12}	

4 D3 015

	col 1	col 2	col 3	col 6	col 7	col 8
row1	7_{246}	7_{135}				
row4				7_{3456}	7_{12}	
row5	7_{5}	7_{6}	7_{1234}			
row6				7_{12}		7_{3456}
row8	7_{1}	7_{2}			7_{3456}	
row9	7_{3}	7_{4}	7_{56}			7_{12}

4 016
B1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2								X	
row3					X				
row4		1_{3456}	1_{12}						
row5						X			
row6									X
row7			1_{3}	1_{14}			1_{256}		
row8		1_{12}	1_{45}	1_{36}					
row9			1_{6}	1_{25}			1_{134}		

4 016

	col 2	col 3	col 4	col 7
row4	1_{3456}	1_{12}		
row7		1_{3}	1_{14}	1_{256}
row8	1_{12}	1_{45}	1_{36}	
row9		1_{6}	1_{25}	1_{134}

4 017
B4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									X
row2					1_{256}	1_{134}			
row3			X						
row4				X					
row5	1_{35}	1_{12}						1_{46}	
row6	1_{46}							1_{1235}	
row7		1_{3456}			1_{1}	1_{2}			
row8	1_{12}				1_{34}	1_{56}			
row9							X		

4 017

	col 1	col 2	col 5	col 6	col 8
row2			1_{256}	1_{134}	
row5	1_{35}	1_{12}			1_{46}
row6	1_{46}				1_{1235}
row7		1_{3456}	1_{1}	1_{2}	
row8	1_{12}		1_{34}	1_{56}	

4 C5 018

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	X								
row2				9_{1}				9_{2345}	
row3				9_{2}	9_{3}	9_{45}			9_{1}
row4		X							
row5					9_{124}				9_{35}
row6				9_{35}				9_{1}	9_{24}
row7				9_{4}	9_{5}	9_{123}			
row8			X						
row9							X		

4 018

	col 4	col 5	col 6	col 8	col 9
row2	9_{1}			9_{2345}	
row3	9_{2}	9_{3}	9_{45}		9_{1}
row5		9_{124}			9_{35}
row6	9_{35}			9_{1}	9_{24}
row7	9_{4}	9_{5}	9_{123}		

4 019
A3

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			X						
row2							X		
row3						X			
row4		3_5		3_{123}	3_4				
row5									X
row6		3_{1234}			3_5				
row7	3_1				3_3			3_{245}	
row8	3_2			3_{45}				3_{13}	
row9	3_{345}				3_{12}				

4 019

	col 1	col 2	col 4	col 5	col 8
row4		3_5	3_{123}	3_4	
row6		3_{1234}		3_5	
row7	3_1			3_3	3_{245}
row8	3_2		3_{45}		3_{13}
row9	3_{345}			3_{12}	

4 020
A4

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2		2_{1}					2_{2345}		
row3		2_{23}	2_{45}						2_{1}
row4		2_{45}	2_{123}						
row5						X			
row6								X	
row7					2_{35}		2_{1}		2_{24}
row8					2_{124}				2_{35}
row9	X								

4 020

	col 2	col 3	col 5	col 7	col 9
row2	2_{1}			2_{2345}	
row3	2_{23}	2_{45}			2_{1}
row4	2_{45}	2_{123}			
row7			2_{35}	2_{1}	2_{24}
row8			2_{124}		2_{35}

4 B6 021

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{12}		4_{3}	4_{456}					
row2	4_{45}		4_{6}	4_{123}					
row3							X		
row4			4_{1245}						4_{36}
row5					X				
row6	4_{36}							4_{14}	4_{25}
row7		X							
row8								4_{2356}	4_{14}
row9						X			

4 B6 021

	col 1	col 3	col 4	col 8	col 9
row1	4_{12}	4_{3}	4_{456}		
row2	4_{45}	4_{6}	4_{123}		
row4		4_{1245}			4_{36}
row6	4_{36}			4_{14}	4_{25}
row8				4_{2356}	4_{14}

4 B1 022

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							1_{15}	1_{36}	1_{24}
row2			X						
row3				X					
row4		1_{12}					1_{3}	1_{45}	1_{6}
row5		1_{3456}						1_{12}	
row6						X			
row7	X								
row8							1_{246}		1_{135}
row9					X				

4 B1 022

	col 2	col 7	col 8	col 9
row1		1_{15}	1_{36}	1_{24}
row4	1_{12}	1_{3}	1_{45}	1_{6}
row5	1_{3456}		1_{12}	
row8		1_{246}		1_{135}

4 B5

023	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{256}	2_{134}	
row2	X								
row3					X				
row4						X			
row5			2_{3456}				2_{1}	2_{2}	
row6			2_{12}				2_{3}		2_{456}
row7		2_{1236}					2_{4}	2_{5}	
row8		2_{45}						2_{6}	2_{123}
row9				X					

4 B5

col 2	col 3	col 7	col 8	col 9
		2_{256}	2_{134}	
	2_{3456}	2_{1}	2_{2}	
	2_{12}	2_{3}		2_{456}
2_{1236}		2_{4}	2_{5}	
2_{45}			2_{6}	2_{123}

4 B8 024

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2									X
row3	X								
row4		6_{25}				6_{14}		6_{36}	
row5			6_{14}			6_{2356}			
row6		6_{36}						6_{1245}	
row7		6_{1}	6_{23}				6_{456}		
row8		6_{4}	6_{56}				6_{123}		
row9					X				

4 024

	col 2	col 3	col 6	col 7	col 8
row4	6_{25}		6_{14}		6_{36}
row5		6_{14}	6_{2356}		
row6	6_{36}				6_{1245}
row7	6_{1}	6_{23}		6_{456}	
row8	6_{4}	6_{56}		6_{123}	

4 C2 025

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					7_{67}		7_{123}		7_{45}
row2					7_{14}	7_{235}	7_{6}		7_{7}
row3		X							
row4			X						
row5								X	
row6				X					
row7					7_{25}	7_{1467}			7_{3}
row8	X								
row9					7_{3}		7_{457}		7_{126}

4 C2 025

	col 5	col 6	col 7	col 9
row1	7_{67}		7_{123}	7_{45}
row2	7_{14}	7_{235}	7_{6}	7_{7}
row7	7_{25}	7_{1467}		7_{3}
row9	7_{3}		7_{457}	7_{126}

4 B3 026

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	9_{2}	9_{145}						9_{3}	
row2						X			
row3	9_{3}							9_{1245}	
row4									X
row5	9_{1}	9_{23}	9_{4}		9_{5}				
row6			9_{5}		9_{1234}				
row7	9_{45}		9_{123}						
row8							X		
row9				X					

4 B3 026

	col 1	col 2	col 3	col 5	col 8
row1	9_{2}	9_{145}			9_{3}
row3	9_{3}				9_{1245}
row5	9_{1}	9_{23}	9_{4}	9_{5}	
row6			9_{5}	9_{1234}	
row7	9_{45}		9_{123}		

4 B2 027

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	3_{1246}	3_{35}							
row2							X		
row3						X			
row4	3_{35}	3_{46}		3_{1}	3_{2}				
row5									X
row6		3_{12}		3_{34}	3_{56}				
row7								X	
row8				3_{256}	3_{134}				
row9			X						

4 B2 027

	col 1	col 2	col 4	col 5
row1	3_{1246}	3_{35}		
row4	3_{35}	3_{46}	3_{1}	3_{2}
row6		3_{12}	3_{34}	3_{56}
row8			3_{256}	3_{134}

4 B3 028

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{5}		2_{6}			2_{1234}
row2	2_{12}		2_{34}						2_{56}
row3	2_{56}			2_{13}		2_{24}			
row4		X							
row5				2_{246}		2_{135}			
row6								X	
row7					X				
row8							X		
row9	2_{34}		2_{1256}						

4 B3 028

	col 1	col 3	col 4	col 6	col 9
row1			2_{5}	2_{6}	2_{1234}
row2	2_{12}	2_{34}			2_{56}
row3	2_{56}		2_{13}	2_{24}	
row5			2_{246}	2_{135}	
row9	2_{34}	2_{1256}			

4 029
B7

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1								X	
row2	8_{2}	8_{1345}							
row3					X				
row4									X
row5				8_{5}		8_{1234}			
row6	8_{345}		8_{12}						
row7	8_{1}	8_{2}	8_{3}	8_{4}		8_{5}			
row8							X		
row9			8_{45}	8_{123}					

4 029

	col 1	col 2	col 3	col 4	col 6
row2	8_{2}	8_{1345}			
row5				8_{5}	8_{1234}
row6	8_{345}		8_{12}		
row7	8_{1}	8_{2}	8_{3}	8_{4}	8_{5}
row9			8_{45}	8_{123}	

4 030
C1

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				X					
row2			1_{3}					1_{12}	
row3		1_{1}	1_{2}				1_{3}		
row4									X
row5					X				
row6	X								
row7						X			
row8		1_{23}					1_{1}	1_{K}	
row9			1_{1}				1_{2}	1_{3}	

4 030

	col 2	col 3	col 7	col 8
row2		1_{3}		1_{12}
row3	1_{1}	1_{2}	1_{3}	
row8	1_{23}		1_{1}	1_{K}
row9		1_{1}	1_{2}	1_{3}

4 A8 031

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}						4_{23}	4_{45}	
row2		4_{2345}							4_{1}
row3				X					
row4							4_{45}	4_{123}	
row5			X						
row6					X				
row7	4_{35}	4_{1}							4_{24}
row8						X			
row9	4_{24}						4_{1}		4_{35}

4 A8 031

	col 1	col 2	col 7	col 8	col 9
row1	4_{1}		4_{23}	4_{45}	
row2		4_{2345}			4_{1}
row4			4_{45}	4_{123}	
row7	4_{35}	4_{1}			4_{24}
row9	4_{24}		4_{1}		4_{35}

4 C2 032

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		8_{12}	8_{345}			8_{67}			
row2		8_{6}	8_{7}		8_{25}	8_{134}			
row3								X	
row4		8_{37}			8_{146}	8_{25}			
row5		8_{45}	8_{126}		8_{37}				
row6									X
row7							X		
row8				X					
row9	X								

4 C2 032

	col 2	col 3	col 5	col 6
row1	8_{12}	8_{345}		8_{67}
row2	8_{6}	8_{7}	8_{25}	8_{134}
row4	8_{37}		8_{146}	8_{25}
row5	8_{45}	8_{126}	8_{37}	

4 B3 033

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					6_5	6_{1234}			
row2		X							
row3								X	
row4	6_1				6_3				6_{245}
row5			6_{345}		6_{12}				
row6	6_2				6_4	6_5			6_{13}
row7				X					
row8	6_{345}		6_{12}						
row9							X		

4 B3 033

	col 1	col 3	col 5	col 6	col 9
row1			6_5	6_{1234}	
row4	6_1		6_3		6_{245}
row5		6_{345}	6_{12}		
row6	6_2		6_4	6_5	6_{13}
row8	6_{345}	6_{12}			

4 B5 034

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	7_{1235}	7_{46}							
row2							X		
row3				7_{23}	7_{1456}				
row4			X						
row5						X			
row6								X	
row7		7_{123}		7_{456}					
row8	7_{6}				7_{3}				7_{1245}
row9	7_{4}	7_{5}		7_{1}	7_{2}				7_{36}

4 B5 034

	col 1	col 2	col 4	col 5	col 9
row1	7_{1235}	7_{46}			
row3			7_{23}	7_{1456}	
row7		7_{123}	7_{456}		
row8	7_{6}			7_{3}	7_{1245}
row9	7_{4}	7_{5}	7_{1}	7_{2}	7_{36}

4 D2 035

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2		8_{5678}						8_{1234}	
row3	8_{1234}						8_{57}		8_{68}
row4	8_{56}			8_{3478}			8_{1}		8_{2}
row5		8_{1234}						8_{5678}	
row6	8_{78}			8_{1256}			8_{3}		8_{4}
row7						X			
row8			X						
row9							8_{2468}		8_{1357}

4 035

	col 1	col 2	col 4	col 7	col 8	col 9
row2		8_{5678}			8_{1234}	
row3	8_{1234}			8_{57}		8_{68}
row4	8_{56}		8_{3478}	8_{1}		8_{2}
row5		8_{1234}			8_{5678}	
row6	8_{78}		8_{1256}	8_{3}		8_{4}
row9				8_{2468}		8_{1357}

4 036
A5

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1				2_{123}	2_{45}		2_{67}		
row2	X								
row3					2_{67}		2_{12345}		
row4		2_{1357}	2_{246}						
row5						X			
row6								X	
row7		2_{246}	2_{357}		2_{1}				
row8									X
row9			2_{1}	2_{4567}	2_{23}				

4 036
A5

	col 2	col 3	col 4	col 5	col 7
row1			2_{123}	2_{45}	2_{67}
row3				2_{67}	2_{12345}
row4	2_{1357}	2_{246}			
row7	2_{246}	2_{357}		2_{1}	
row9		2_{1}	2_{4567}	2_{23}	

4 A7 037

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1						2_{56}	2_{1234}		
row2	X								
row3				2_{1234}					2_{56}
row4								X	
row5		X							
row6					2_{3456}	2_{12}			
row7					2_{12}	2_{34}	2_{56}		
row8			2_{246}	2_{5}					2_{13}
row9			2_{135}	2_{6}					2_{24}

4 A7 037

	col 3	col 4	col 5	col 6	col 7	col 9
row1				2_{56}	2_{1234}	
row3		2_{1234}				2_{56}
row6			2_{3456}	2_{12}		
row7			2_{12}	2_{34}	2_{56}	
row8	2_{246}	2_{5}				2_{13}
row9	2_{135}	2_{6}				2_{24}

4 B2 038

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1					X				
row2									X
row3		3_{2456}	3_{13}						
row4		3_{1}	3_{2}	3_{34}		3_{56}			
row5							X		
row6		3_{3}	3_{456}	3_{12}					
row7								X	
row8				3_{56}		3_{1234}			
row9	X								

4 038

	col 2	col 3	col 4	col 6
row3	3_{2456}	3_{13}		
row4	3_{1}	3_{2}	3_{34}	3_{56}
row6	3_{3}	3_{456}	3_{12}	
row8			3_{56}	3_{1234}

4 039 A9	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2	8_{45}	8_{123}							
row 3				8_{35}		8_{124}			
row 4			8_{1}			8_{35}	8_{24}		
row 5	8_{23}	8_{45}						8_{1}	
row 6				8_{124}			8_{35}		
row 7					X				
row 8	8_{1}							8_{2345}	
row 9			8_{2345}				8_{1}		

4 039	col 1	col 2	col 3	col 4	col 6	col 7	col 8
row 2	8_{45}	8_{123}					
row 3				8_{35}	8_{124}		
row 4			8_{1}		8_{35}	8_{24}	
row 5	8_{23}	8_{45}					8_{1}
row 6				8_{124}		8_{35}	
row 8	8_{1}						8_{2345}
row 9			8_{2345}			8_{1}	

PATTERN FILE 5

5 001	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1									X
row 2				X					
row 3		X							
row 4					2_{23456}			2_{1}	
row 5	2_{1456}						2_{23}		
row 6	2_{23}				2_{1}		2_{45}	2_{6}	
row 7			2_{1356}					2_{24}	
row 8			2_{24}				2_{16}	2_{35}	
row 9						X			

5 002	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	$9_{\mathbf{12}}$		$9_{\mathbf{34}}$				$9_{\mathbf{5678}}$		
row 2					X				
row 3	$9_{\mathbf{56}}$		$9_{\mathbf{78}}$				$9_{\mathbf{1234}}$		
row 4	$9_{\mathbf{3478}}$			$9_{\mathbf{156}}$		$9_{\mathbf{2}}$			
row 5								X	
row 6			$9_{\mathbf{1256}}$	$9_{\mathbf{37}}$		$9_{\mathbf{48}}$			
row 7		X							
row 8				$9_{\mathbf{248}}$		$9_{\mathbf{13567}}$			
row 9									X

5 003

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1							2_{2}	2_{3}	2_{14567}
row2				2_{46}		2_{12357}			
row3									
row4									
row5							2_{367}	2_{1245}	
row6									
row7	2_{46}			2_{12357}					
row8	2_{57}					2_{46}	2_{1}		2_{23}
row9	2_{123}						2_{45}	2_{67}	

5 004

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1		2_{12}	2_{34}				2_{5678}		
row2									
row3	2_{56}		2_{78}				2_{1234}		
row4	2_{137}	2_{5}							2_{2468}
row5									
row6	2_{248}		2_{6}						2_{1357}
row7									
row8		2_{34678}	2_{125}						
row9									

5 006

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2			6_{12}				6_{34}	6_{56}	
row3			6_{3456}					6_{12}	
row4							6_{15}	6_{3}	6_{4}
row5									
row6				6_{1345}			6_{26}		
row7								6_{4}	6_{12356}
row8									
row9									

5 007

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			4_{23456}		4_{1}				
row2			4_{1}	4_{23}	4_{4}	4_{56}			
row3									
row4				4_{56}		4_{1234}			
row5									
row6									
row7				4_{14}	4_{25}		4_{36}		
row8									
row9					4_{36}		4_{1245}		

5 008

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	1_{1}	1_{2}		1_{34}				1_{5}	1_{6}
row2	1_{356}							1_{124}	
row3	1_{4}			1_{1256}					1_{3}
row4									
row5									
row6	1_{2}	1_{13456}							
row7									
row8								1_{36}	1_{1245}
row9									

5 009

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{123}			4_{478}				4_{5}	4_{6}
row2	4_{456}						4_{127}	4_{38}	
row3	4_{78}			4_{12356}					4_{4}
row4								4_{246}	4_{13578}
row5									
row6									
row7									
row8							4_{34568}	4_{17}	4_{2}
row9									

5

010	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1									
row2	1_{1234}		1_{5}						
row3									
row4						1_{4}	1_{3}		1_{125}
row5						1_{1235}	1_{4}		
row6									
row7	1_{5}		1_{1}				1_{2}		1_{34}
row8									
row9			1_{234}				1_{15}		

5 011

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1	4_{1}		4_{23}					4_{4567}	
row2	4_{4}		4_{56}	4_{1237}					
row3	4_{7}			4_{456}				4_{123}	
row4									
row5									
row6									
row7									
row8	4_{25}		4_{147}		4_{36}				
row9	4_{36}				4_{12457}				

5 012

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row1			6_{123}				6_{4}		
row2									
row3	6_{4}							6_{1}	6_{23}
row4			6_{4}				6_{123}		
row5				6_{12}	6_{3}			6_{K}	6_{4}
row6	6_{123}				6_{4}				
row7				6_{34}				6_{2}	6_{1}
row8					6_{12}			6_{34}	
row9									

5 013	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1	$1_{\mathbf{1}}$	$1_{\mathbf{12}}$				$1_{\mathbf{34567}}$	$1_{\mathbf{1}}$	$1_{\mathbf{2}}$	
row 2									$1_{\mathbf{34}}$
row 3			$1_{\mathbf{34}}$	$1_{\mathbf{12}}$					$1_{\mathbf{567}}$
row 4				$1_{\mathbf{34567}}$					$1_{\mathbf{12}}$
row 5		X							
row 6						$1_{\mathbf{12}}$	$1_{\mathbf{356}}$	$1_{\mathbf{47}}$	
row 7							$1_{\mathbf{247}}$	$1_{\mathbf{1356}}$	
row 8					X				
row 9	X								

PATTERN FILE 6

6 001

	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			9_{456}			9_{78}	9_{12}	9_{3}	
row 2			9_{12378}				9_{45}		9_{6}
row 3						9_{123456}		9_{7}	9_{8}
row 4					9_{25}		9_{3678}		9_{14}
row 5					9_{134678}				9_{25}
row 6		X							
row 7								9_{124568}	9_{37}
row 8				X					
row 9	X								

6 002	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1							X		
row 2			$8_{\mathbf{348}}$	$8_{\mathbf{569}}$		$8_{\mathbf{127}}$			
row 3			$8_{\mathbf{125679}}$			$8_{\mathbf{348}}$			
row 4				$8_{\mathbf{1234}}$		$8_{\mathbf{56}}$		$8_{\mathbf{789}}$	
row 5		X							
row 6				$8_{\mathbf{78}}$		$8_{\mathbf{9}}$		$8_{\mathbf{135}}$	$8_{\mathbf{246}}$
row 7								$8_{\mathbf{246}}$	$8_{\mathbf{135789}}$
row 8					X				
row 9	X								

6 003	col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
row 1			1_{3456}	1_{1}		1_{2}	1_{78}		
row 2			1_{1278}	1_{3}	1_{45}	1_{6}			
row 3					1_{78}				1_{123456}
row 4							1_{123456}		1_{78}
row 5				1_{2567}		1_{1348}			
row 6		X							
row 7								X	
row 8				1_{48}	1_{1236}	1_{57}			
row 9	X								

PATTERN DESCRIPTION CODES 1

Pattern Description Codes 1:

A1 **2 – 2 – 2** **017, 033.**

A2
```
2 – 2
|
2
```
006, 032.

A4
```
2 – 2
    |
  2 – 2
```
020, 035.

A5
```
    2 – 2 – 2
    |
2 – 2
```
034

A6
```
    2
    |
2 – 2
|
2
```
024

A7
```
    2 – 2
    |
2 – 2
|
2
```
009

B1
```
2 – 2
|   |
2 – 2
```
002, 005, 013, 015, 019, 021, 022, 029, 036.

B2
```
2 – 2 – 2
|   |
2 – 2
```
008, 023, 030.

B3
```
        2
        |
2 – 2 – 2
|   |
2 – 2
```
038

Pattern Description Codes 1:

B9

```
2 --------2
|         |
2 – 2     |
    |     |
    2 – 2
```

001, 003, 007, 010, 011, 012, 014, 016, 025, 026, 028, 031, 039.

C0

```
3 – 2
|
2
```

037

C1

```
        2
        |
3 – 3 – 2
|   |
2 – 2
```

027

C2

```
3--------3
|         |
2 – 2     |
    |     |
    2 –  2
```

004

C8

```
    3 – 2
    |   |
3 – 2   |
|       |
3 -------2
```

014

C3

```
3--------3
|         |
2 – 2     |
    |     |
    3 –  2
```

018

PATTERN DESCRIPTION CODES 2

Pattern Description Codes 2:

```
A0    2 – 2          see K1
        |
      2 – 2

A1    3 – 2          S  023, 038, 047, 048, 056, 066, 068, 091, 092, 093, 094, 096,
      |                 105, 145, 170, 171, 179.
      2

A6    3 – 2          168
        |
      2

A3    3 – 2 – 2      030, 102. (Straight three)

A4    3 – 2 – 2      S  110, 113, 114, 127.
      |              L  020, 039, 051, 070, 072, 079, 095, 107, 110, 120, 123.
      2

A6    3 – 2 – 2      X 104
        |
      2

A5      3 – 2 – 2    L  097
        |            S  111, 119, 146
    2 – 2

D       2            S  002, 003, 006, 010, 011, 050, 078, 080, 089, 098, 099,
        |               103,106, 115, 118, 122, 124, 152, 154
    3 – 2
      |
      2

      2 – 2
        |
D1  3 – 2            172
      |
      2

E.        2          subgroup: S  004, 026, 073.
          |
      3 – 2
        |
    2 – 2
```

Pattern Description Codes 2:

```
F          2 – 2        S  008, 044, 071, 117, 151, 162.
             |
        3 - 2
        |
        2
G1      3 – 2
        |   |
        2 – 2

G2      3 – 2 – 2       L  007, 015, 017, 019, 021, 027, 029, 031, 046, 049, 059, 062, 063,
        |   |              067, 074, 075, 077, 082, 083, 088, 108, 150, 164, 166, 167, 176,
        2 – 2              183.

G3      3 – 2           S  151
        |   |           L  076
        2 – 2 – 2

G4      3 – 2 – 2       L  036
        |   |
        2 – 2
        |
        2

G7      3 – 2 – 2       L  156
        |   |
        2 – 2
            |
            2

G5      3 – 2           L 045
        |   |
        2 – 2 – 2
        |
        2

G6            2 – 2     143
                |
      3 – 2 – 2
      |   |
      |   2
      2
```

Pattern Description Codes 2:

```
G7    2                169, 187.
      |
      3 – 2 – 2
          |   |
          2 – 2

L1    3 – 3
          |
          2 – 2

K1    3 – 3            158 (= A0 after killers removed)
      |   |
      K – 3 – 2
      |
      2

L2    3 – 3            053, 109.
      |   |
      2 – 2

L1    3 – 3 – 2        185. 188.
      |   |
      2 – 2

L3    3 – 3 – 2        138
      |
      2

L4    3 – 2            163
      |   |
      2 – 3

ML.   3 – 3 –2         001, 005, 016, 022, 024, 034, 035, 040, 042, 043, 054, 055, 060,
      |   |            069, 084, 086, 139, 144, 147, 153 159 160, 161, 165, 177, 180.
      2 – 2

NS    3 – 3            085, 087.
      |   |
      3 – 2

OS    3 – 3            136
      |   |
      3 – 2 – 2
```

Pattern Description Codes 2:

P1

```
4 – 2
|
2
```

013, 028, 052, 101, 126, 130, 132.

Q1

```
    2
    |
4 – 2
```

Q

```
    2
    |
4 – 2
|
2
```

018, 041, 057, 064, 112, 125, 137, 141, 178, 184, 186.

R

```
4 – 2 – 2
|
2
```

058, 181.

S

```
    2 – 2
    |
4 – 2
|
2
```

134.

T

```
4 – 2 – 2
|
2
```

148, 149.

T4

```
2 – 4
    |
    2 – 2 – 2
        |   |
        2 – 2
```

173

U

```
4 – 2 – 2
|   |
3 – 2
```

065

U2

```
4 – 3 – 2
|   |
2 – 2
```

Pattern Description Codes 2:

```
U3    4 – 3 – 2      037
      |   |
      3 – 2

U5    4 – 3 – 2      174
      |   |
      2 – 3

U4    4 – 3 – 2      014
      |   |
      3 – 3

V1    4 – 2
      |   |
      2 – 2

                2
                |
V2    4 – 2 – 2      182
      |   |
      2 – 3

W1    3– 3 – 2       100, 102.

W2    3 – 2 – 2      061, 116, 121.
          |
          2

W3    3 – 2 – 2      129
          |
          2
          |
          2

W4        2
          |
      3 – 2
      |
      2

W5    3 – 2 – 2      090
          |
          2------2
```

Pattern Description Codes 2:

```
W6    3 – 2 – 2        012
      |   |   |
      2 – 2   |
      |       |
      2--------2

W7    3 – 3 – 2        032
      |   |   |
      |   2 – 2
      |   |
      2 – 2

X1    3 – 3 – 2        081, 142.

X2    3 – 3 – 2        009 (all straight)
              |
              2

X3    3 – 3 – 2        131 (mixed 3's)
      |
      2

X4    3 – 3 – 2        140 (mixed 3's)
      |
      2
      |
      2

W8    4 – 2 – 2        033
      |   |   |
      3 – 2   |
      |       |
      2--------2

Y1    3 – 3 – 3        128

Y2    3 – 3 – 2
      |   |
      3   2
```

Pattern Description Codes 2:

Y3 3 – 3 – 2 014, 037.
| |
3 – 2

PATTERN DESCRIPTION CODES 3

Pattern Description Codes 3:

A2

```
      2
      |
  3 – 2
  |
  2
```

subgroup 1 (small ells)**: 008, 032.**
subgroup 2 (large ells)**: no members**

A8

```
  3 – 3 – 2
  |
  2
```

031

A4

```
          2
          |
  3 – 3 – 2
      |
      2
```

011, 020

G3

```
      2
      |
  3 – 3 – 2
  |
  2
```

033

B2

```
  3 – 2  – 2
  |   |
  2 – 3
      |
      2
```

024

B3

```
  3 – 3 – 2
  |
  2
```

029, 031, 043, 044.

B4

```
      2
      |
  3 – 3
  |
  2
```

subgroup 1: **009, 010, 015, 018, 039, 047, 050, 051**
subgroup 2: **035, 041, 037**

B5

```
      3 – 2 – 2
      |
  2 – 3
```

045, 046

Pattern Description Codes 3:

G6 **042**

```
        2
        |
3 – 3 – 2
    |
    2
```

B6 **038**

```
    3 – 3 – 2
    |
2 – 2
```

A5 **005**

```
    2
    |
3 – 3
|
2
```

B7 **011, 020.**

```
    2
    |
3 – 3 – 2
        |
        2
```

B8 **033, 048, 054.**

```
    2
    |
3 – 3 – 2
|
2
```

B9 **005**

```
    2 – 2
    |
3 – 3
|
2
```

G4 **038**

```
    3 – 3 – 2
    |
2 – 2
```

Pattern Description Codes 3:

A6 **012**

```
        2
        |
    2 – 2
    |
3 – 3
|
2
```

A7 **030**

```
    2
    |
3 – 3 – 2
|       |
2       |
        2
```

A3 **061**

```
2
|
3 – 3 –----2
    |
    2 – 2
```

C2 **004, 024**

```
3 – 2
|   |
2 – 3 – 2
|
2
```

C3 **017**

```
3 – 2 – 2
|   |
2 – 3
    |
    2
```

C4 **030**

```
    2
    |
3 – 3 – 2
|       |
2       |
        2
```

Pattern Description Codes 3:

C5

```
3 –  2 – 2
|    |
2 –  3
     |
     2
```

059

C6

```
2
|
3 – 2 – 3
        |
        2 – 2
```

061

C7

```
        2
        |
    2 – 2
    |
3 – 3
|
2
```

012

D1

```
3 – 3
|   |
3 – 2
```

006, 019, 021, 023, 028, 036.
subgroup 1 (24 possibilities): 006, 021, 023, 028
subgroup 2:(24 possibilities): 019, 036

C9

```
3 – 2
|   |
2 – 3 – 2
|
2
```

017, 059.

D2

```
        2
        |
3 – 3 – 3
|   |
2 – 2
```

025

D3

```
3 – 3 – 3
|   |
3 – 2
```

026

Pattern Description Codes 3:

```
E1    4 – 2 – 2          001, 007, 022, 049.
      |
      2
G5      4 – 2 – 2        040
        |
      2 – 2

E3    4 – 2 – 2          060
      |   |
      2 – 2
      |
      2

E4    4 – 3 – 2          056
      |
      2

E5      2                062
        |
      4 – 3
      |
      2

G1    4 – 3              003, 053.
      |   |
      2 – 3

E6    4 – 3 – 2          057, 058.
      |   |
      3 – 3

E8    4 – 3 – 3          027
      |   |   |
      2 – 2   |
      |       |
      2--------2

F1    5 – 2 – 2          034
      |
      2
```

Pattern Description Codes 3:

F2 **2** **002, 013, 016.**

5 – 2 – 2

2

PATTERN DESCRIPTION CODES 4

Pattern Description Codes 4:

```
A3        3 – 3 – 2          019
          |
      2 – 3

A4        3 – 2              020
          |
      3 – 2
      |
      2

A5        3 – 2              036
          |
      3 – 3
      |
      2

A6            3 – 2          004
              |
          3 – 2
          |
      2 – 3

A8    3 – 3 – 2              008, 011, 031.
      |   |
      3 – 2

A9            2              039
              |
      3 – 3 – 2
      |   |
      2 – 2
      |
      2

A7    2                      037
      |
      4 – 2 – 2
      |   |
      2 – 2

B1    4 – 3 – 2              003, 016, 022.
      |
      2
```

Pattern Description Codes 4:

B2 **027, 038.**

```
      2
      |
  4 – 3
  |
  2
```

B3 **026, 028, 033**

```
      2
      |
  4 – 3 – 2
  |
  2
```

B4 **017**

```
      3 – 2
      |
  4 – 2
  |
  2
```

B5 **023, 034.**

```
      2
      |
  4 – 4 – 2
  |
  2
```

B6 **021**

```
      4 – 2
      |
  3 – 2
  |
  2
```

B7 **029**

```
      4 – 2 – 2
      |
  2 – 3
```

B8 **024**

```
  2 – 4
      |
      3 – 2 – 2
```

C1 **030**

```
  4 – 2
  |   |
  2 – 3
```

Pattern Description Codes 4:

C2

```
4 – 3
|   |
3 – 3
```

025, 032.

C3

```
    2
    |
4 – 3 – 2
|
2
```

012

C0

```
4 – 3 – 2
|   |
2 – 2
|
2
```

002

C4

```
4 – 3 – 2
|   |
2 – 3
```

005

C5

```
4 – 2 – 3
|   |
2 – 3
```

018

C6

```
2 – 2
    |
    4 – 3 – 2
        |
        2
```

006

C7

```
2
|
4 – 3 – 3
    |   |
    2 – 2
```

013, 014

C8

```
4 – 3 – 2
|   |
3 – 2
|
2
```

001, 009.

Pattern Description Codes 4:

```
C9      4 -------3          007
        |        |
        3 – 2    |
        |   |    |
        3 – 2 – 2

D1          5 – 3 – 2       010
            |
        2 – 2

D2      5 – 3 – 2           035
        |   |
        3 – 2

D3      5 – 3 – 2           015
        |
        2 – 2
            |
            2
```