Network Drafting for Double Weave

Introduction

At Convergence 1992 in Washington D.C. Alice Schlein and I both presented seminars. I had just published my book “Loom Controlled Double Weave” and thought that I understood double weave rather well. That is, until I heard Alice’s presentation on network drafting! Among her many beautiful and mysterious samples was a group in double weave and I realized there was still a fair amount about double weave that I needed to ponder.

That started me on a rather lengthy program of trying to “get a handle on” what happens when the principles of network drafting are applied to double weave. Along the way I wandered down some different paths for a while (four double weave blocks with an 8 shaft loom; eight double weave blocks with an 8 shaft loom; dividing and recombining the two basic tieups of double weave which leads to integrated double weave) and it is only now that I see how those different paths interrelate with network drafting. Alice Schlein’s book “Network Drafting: an Introduction” published in 1994, along with her articles in Weaver’s magazine, provided both an inspiration and a challenge for me. I urge any weaver interested in network drafting to read her book. In the discussion that follows, I make use, with permission, of several examples that Alice has presented.

Chapter I. A Voyage of Discovery

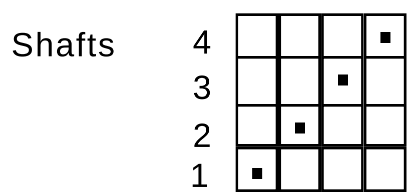
For many years I lived very happily in a “Lotus Land of Double Weave” where four shafts are needed for each double weave block, where all designs are nicely rectilinear, and where the warp and the weft threads move from one layer of double weave to another layer and back again. Rather suddenly I became aware that there are other “Double Weave Lands” to be explored where the design may have curved forms with fuzzy edges and where all the threads of a double weave are in a single cloth layer! I embarked on a rather long voyage of discovery, sometimes over dark and mysterious waters, sometimes foundering on the shoals of “Network Drafting for Single Layer Weaves” before I landed safely. This chapter describes some aspects of that voyage culminating in the day that I found my own Rosetta Stone to unlock the mysteries of network drafting. So join me on the voyage. But first some background on network drafting for a single layer weave.

I. Network Drafting for a Single Layer Weave

A. Initials and Networks.

The smallest amount of information necessary to determine the threading for a weave structure is called its “initial”. The initial in figure 1 applies for a number of weave structures including plain weave, basket weave, many 4 shaft twill weaves, and double weave.

Figure 1. The 4-End Initial



An initial is used to build up a network which may be right or left handed and can also be a combination of directions. The 4-end network can be extended to any number of shafts that is a multiple of 4.   Examples are shown in Figures 2 and 3.

Figure 2. Three Networks on 4 Shafts

A Symmetrical Network

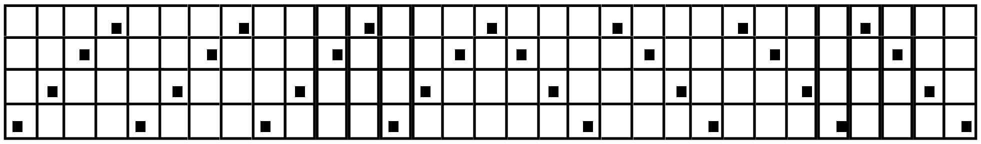
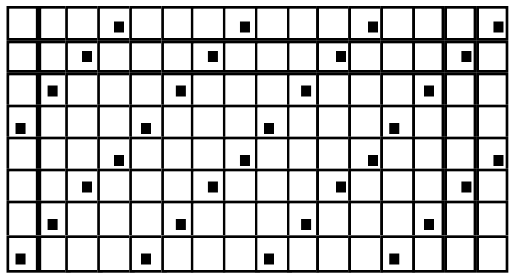
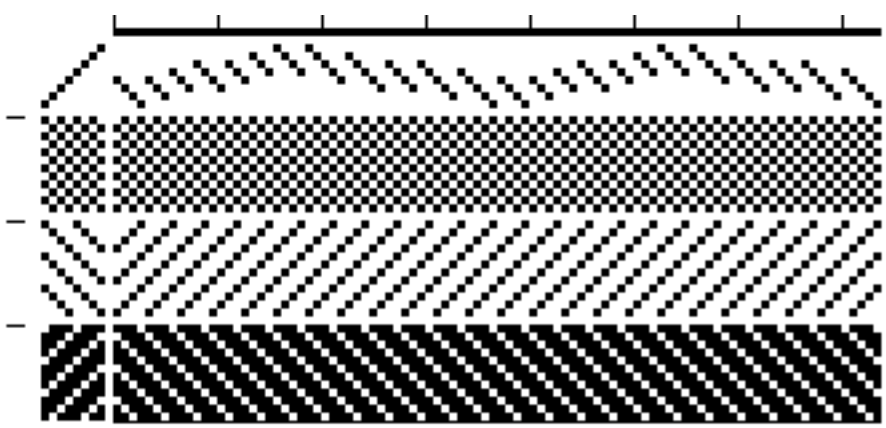


Figure 3. A Network on 8 Shafts Based on the 4-End Initial



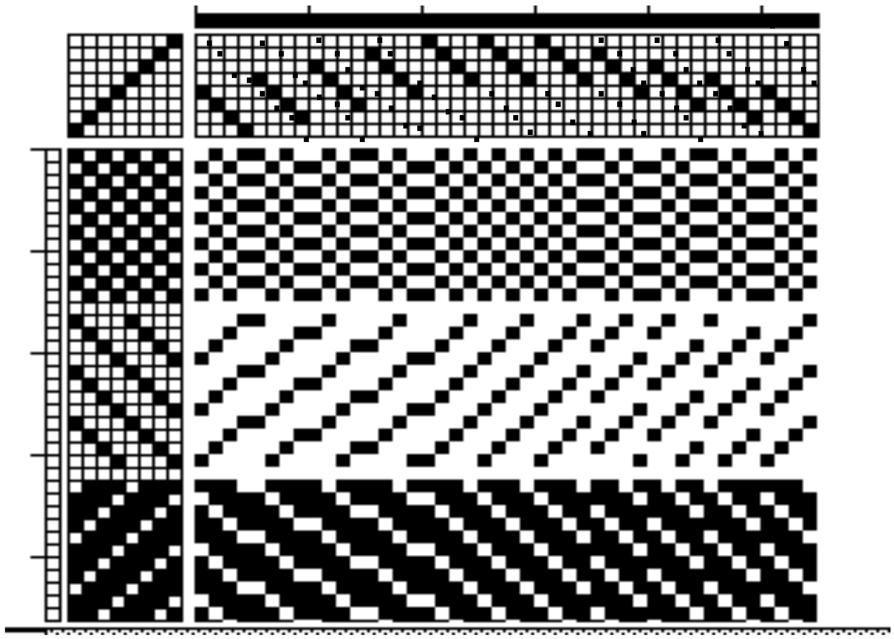
As long as the threading draft chosen for the weaving "falls" on the network made from the 4-end initial, any four shaft weave structure can be woven with that draft. For example, here is a threading draft for an 8-shaft loom that I will use to illustrate a number of points about network drafting. Three different peg plans are shown on the left: for plain weave, for 1/3 twill and for 3/1 twill. The drawdowns for the three peg plans are presented. (The important thing to recognize is that the drawdown will show the appropriate weave structure throughout because the threading falls on the network).

Figure 4. A Threading on the Network and Three Peg Plans



Let's try another threading, an advancing twill. Notice however that this threading sometimes falls on the 4-end initial and sometimes does not. Now when the drawdown is made, pure weave structures are not woven. In both these diagrams, the warp is dark and the weft is light.

Figure 5. A Threading Not on the Network and Three Peg Plans

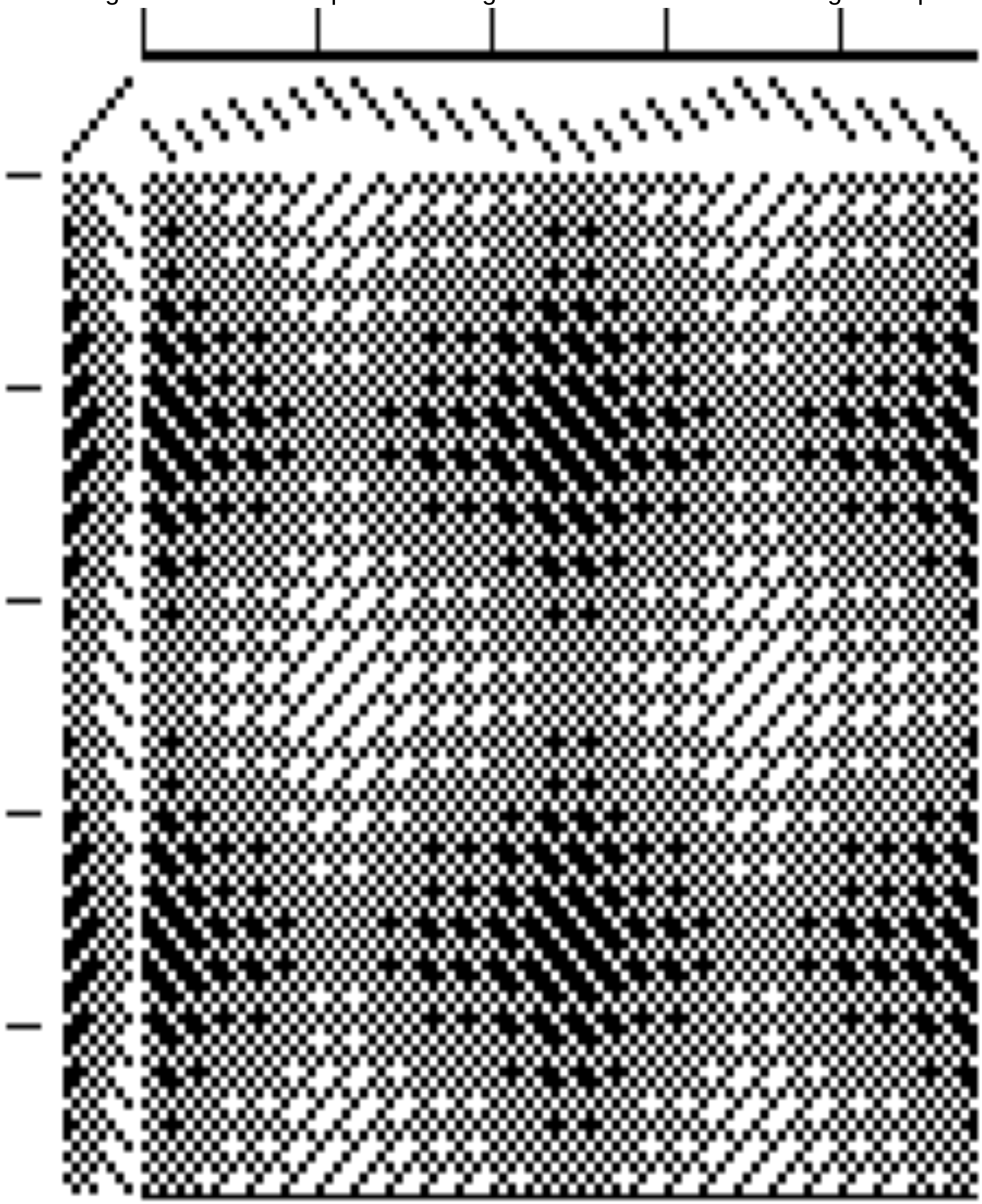


* Small squares define the network. Filled squares show the threading.

B. Drawdowns

Figure 6 illustrates what can be achieved when the rules of network drafting are followed. A pattern line placed on the network leads to a threading draft. Then, when "cut and paste" treatment of three different types of peg plans is carried out, a final peg plan containing aspects of the three different weave structures results. This diagram, from page 10 of Alice Schlein's book "Network Drafting: An Introduction", proved to be the Rosetta Stone for me, unlocking the mysteries of network drafting.

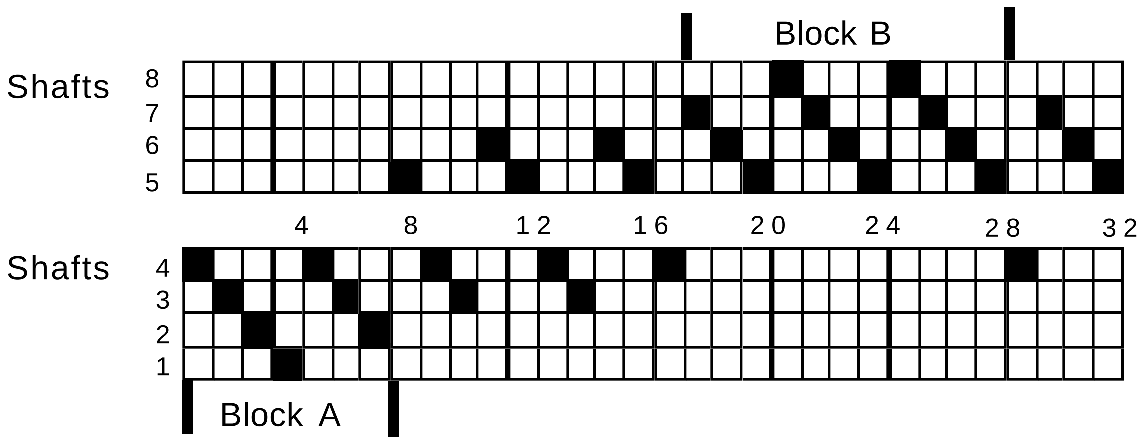
Figure 6. An Example of a Design Based on Network Drafting Principles



C. Dissecting the Threading

The first 32 threads in the threading draft look like this. They have been separated into two groups. The top diagram shows the threading for shafts 5-8 and the lower diagram the threading for shafts 1-4. The vertical bars mark the neighboring threads 1-7 that belong to block A (threads on shafts 1-4) and the neighboring threads 18-27 that belong to block B (threads on shafts 5-8).

Figure 7. The Threading Diagram Dissected



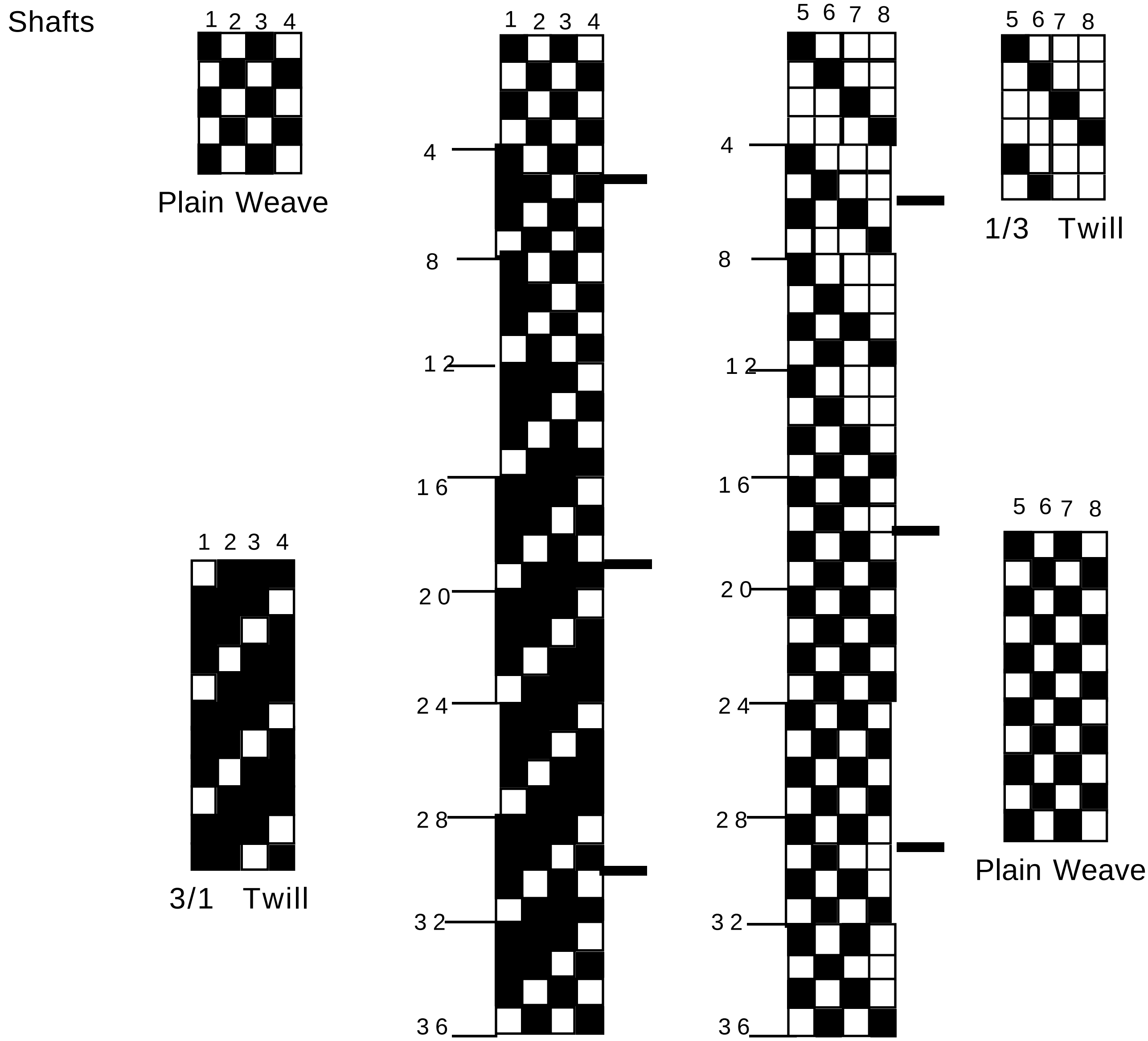
Threads 8-17 and 29-32 don't belong to a specific block and I like to think of them as transition threads.

D. Dissecting the Peg Plan.

The same idea can be applied to the peg plan. In order to see this more easily, the peg plan is divided, one for shafts 1-4 and the other for shafts 5-8. Now the horizontal bars show regions where the peg plan identifies a specific weave structure (plain weave, 1-3 twill, or 3-1 twill). Those regions have been pulled out to the right or left so they are easy to identify.

The peg plans numbered 6-19 and 31-36 on shafts 1-4 and the peg plans numbered 7-18 and 30-36 on shafts 5-8 can be considered to be transition peg plans.

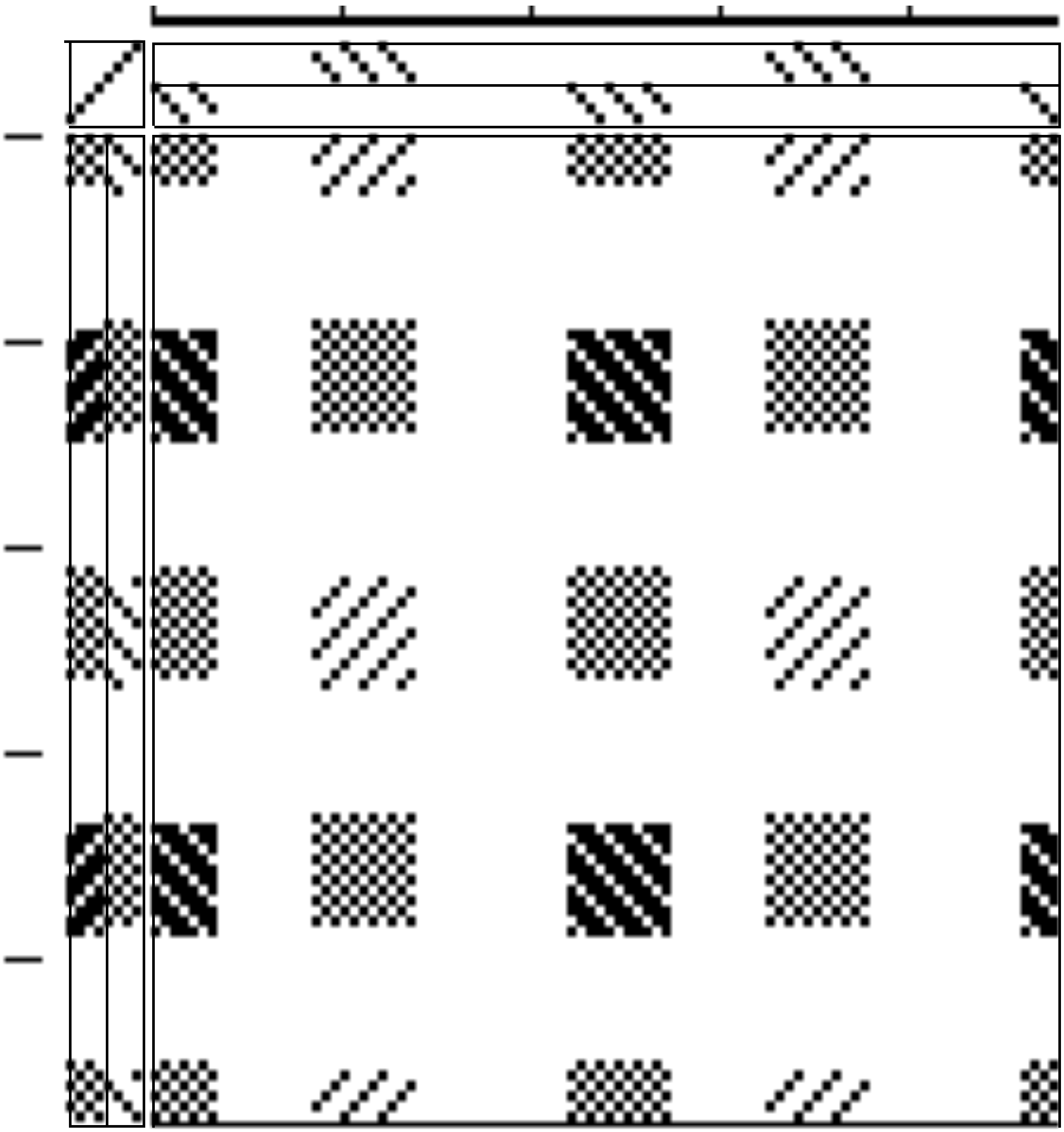
Figure 8. The Peg Plan Dissected



Perhaps there is an easier way to see the total picture. So let's go back to the full design. But now only those threading regions that belong to either block A or B are shown. In addition only those peg plans that belong exclusively to shafts 1-4 or shafts 5-8 are indicated. When the drawdown is made, there are isolated islands where the three different weave structures appear. Here is that drawdown. Remember that this works because all of the threads fall on the network.

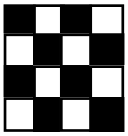
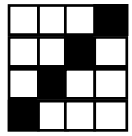
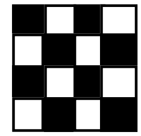
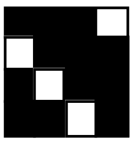
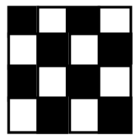
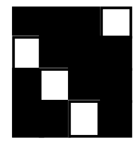
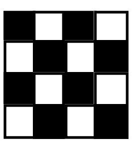
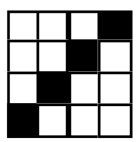
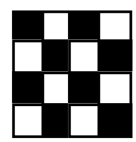
It is worthwhile to compare figures 6 and 9.

Figure 9. Partial Drawdown Showing Regions of Pure Weave Structures



But how about the white areas in this diagram? I began to see them as transition regions because the threading did not fall within either block A or block B, or because the pegging plans did not belong either to shafts 1-4 or shafts 5-8, or because of both of these. I finally had the answer I was searching for, namely, what happens in network drafting. These ideas can be presented schematically.

Figure 10. Schematic Diagram to Show Islands of a Single Weave Structure
And Regions of Transition Weave Structures

Shafts 1-4		**Shafts 5-8**		**Shafts 1-4**
 Plain Weave	Single Transition in Threading	 1 / 3 Right Twill	Single Transition in Threading	 Plain Weave
Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan
 3 / 1 Left Twill	Single Transition in Threading	 Plain Weave	Single Transition in Threading	 3 / 1 Left Twill
Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan
 Plain Weave	Single Transition in Threading	 1 / 3 Right Twill	Single Transition in Threading	 Plain Weave

II. Network Drafting for Double Weave.

The ideas expressed in figure 10 should apply just as well in double weave as in single weave.   One schematic diagram looks like this.

Figure 11. Schematic Diagram for Network Drafting for Double Weave

Shafts 1-4		**Shafts 5-8**		**Shafts 1-4**
Double Weave I	Single Transition in Threading	Double Weave II	Single Transition in Threading	Double Weave I
Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan
Double Weave II	Single Transition in Threading	Double Weave I	Single Transition in Threading	Double Weave II
Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan	Double Transition in Peg Plan & Threading	Single Transition in Peg Plan
Double Weave I	Single Transition in Threading	Double Weave II	Single Transition in Threading	Double Weave I

The two basic peg plans for double weave that I have called Double Weave I and Double Weave II have the forms shown here. Both produce two cloth layers, traditional double weave.

WARP COLOR

D	L	D	L
1			
1	2	3	
		3	
1		3	4

D	L	D	L
1	2		4
	2		
	2	3	4
			4

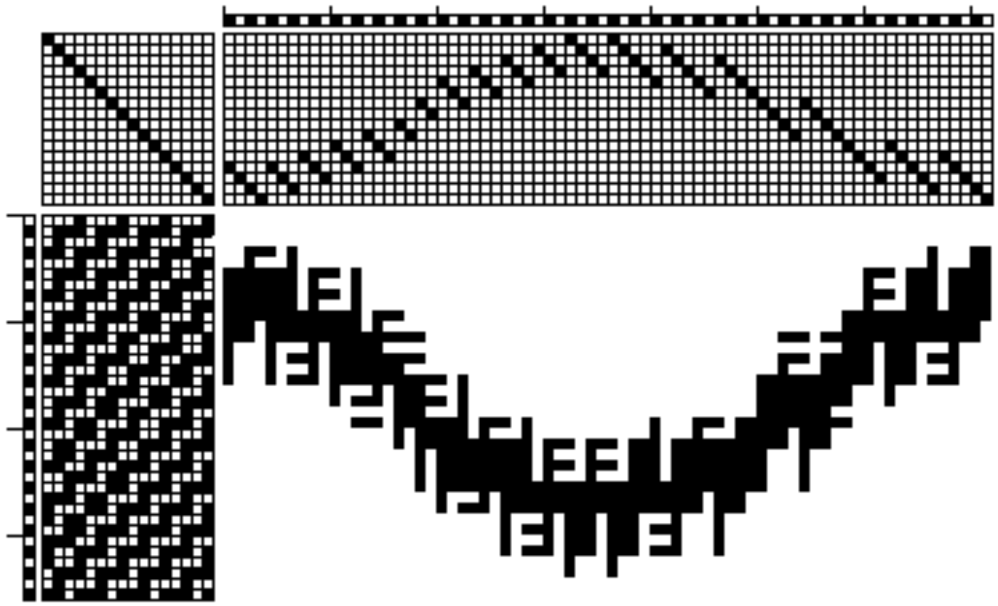
When the weft color order is also DLDL, the first of these peg plans produces a dark top layer and a light bottom layer while the second gives the opposite effect, light on top and dark on the bottom.

Alice Schlein uses a different setof rules from those I use.
Her threading is right to left and her warp color order is LDLD
My threading is left to right and I use warp color order DLDL.
Her weft color order is LDLD while mine is DLDL.
Because of this the two basic peg plans become reversed.

In this book when I use one of Alice Schlein's examples, I will use her rules. All other examples are presented with my rules.

Here is an example that Alice Schlein presents in her article on page 54, Weaver’s Magazine Issue 33, Fall 1996. The drawdown is slightly modified to show the dark and light threads in the top layer of double weave.

Figure 12. Waves # 1

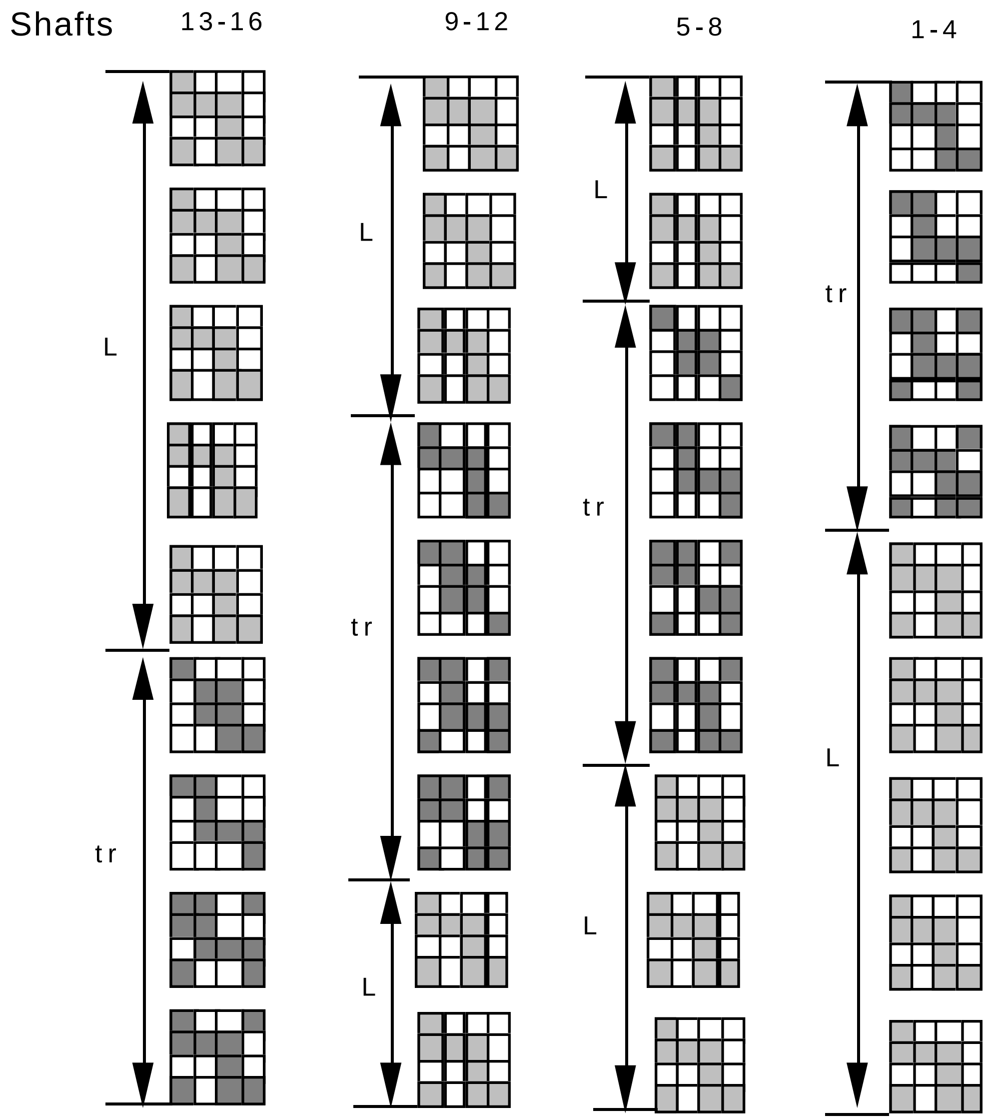


Well so far, so good. There definitely seem to be regions that are all light or all dark with transition regions along the edges of those regions. My hypothesis is holding together. Let's check things out in a bit more detail by examining the peg plans for Waves # 1.

A. Peg Plans for Waves # 1, Testing the Hypothesis!

I expected to find Peg Plan I and Peg Plan II somewhere in each column to provide for the areas that are light or dark in the top layer, along with a number of peg plans that create the transition regions. Here are the four columns of pegging presented separately so they are easier to examine. In addition the pegging is grouped in sets of four.

Figure 13. Analysis of Peg Plan for Waves # 1



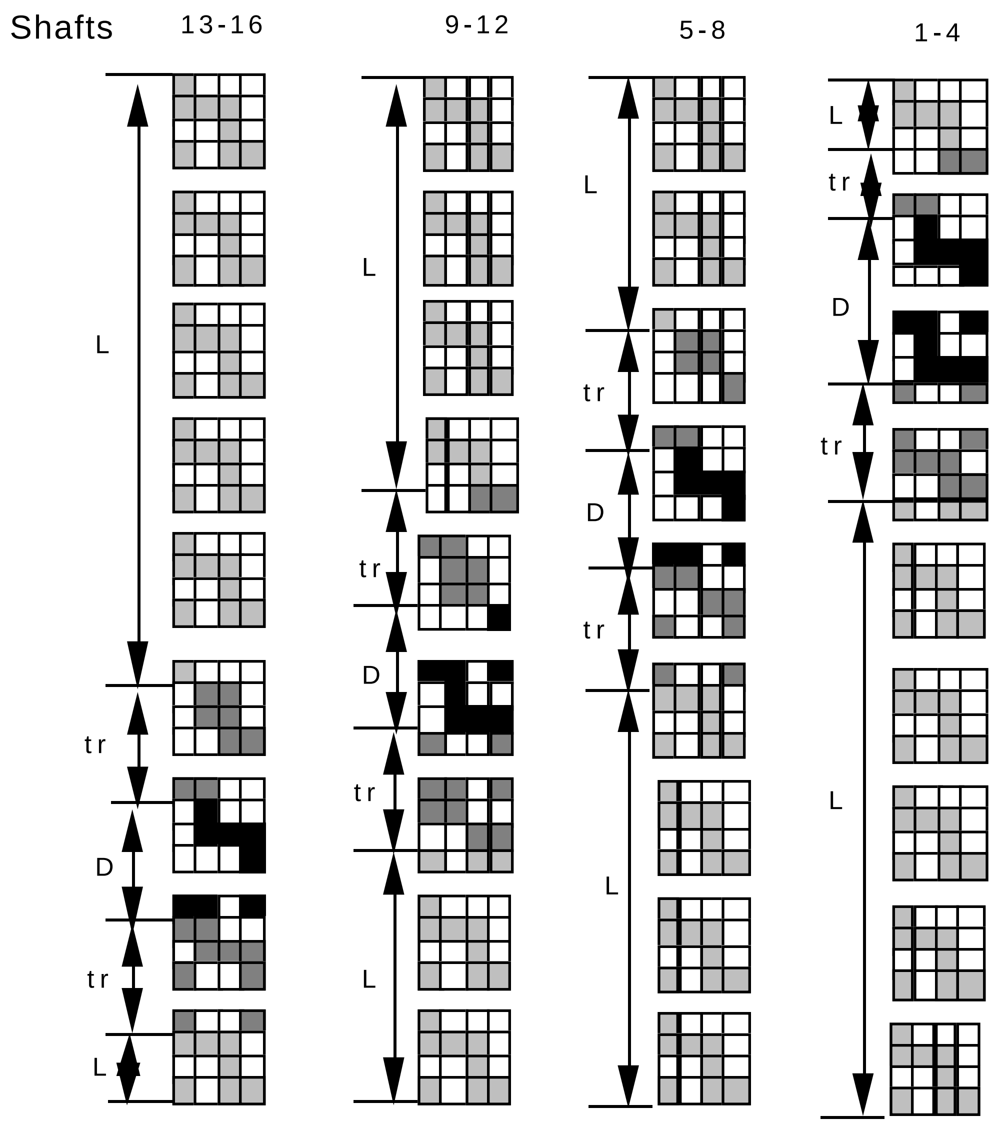
Certain things look pretty good. There are regions where the light layer of traditional double weave appears and there are regions where the transitional motifs of integrated double weave will show up.

BUT!

Where are the sections with the dark layer of traditional double weave? Both the picture in Weaver's magazine and the computer printout indicate that there should be a meandering line of black. So someplace in each column there should be peg plan II to indicate where the dark layer of traditional double weave will be in the overall weaving. Careful checking failed to find peg plan II in the overall peg plan. There is of course the possibility that I had overlooked something.   I pondered the situation for several days and suddenly the answer popped into my mind one night as I was going to sleep. It seems that I had returned to Lotus Land where the peg plans are always in groups of four!

Sure enough! I looked down each column to see if the four lines of peg plan II showed up but not necessarily in a well ordered group of four. Lo and behold, there they were hidden in the transition sections. The next diagram shows the new analysis.

Figure 14. New Analysis of Peg Plan for Waves # 1



Voila and eureka!

The dark peg plans show up in three different ways. This was an important message for me. Peg plans are not limited just to groups of four nor do they have to appear always in a certain order.

B. What Lies Ahead?

Before embarking on a more general discussion of network drafting for double weave in the next chapter, I want to give one example of how a network drafting design may be extended. The transition regions in the peg plans in many examples of network drafting are relatively

short so why not extend them. I repeat the drawdown for Waves # 1 in figure 15 and then show how it can be modified by lengthening the transition pegging sections.

Figure 15. Original Drawdown for Waves # 1

Figure 16. Drawdown for Waves # 1 with Additional Transition Pegging Sections

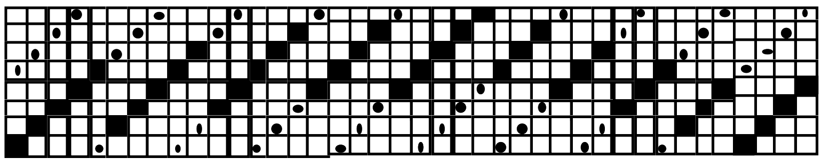
Chapter II. Some Nuts and Bolts of Network Drafting

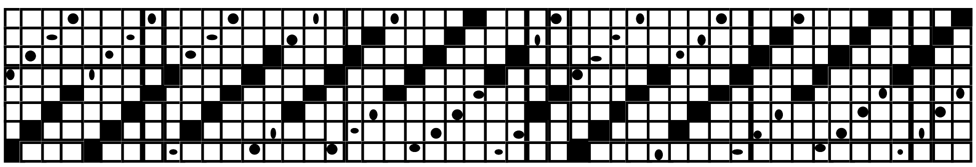
I. Some Threadings on the 4-End Initial

The 4-end initial on 8 shafts will be used in this chapter. The asymmetrical threadings in figure 1A can be used for either single or double layer weaves. The threading in I B can be used for a single layer weave but not for double weave while the threading in I C can be used for double weave but not for single weave.

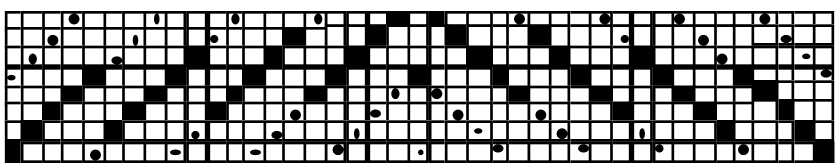
Figure 1. 4-End Initial on 8 Shafts

A. Two Asymmetrical Threadings

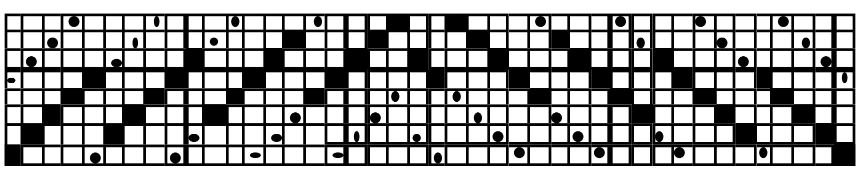




B. A Symmetrical Threading



C. Another Symmetrical Threading



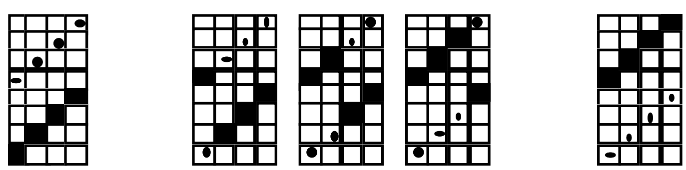
The network in figure I B can be used for any single layer weave that can be woven on the 4-end initial because threads always alternate on odd and even number shafts. In the most common form of double weave, threads on odd numbered shafts are in one cloth layer and the threads on even number shafts will be in the other cloth layer. This means that at the turning point in figure I B two threads on shaft 8 will always weave together in one of the cloth layers of double weave. A way to avoid that problem is to use the network shown in figure I C.

Whenever a turning point is introduced in the threading for double weave in order to achieve horizontal symmetry, two extra threads are added to the threading draft to avoid a weaving error.

However for the computer prints shown in this book, only one extra thread is shown at the turning point. This is to avoid a computer artifact. If you use any of the threadings, be sure to add two at every turning point in the threading draft.

A great variety of threadings can be derived. I find it helpful to develop a threading on the network by looking at groups of 4 threads. For example, figure 2 shows how the threading of figure I C can be expanded to bring out the 4 thread groupings.. The first and last are often labeled as block A and block B for traditional 8 shaft double weave. The middle three can be considered transition blocks (they become important in weaving 4 or 8 blocks of double weave with an 8-shaft loom).

Figure 2. 4 Thread Groupings



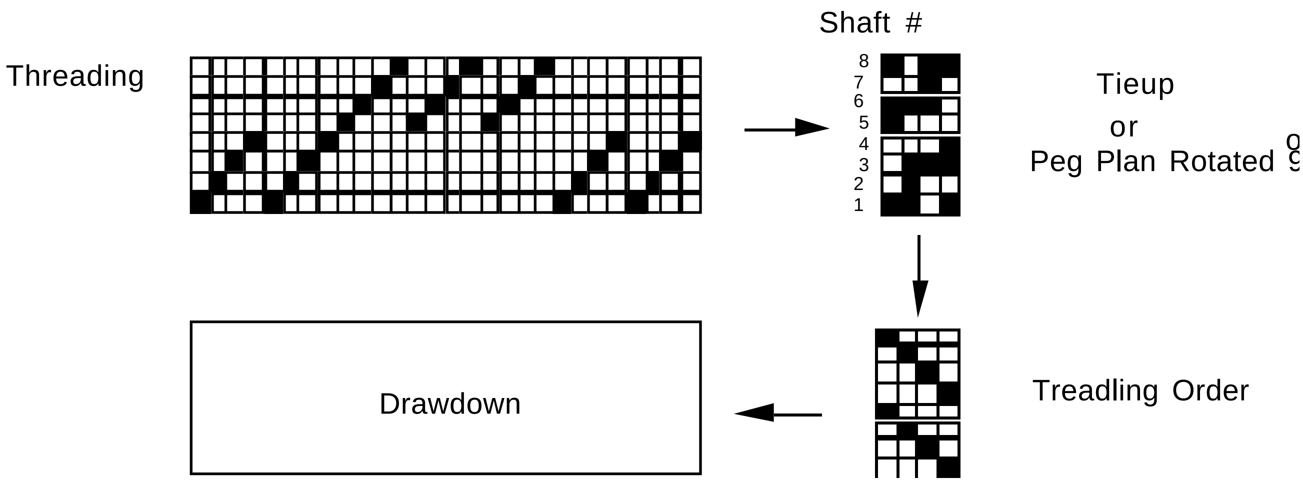
The real advantage in looking at threading in this fashion is that new or expanded threadings are so easy to derive. These four thread groups can be repeated or deleted or rearranged at will because the threading will always fall on the network. Examples of this will be presented in Chapters III and IV.

II. Threading, Tieup, Peg Plan and Treadling

A. For Non-Symmetrical Designs

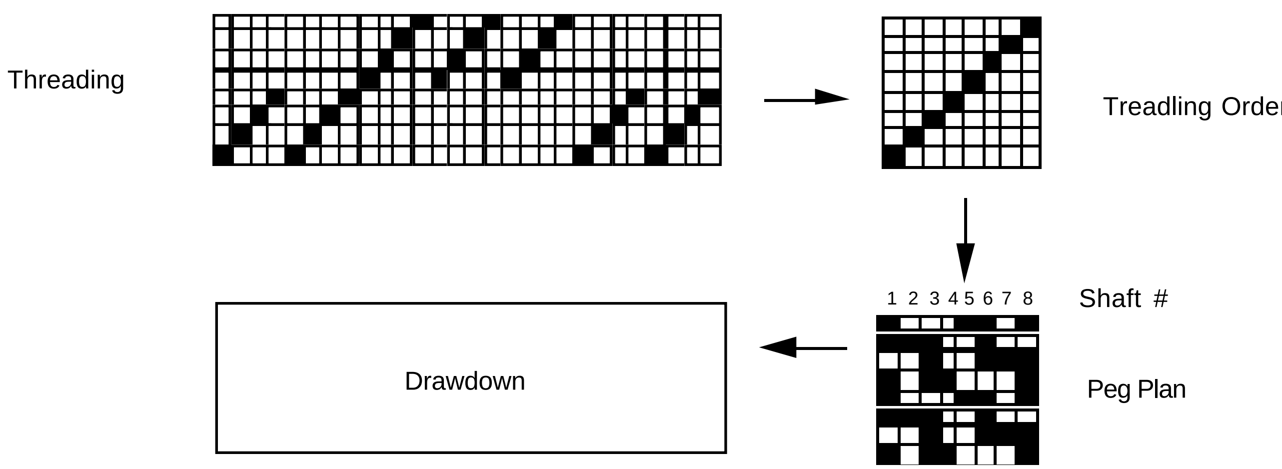
All floor loom weavers soon become familiar with the format for making a drawdown: from the threading to the tieup to the treadling order to the drawdown. Figure 4 gives an example (without the actual drawdown!) which could be used with a treadle loom, a table loom, or a dobby loom.

Figure 3. Scheme Leading to the Drawdown



A dobby loom can be set up in a slightly different way which is shown next. This is sometimes referred to as “single ties to multiple treadles”.

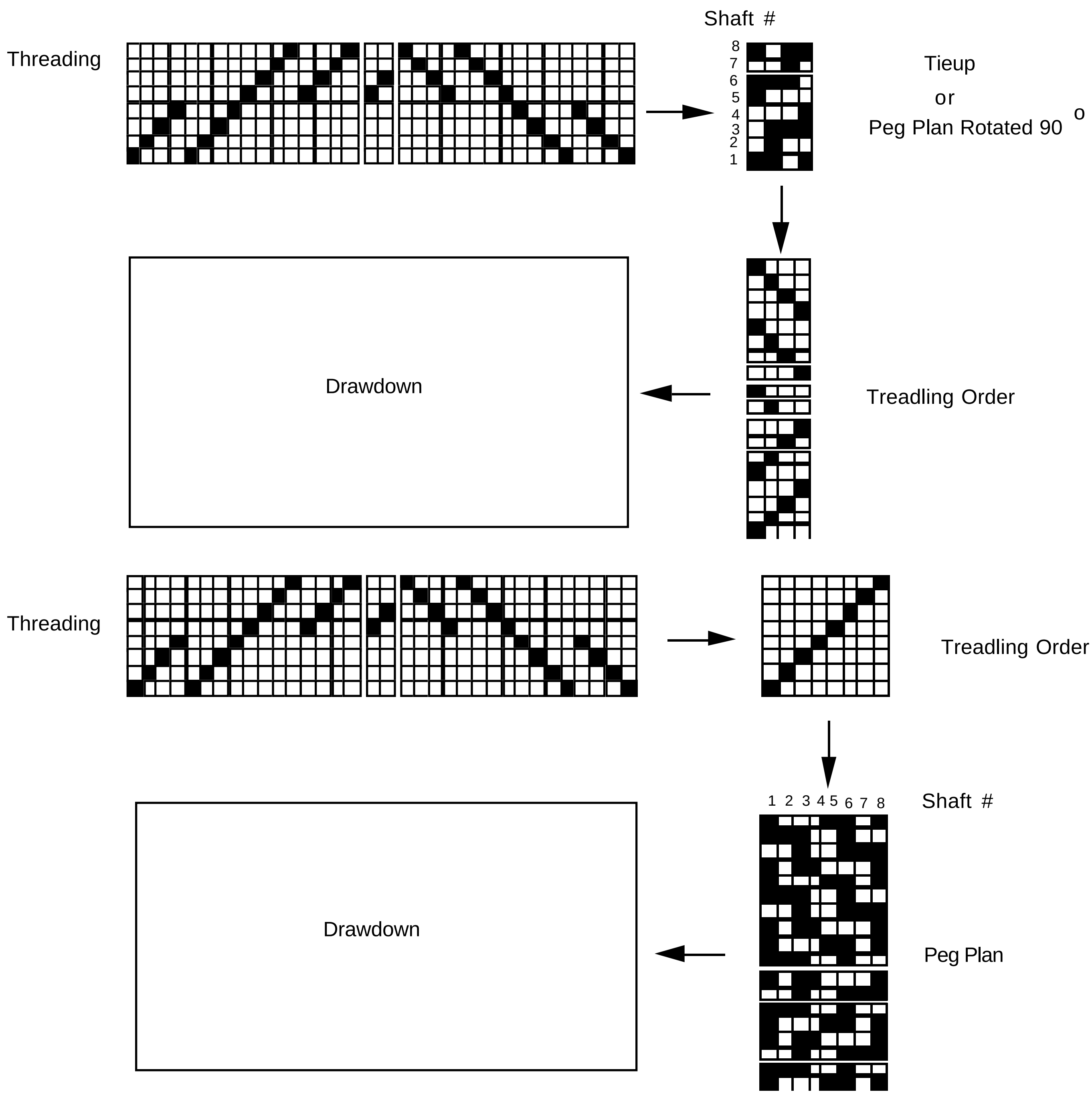
Figure 4. An Alternate Scheme Leading to the Drawdown



B. For Symmetrical Designs

It is quite straightforward to make designs symmetical in the horizontal direction (through changes in the threading) or in the vertical direction (through changes in the treadling order or in the peg plan). Figure 4 repeats the information in figure 3 to show how symmetry can be achieved. For double weave note that it is necessary to have <u>two extra threads</u> so that errors do not occur in either the top or the bottom cloth layers. Similarly <u>two extra treadlings or peg plans</u> are required for the same reason. The extra threads and treadlings or peg plans have been separated to let you see more easily what happens before each of these is reversed to achieve symmetry.

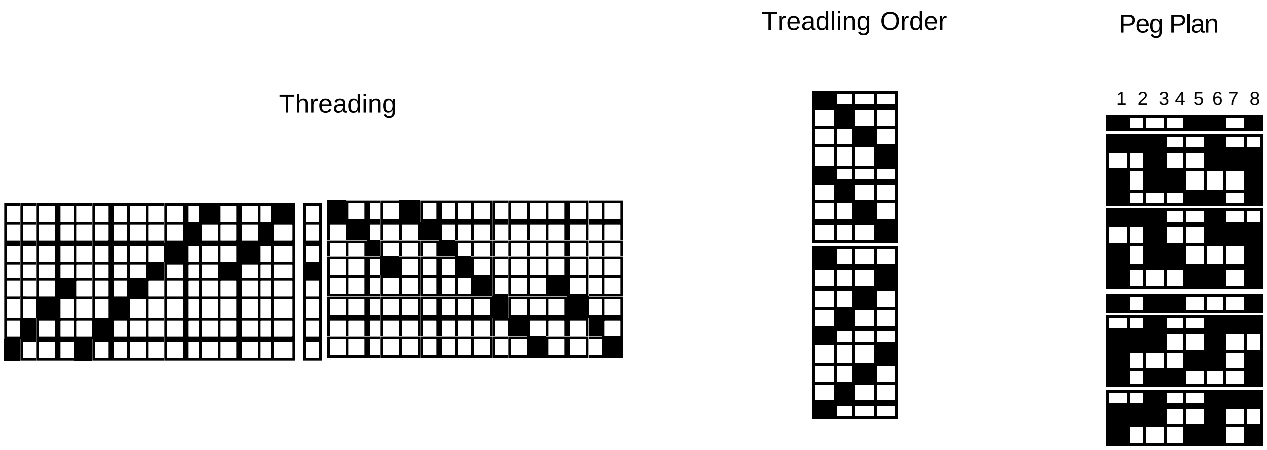
Figure 5. Symmetrical Schemes leading to the Drawdowns



RULE. Remember two extra warp threads are needed at the turning point for horizontal symmetry and two extra treadlings or peg plans are needed at the turning point for vertical symmetry.

So having said that I want to alert you to the fact that all of the computer printouts where symmetrical designs are given do not follow that rule. Sorry. The reason is that the weave programs I have been using with my MacIntosh computer do not have the capability to show the two sides of a double woven fabric. Figure 6 shows examples of the threading, treadling and peg plan format used for the computer printouts. **REMEMBER** to carry out the weaving in the manner of figure 5, not figure 6.

Figure 6. The Formats for the Computer Printouts



Further explanation is presented in Appendix C. But as my computer son says, this is "`geek stuff".

III. Transitions between Peg Plans

A basic element in network drafting is the transition that occurs from one weave structure to another weave structure. The pattern line provides a very efficient way to derive the threading and the peg plan for this transition. I would like to present another method that looks at the peg plan in a more general manner. In double weave there are six different peg plans giving different combinations of the four warp threads in the two layers. The discussion here is limited to Peg Plan I (dark top layer, light bottom layer) and Peg Plan II (light top layer, dark bottom layer). The transition between the two peg plans is given in figure 7. The numbers used in the peg plans are for shafts 1-4 but of course the diagrams are applicable to other shafts.

Figure 7. Transition between Peg Plan I and Peg Plan II

1			
1	2	3	
		3	
1		3	4

1	2		4
	2		
	2	3	4
			4

There are several things in these two diagrams that are identical. First, some numbers always appear in the same place which means that there is always a peg in that square. Second, four empty spaces always appear in the same place which means there is never a peg in that position. In figure 8, a zero, 0, indicates a square where a peg never appears.

Figure 8. Common Features of the Two Basic Peg Plans

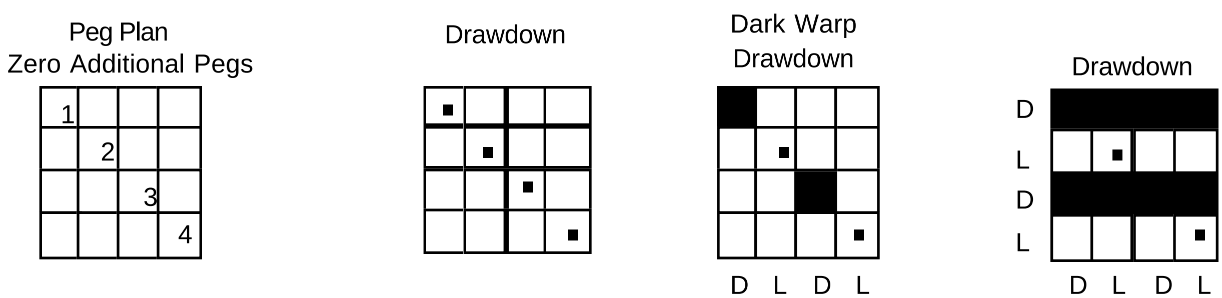
1		0	
	2		0
0		3	
	0		4

That leaves eight squares in Figure 8 where a peg may or may not go. "To peg or not to peg" are the choices. Two choices for each empty space lead to a total of

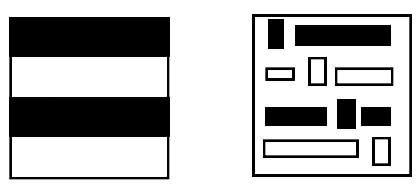
$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$$

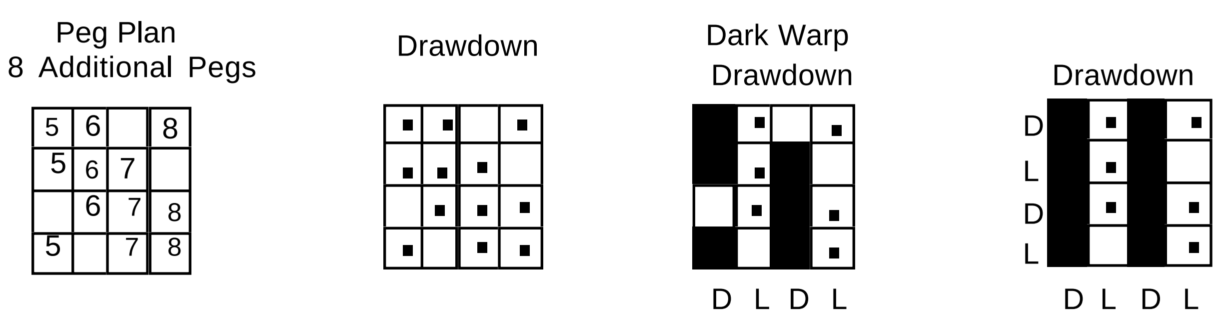
different peg plans for double weave. These peg plans are given in Appendix A-1 with their drawdowns and A-2 with their drawups.. Let me show the drawdowns for two of the 256 peg plans, the first where no additional pegs are added to figure 8 and the second where eight additional pegs have been added. The procedure I use for drawdowns is presented in figure 9. The peg plan comes first and next a diagram where dots replace the numbers. The third diagram is a warp drawdown for the dark warp threads (a jack loom with rising shed is assumed). In the final square, dark weft threads complete the drawdown. (An empty square indicates a light weft thread in the top layer and a square with a black dot stands for a light warp thread also in the top layer.)

Figure 9.   From Peg Plan to Drawdown in Four Steps

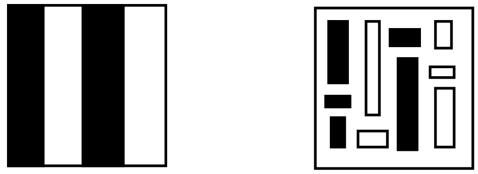


The finished weaving looks like the first of the next two diagrams when the grid lines and dots are erased. The second diagram shows the weave structure with the DLDL color order for both the warp and the weft.





The appearance of the weaving and the weave structure are shown next.



For two of the 256 peg plans, peg plans I and II, there will be the two cloth layers of traditional double weave. Half of the warp and weft threads are in one cloth layer and the other half are in the second cloth layer. Because of this the sett that is recommended for traditional double weave is twice the sett for single layer plain weave.

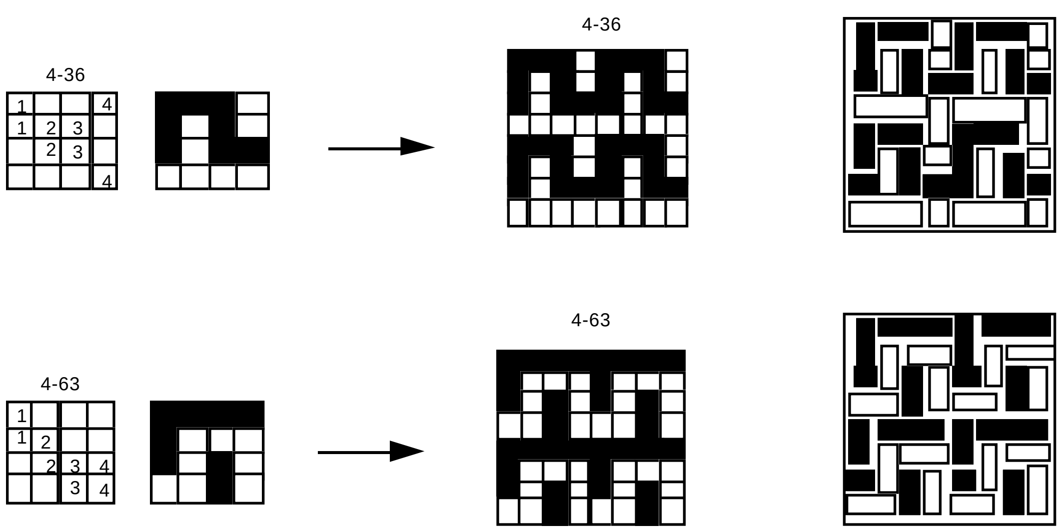
For the remaining 254 peg plans, there will be a single cloth layer in integrated double weave. All warp and weft threads are in the same cloth layer and the sett should revert to the one proper for single layer plain weave, that is half the sett appropriate for two layer double weave.

So what should be the sett for a weaving that has some areas in traditional double weave and other areas in integrated double weave? If the sett is proper for the two layer sections, then twice as many threads are crowded into the integrated double weave section. On the other hand if the sett is proper for the single layer areas, then the two-layer region will probably be much too loose. Well there is no one answer except to try different setts and choose the one you like. I find that a sett that is about 10 - 20 % more open than the sett used for traditional double weave seems about right.

IV. Another Look at the 254 Peg Plans

The drawdowns in Appendix A-1 are all one unit on a side. More revealing are drawdowns of two units on a side and these are given in Appendix B-1. Notice that there are far fewer than 254 distinct designs and they have been grouped in Appendix B-1 to emphasize this. Some are shifted up or down by a few threads. Others are the positive-negative images of each other. In figure 10 the drawdowns and weave structures for the tieups numbered 4-36 and 4-63 are shown. The drawdowns come from Appendix A-1 and the 4 unit drawing from Appendix B-1.

Figure 10. The Drawdowns and Weave Structures for Two of the 254 Peg Plans



The designs in single unit size seem to be quite different. However the four unit drawdowns begin to reveal their similarity. In the example used here, the designs are the positive-negative versions of each other. Also the design of 4-63 has been shifted by one thread in both the vertical and horizontal directions from the design in 4-36.The weave structure diagrams in figure 9 and 10 show that the warp and weft threads interlock so that none of the threads can slide under other threads, two more examples of integrated double weave, single layer weaves that show all the warp and weft threads. That this is not always true is explained in Appendix D where the problem of drawdown for double weave is developed more extensively.

Chapter III. Some Networked Double Weave Designs, Using Tieups

It is time to get down to business!

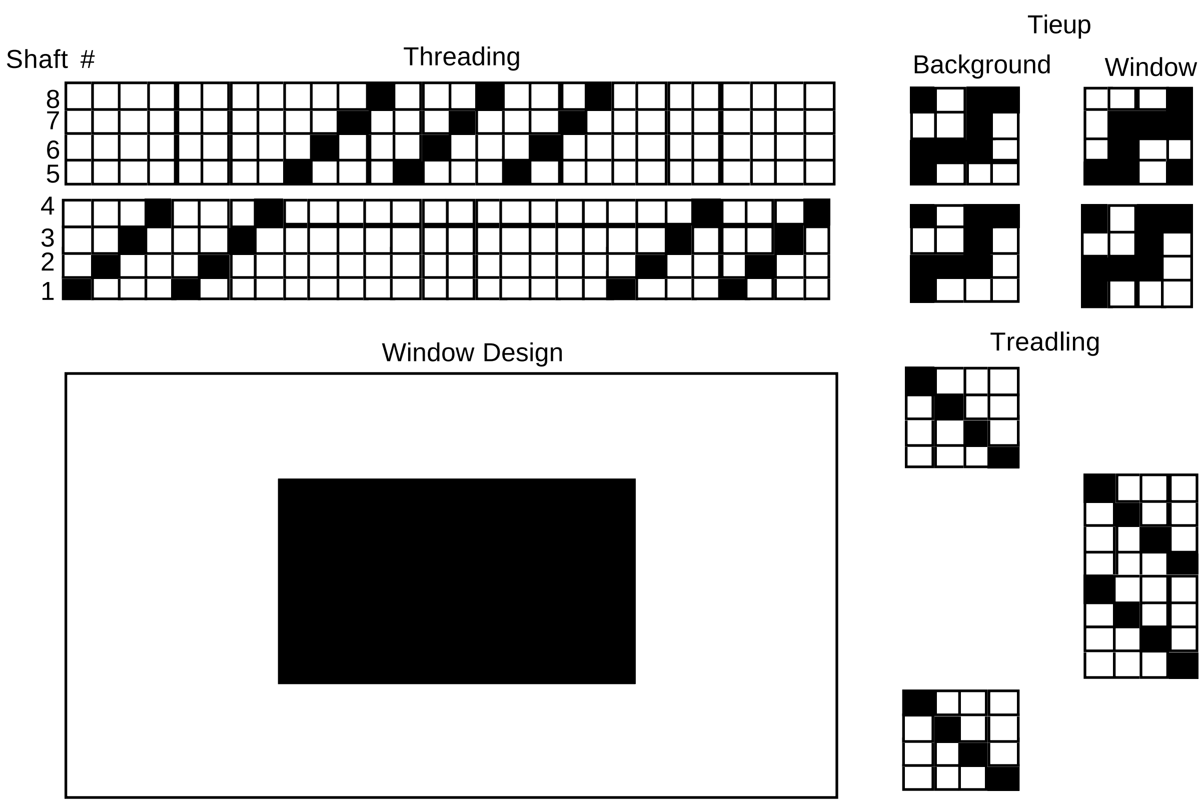
The next chapters discuss some of the designs that can be woven in double weave using network drafting principles and how to achieve or alter them. The approach in this chapter is based on the use of tieups and works with a treadle floor loom, a table loom with levers to lift each shaft independently, or a dobby loom.

I think of two of the basic designs in double weave as "windows" and "checkerboards" and want to discuss them separately. Eight shafts are required to weave these designs.

I. The Windows Design

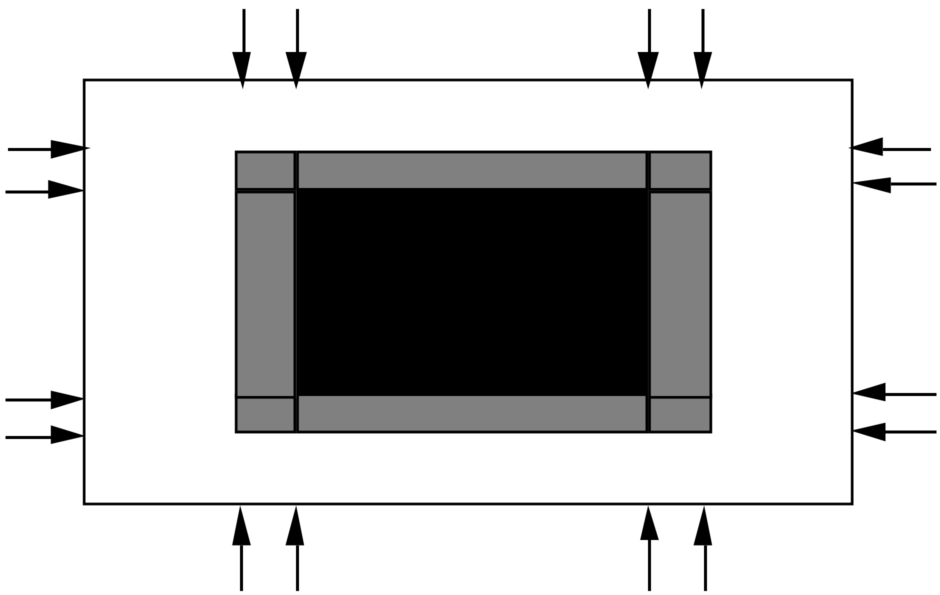
Figure 1 shows the threading, tieup, and treadling needed to weave an 8 shaft double weave windows design. A drawing shows what the drawdown looks like. The windows can be square or rectilinear, wide or tall. Eight treadles or eight dobby bars are required in the weaving. This is made explicit in figure 1 by expanding each part of the diagram so that it is easy to see what happens.

Figure 1. The Windows Design in Double Weave



The transition zones when the design is networked are presented in figure 2. The vertical arrows correspond to transition in the threading. The horizontal arrows correspond to transition in the tieup or the peg plan. Single diagonal lines show where the woven area is a result of the transition in either the threading or the tieup. The crosshatch lines show where the woven area is a result of the transitions in both the threading and the tieup. These designs tend to have the rectilinear appearance of traditional double weave and not the curved shapes that are often seen in networking drafting.

Figure 2. Transition Regions in the Window Design

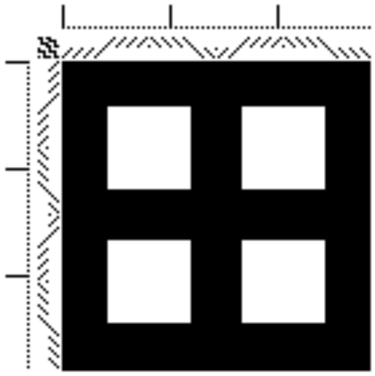


B. Computer Printouts for some Window Designs

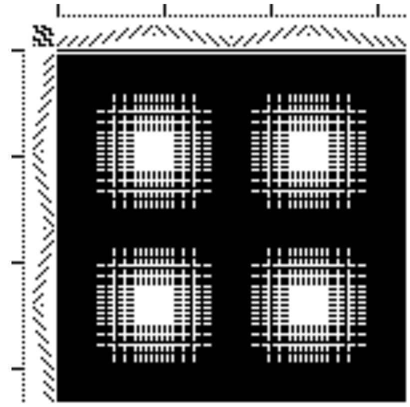
A variety of threadings have been used in the designs that are shown below and also in the next section where the checkerboard design is used. The first printout is for traditional double weave and is an expansion of the threading in figure 1. Notice that there is symmetry in the horizontal and vertical directions.

Figure 3. Some 8 Shaft Window Designs for Networked Double Weave

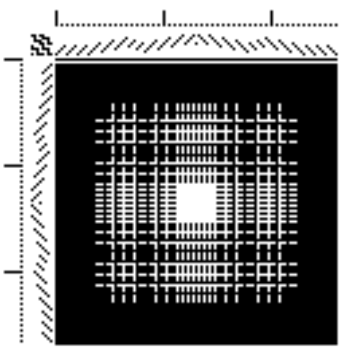
Traditional Double Weave



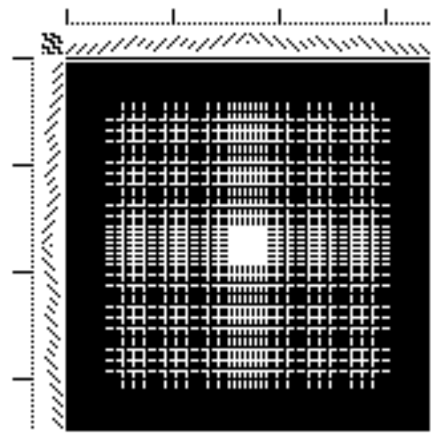
Transition 1 A in Threading and Treadling



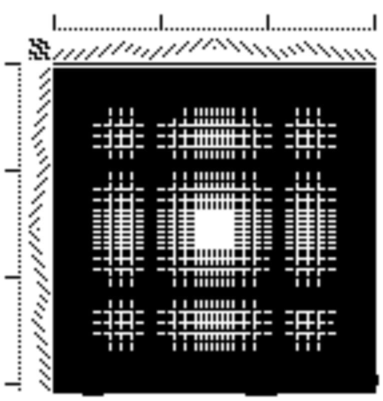
Transition 1 B in Threading and Treadling



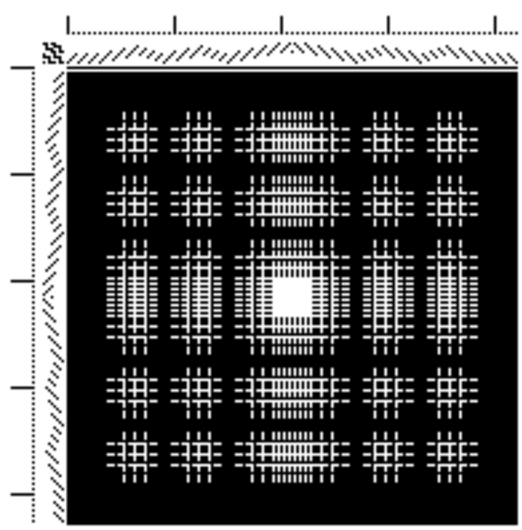
Transition 1 C in Threading and Treadling



Transition 1 D in Threading and Treadling



Transition 1 E in Threading and Treadling



II. The Checkerboard Design

Figures 8 and 9 show the threading, tieup and treadling needed to weave an 8 shaft checkerboard design and should be compared with figures 1 and 2 of section I where the window design for double weave was discussed.

Figure 4. The Checkerboard Design in Double Weave

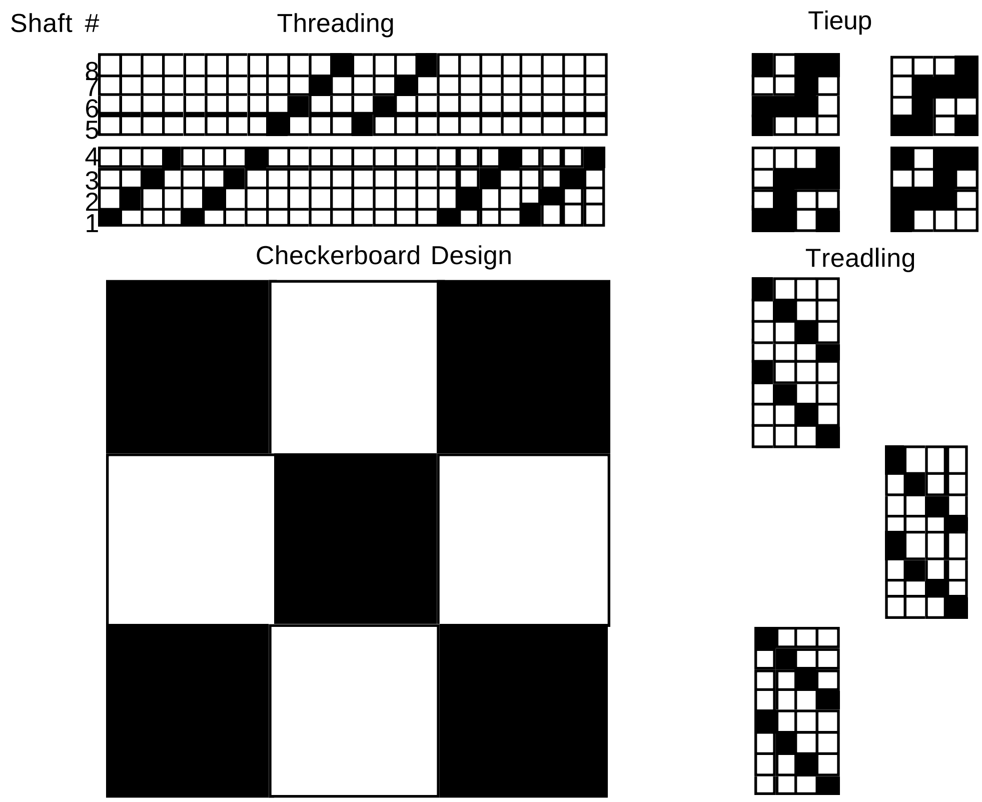
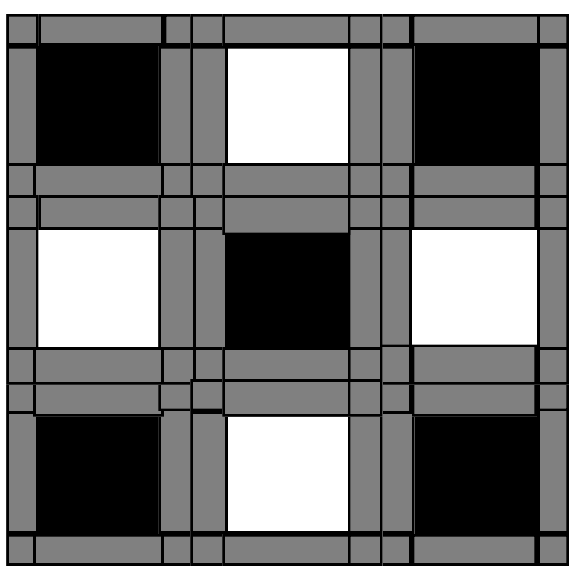


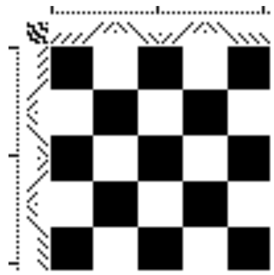
Figure 5. The Checkerboard Design Networked



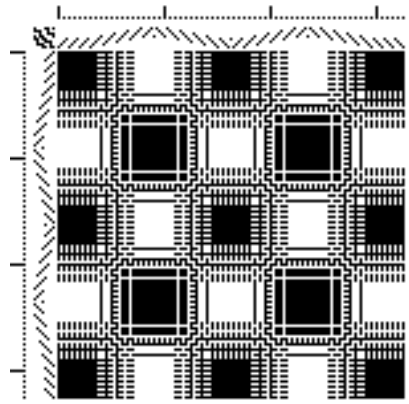
Here are some computer printouts for the 8 shaft double weave checkerboard design. The central checkerboard square has been enlarged in the last printout to improve the design. Even so, it seems to me that the overall impact for I C is not very pleasing.

Figure 5 Some 8 Shaft Checkerboard Designs in Network Double Weave

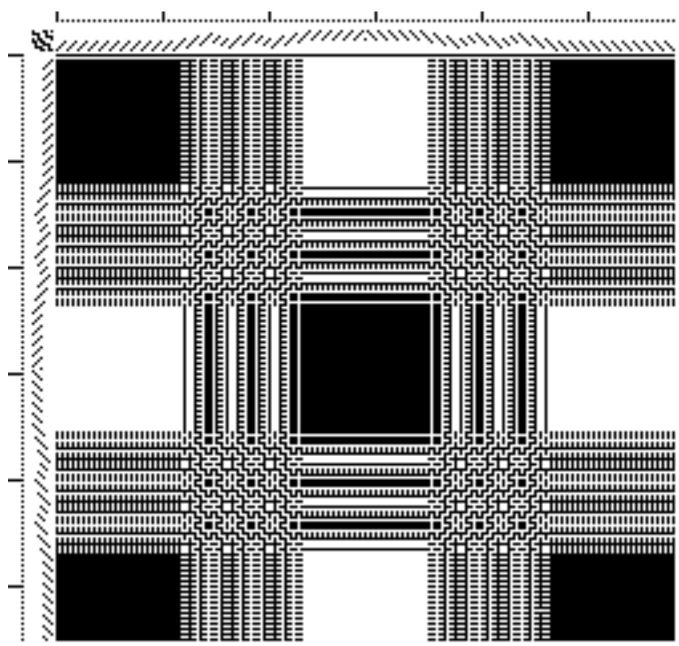
Traditional Checkerboard design



Transition I A



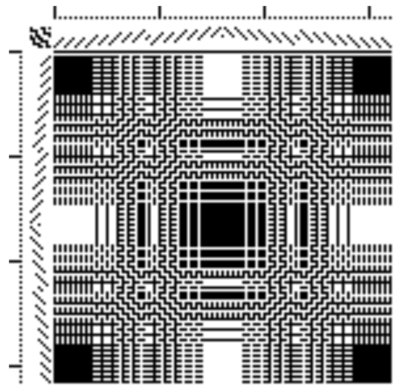
Transition I C



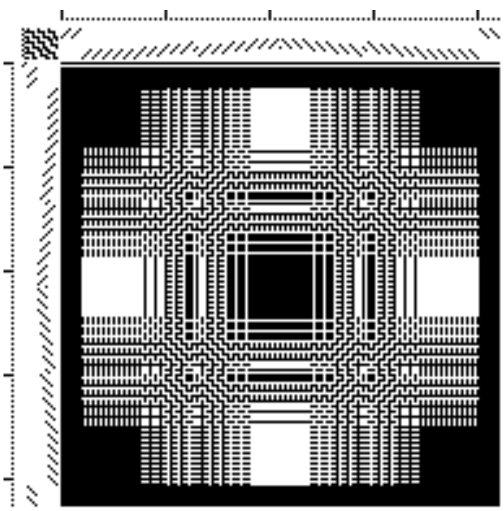
I decided to take one example, II B, to see if I could create a design I did like. Figure 6 shows the modifications I made. The first major change introduced a background around the checkerboard creating a window design where the window was in the form of a checkerboard. I needed to use 12 shafts to achieve this. The design was still confusing to me so I began to delete sections in the threading and treadling order and replace them with more of the background. The easiest way to do this was to shift threads from shafts 5-8 to shafts 9-12, always staying on the network. Notice also that the original checkerboard squares are larger and some are rectangular in shape. I felt that these changes produced a much more satisfactory double weave design.

Figure 6. The Development of a Design in Networked Double Weave
The Development of a Checkerboard Design in Networked Double Weave

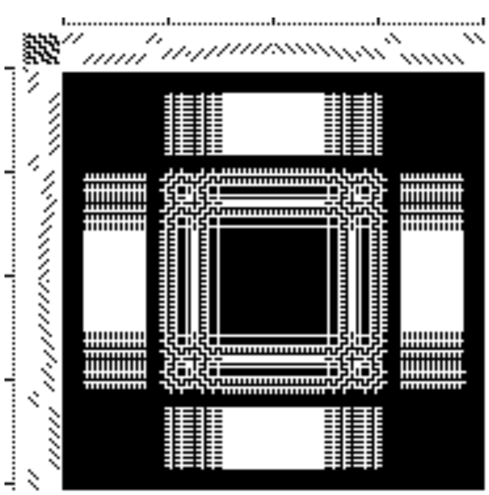
Transition II B in Threading and Treadling



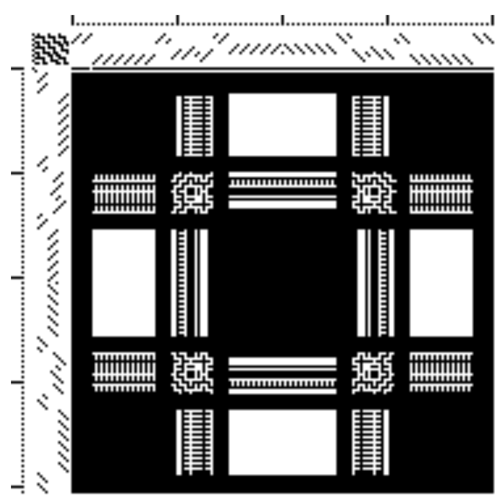
Outline Added, 12 Shafts. Threading Extended



Variation I



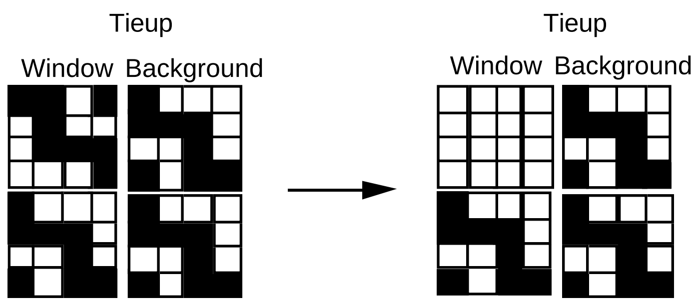
Variation II



III. A Different Treatment for the Windows Design.

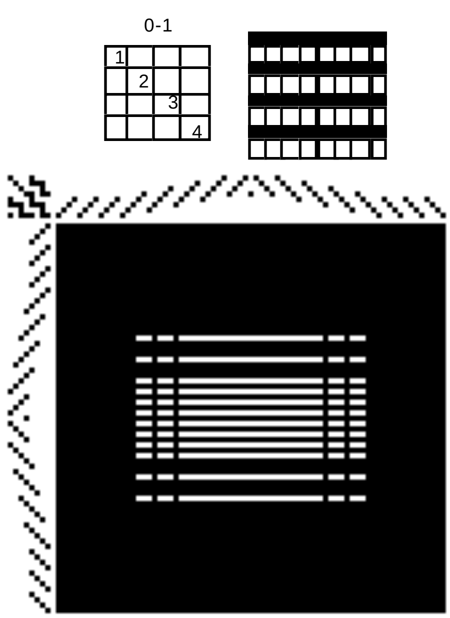
The window part of the designs presented in sections I and II of this chapter has been in traditional double weave with peg plan II producing the light top layer. However any of the other 254 peg plans could have been used for the windows. Figure 7 shows how the tieup can be altered substituting another peg plan for peg plan II.

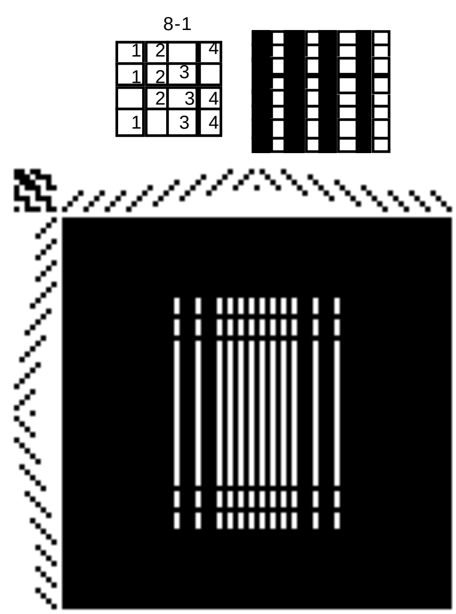
Figure 7. Changing the Tieups for the Window Design



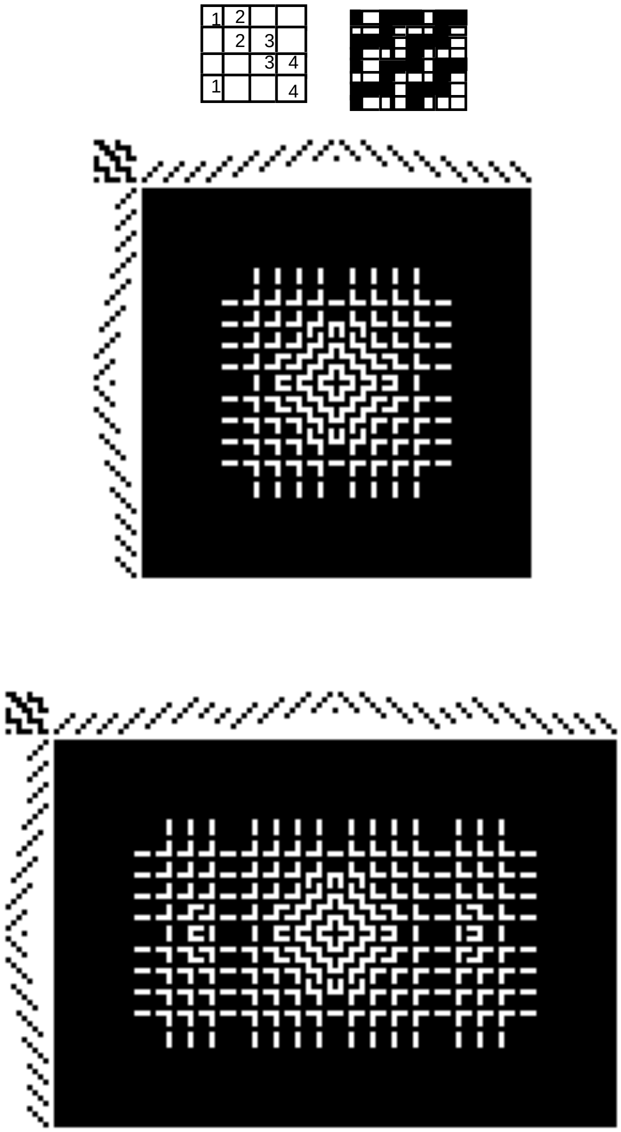
Here are some examples of what happens when this substitution is made. For each drawdown, the peg plan from Appendix A-1, with its identifying number and the 2 x 2 drawdown from Appendix B-1 are given. Remember that the window is now in integrated double weave, a single cloth layer. All of the designs are symmetrical.

Figure 8. Substitution of other Peg Plans in the Window Design

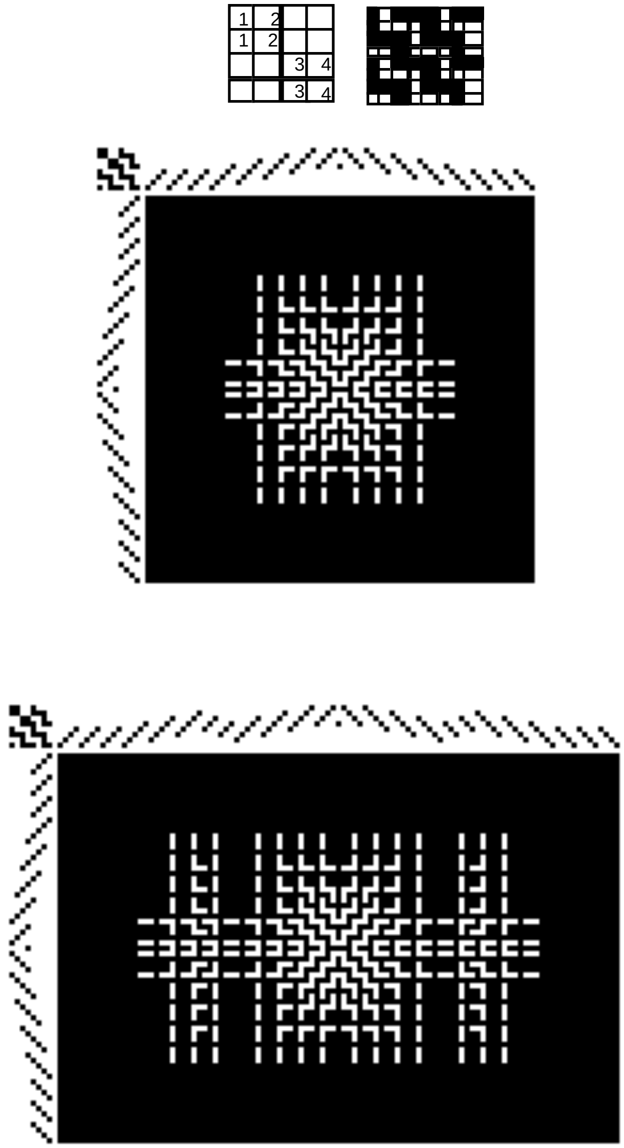




4-29



4-24



Chapter IV. Some Networked Double Weave Designs, Using Peg Plans

A. Some 8 Shaft Window Designs using Peg Plans

With a dobby loom, peg plans can be used rather than tieups (this method is sometimes called “single ties controlling multiple treadles”). Compare this diagram with figure 1 in chapter III.

Figure I. The Windows Design in Double Weave using Peg Plans

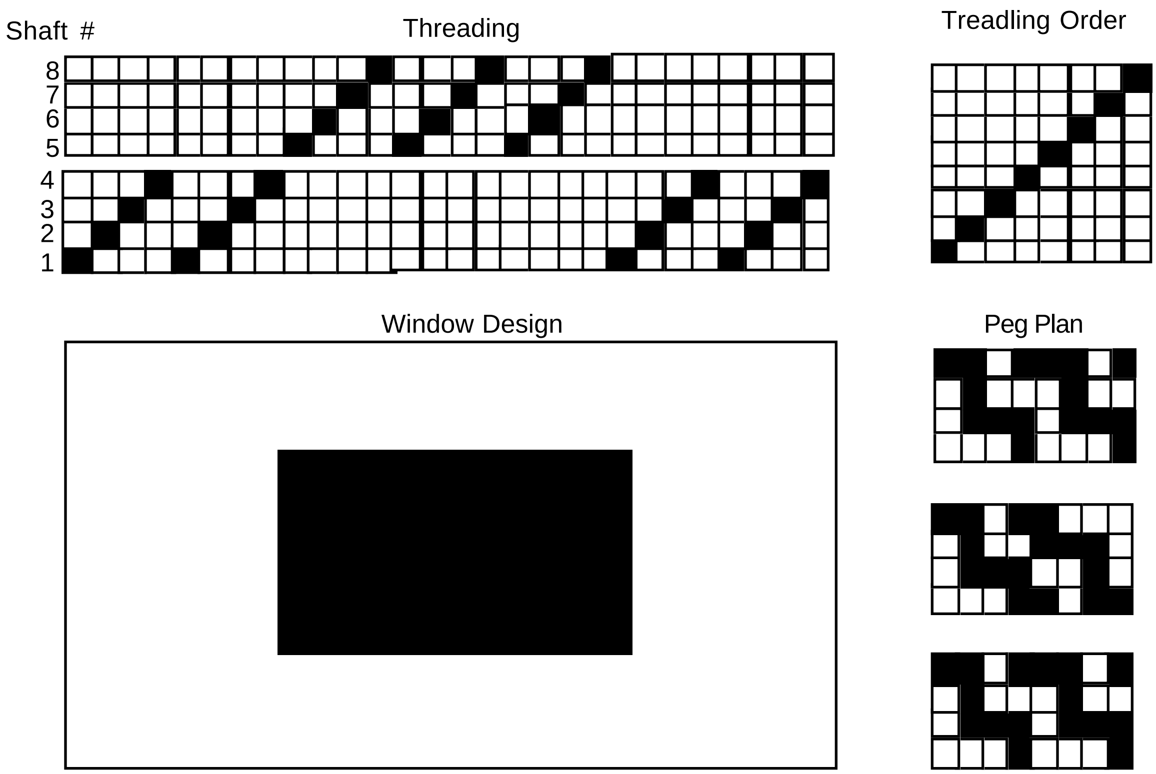
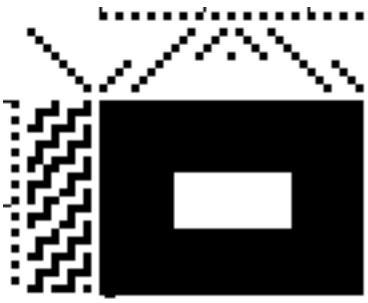


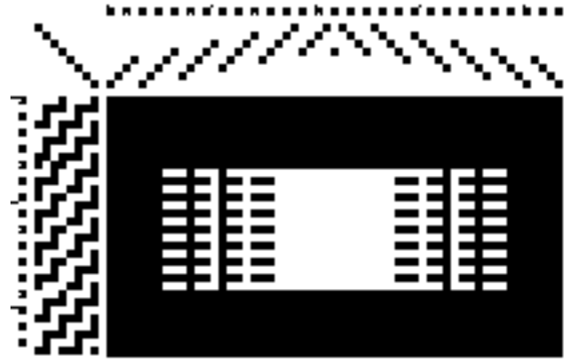
Figure 2 presents a series of diagrams beginning with a traditional double weave window design, adding transitions in the threading, the peg plan, and then both the threading and the peg plan. Diagram E extends the transition in the threading to show how changes can easily be made. The figures have a more curved appearance with this system than was true for tieups.

Figure 2. Some 8 shaft Window Designs

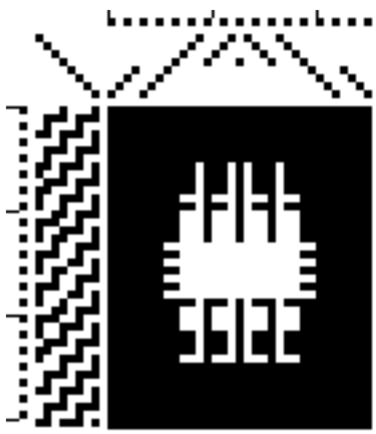
A. Traditional Double Weave



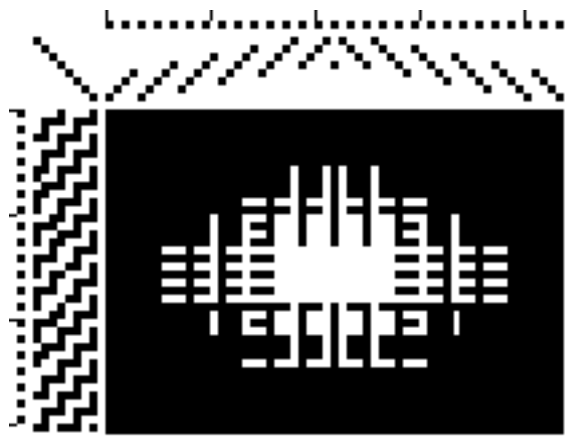
B. Transition in Threading Only



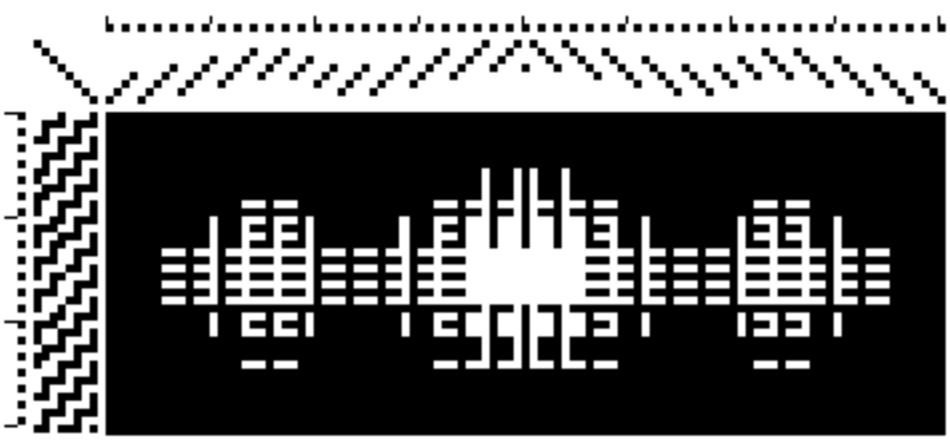
C. Transition in Peg Plan Only



D. Transition in Threading and Peg Plan

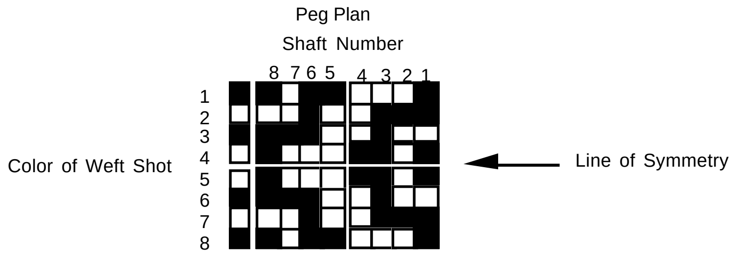


E. Extended Transition in the Threading   Same Transition in the Peg Plan



All of the examples are symmetrical in the horizontal direction. It is as easy to make the designs symmetrical in the vertical direction when using peg plans as was true in the system that used tieups. Here is how to do it. Choose the point where you want the design to become vertically symmetrical. Now simply reverse the entire peg plan back to the beginning. This is shown in figure 3 for the two peg plans at this reflection point.

Figure 3. Reversal of the Peg Plan to Achieve Vertical Symmetry



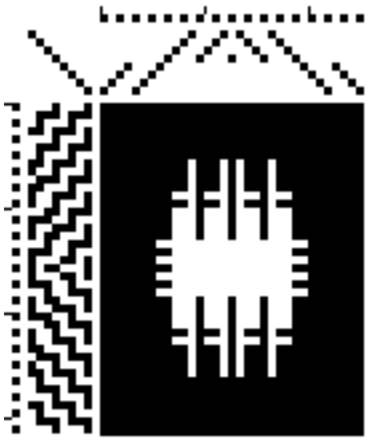
The peg bars for the fourth and the fifth weft shots are the same, a weaving error in the top layer. Moreover the third and sixth weft shots are the same, a weaving error in the bottom layer.

In Chapter II section II, the methods to achieve horizontal and vertical symmetry were discussed. To achieve horizontal symmetry, two additional warp threads must be added before reversing the threading and to achieve vertical symmetry, two additional peg bars must be added before reversing the order of the peg plan. The peg plan in figure 3 then becomes the peg order shown in figure 4. Both the warp and the weft color order must be changed from DLDL to LDLD at the reverse point.

Figure 4. Vertical Symmetry in the Weaving and in the Computer Graphics

For diagrams 5,6, and 7 it is important to recognize that the threading has only a single warp thread at the turning point and that the weft shots have only a single extra weft shot at the turning point. This avoids computer artifacts in the printouts.

Figure 5. Diagrams 2C and 2D made Vertically Symmetrical



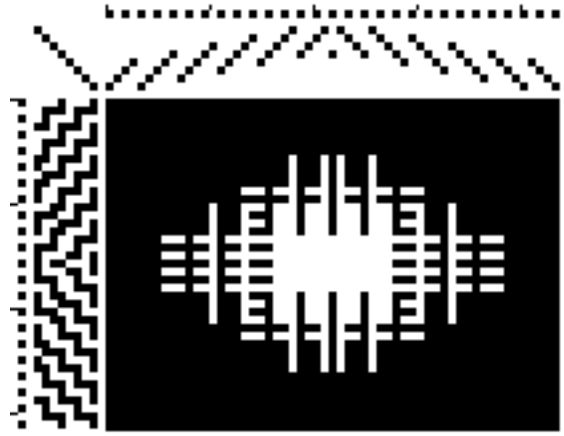
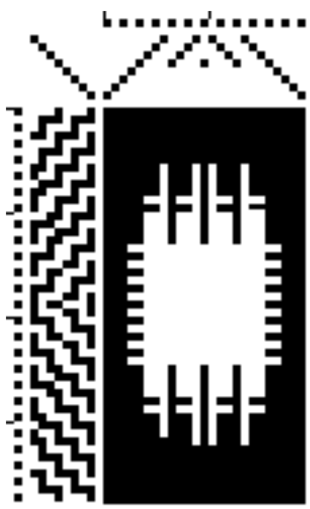
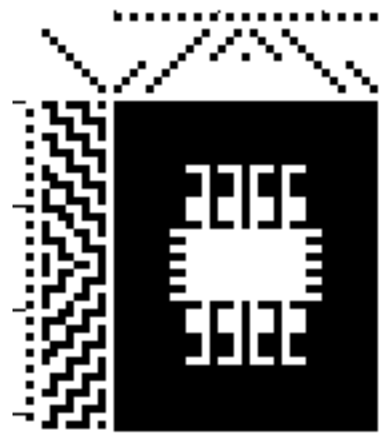


Figure 6 shows that 2C can be made symmetrical in two ways. The weft color order must change to LDLD for the second diagram.

Figure 6. Diagram 2C made Symmetrical in Two Different Ways

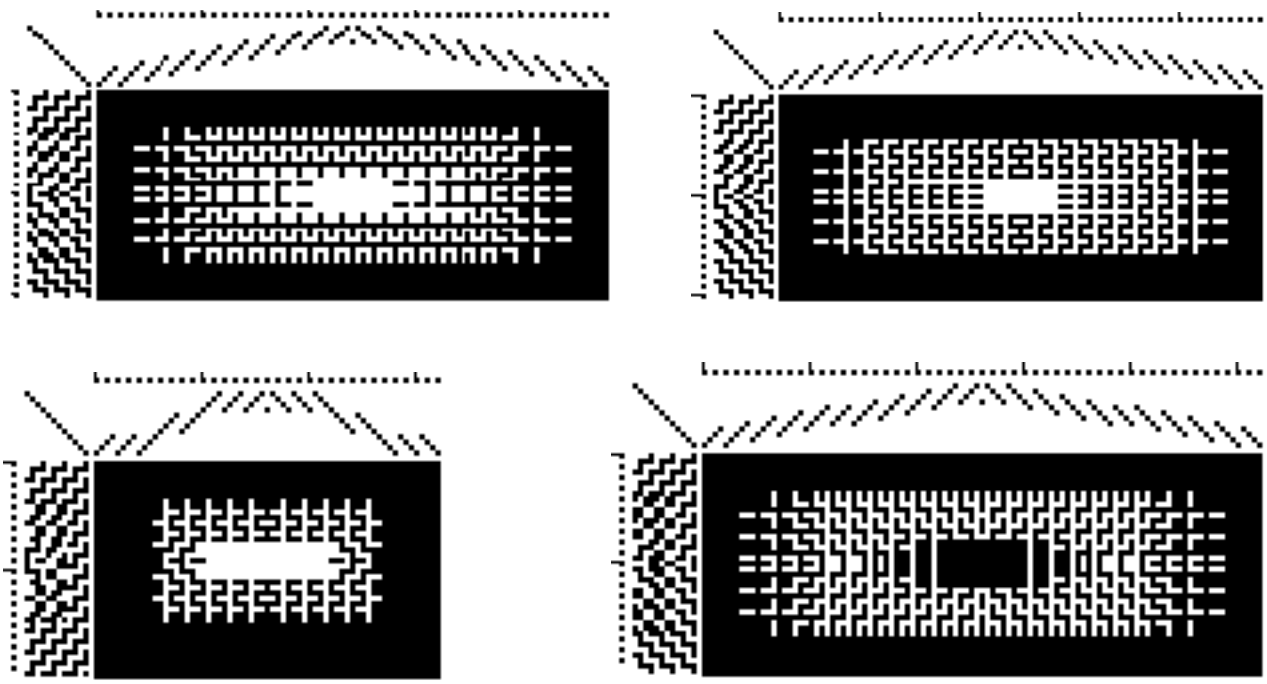




C. Some 12 and 16 Shaft Window Designs.

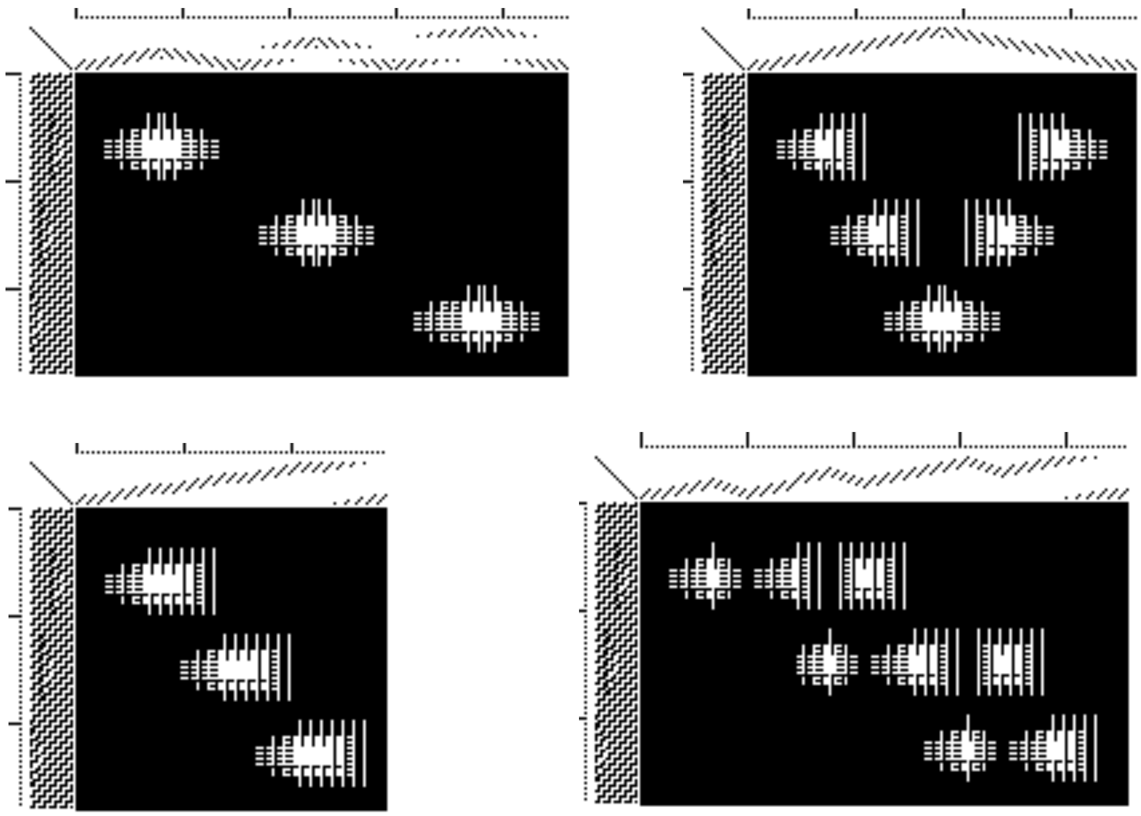
It is easy to extend the ideas presented for 8 shaft weaves to more shafts. Some computer printouts are shown on the next pages. The 12 shaft designs in figure 7 might be thought of as "windows within windows" and all show vertical symmetry.

Figure 7.   12 Shaft Networked Designs



The second and third use the same motifs, with slight differences in placement. The 16 shaft designs in figure 8 illustrate how window motifs can be arranged in a variety of ways with some symmetrical and others asymmetrical.

Figure 8. Some 16 Shaft Networked Designs



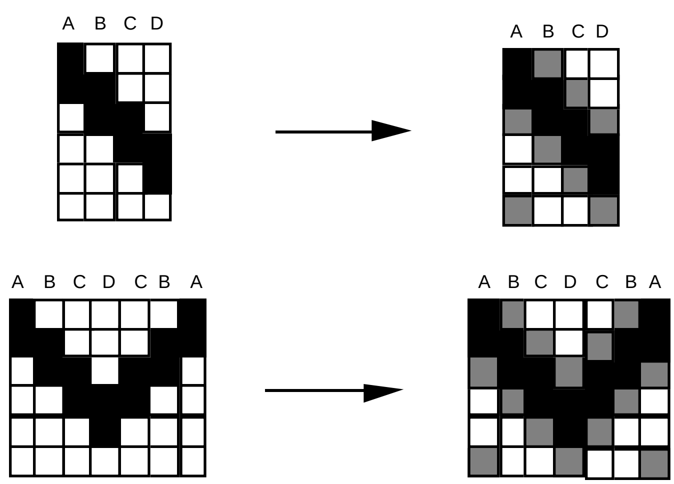
Chapter V. Blocks Applied to Networked Double Weave

Four shafts are needed for each block of traditional double weave. Therefore an 8-shaft loom provides for two double weave design blocks, a 12-shaft loom three blocks and a 16-shaft loom ups the ante to four blocks. The more blocks available to a weaver, the easier it is to soften the rectangular lines of the block. Even better when the principles of network drafting are added to a block design, curved forms are easy to obtain. In this chapter I want to outline how one can start with block designs for 16 shafts and modify them easily using networking as the guide.

I. Some Four block Designs in Double Weave

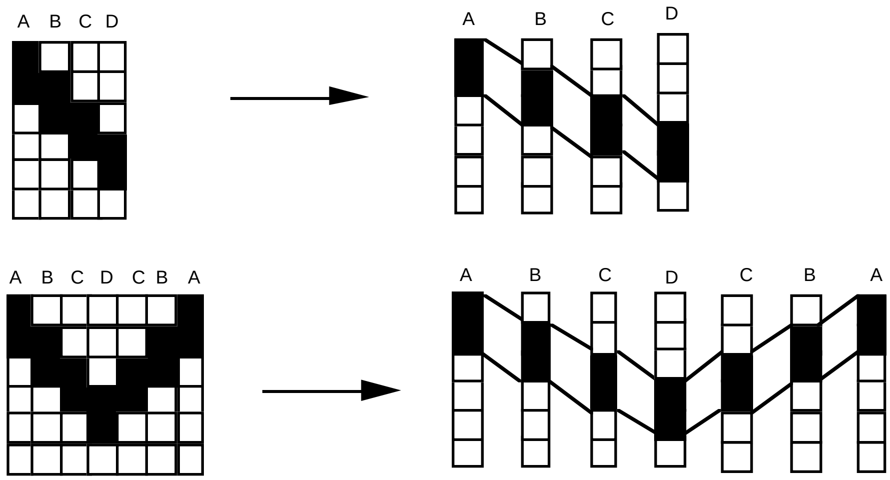
Figure 1 shows two 4-block double weave designs, the left diagram for each in the form of traditional double weave with well defined rectangular forms. Then on the right is a schematic diagram with transitional peg plans above and below the blocks of the preceding diagram.

Figure 1. Four Block Double Weave Designs with and without Transition Peg Plans



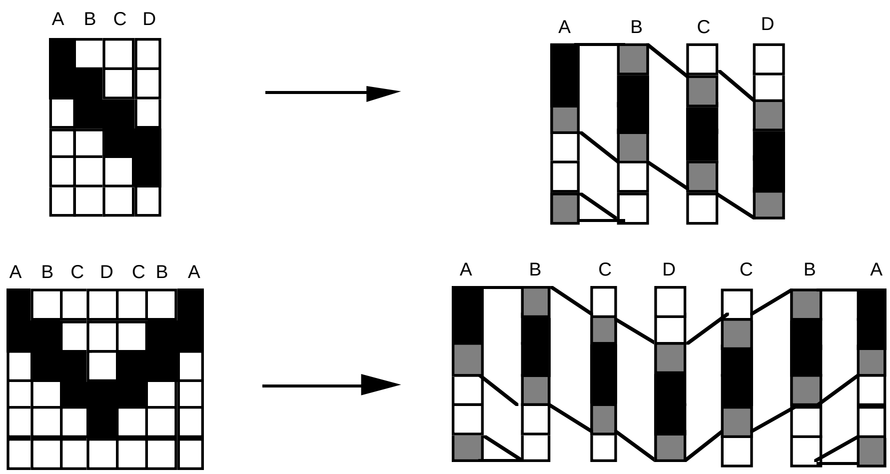
A transition in the threading can be introduced as well. It is somewhat more difficult to present this type of transition than it is for the peg plan transitions of figure 1. Figure 2 attempts to do that in a schematic way with diagonal boxes connecting blocks with one another. Then both transitions are put together in figure 3. In the next section complete threading and peg plans will serve to illustrate what is presented in these figures.

Figure 2. Four Block Double Weave Designs with and without Threading Transitions



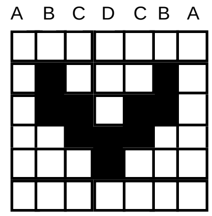
Putting the two types of transitions together produces the diagrams in figure 4.

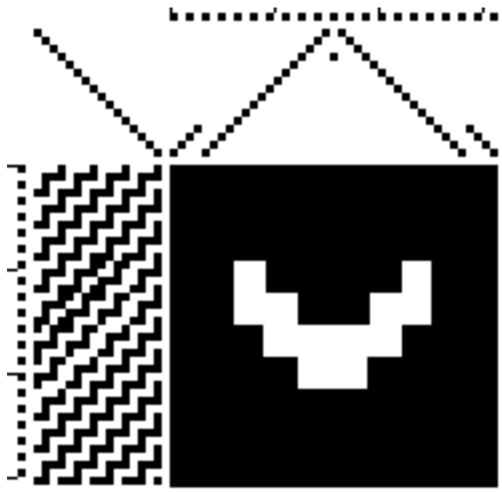
Figure 3. Four Block Double Weave Designs with Transitions in Threading and Peg Plan



B. From a 4 Block Design to Networked Designs in Double Weave

Figure 4. A Four Block Double Weave Window Design

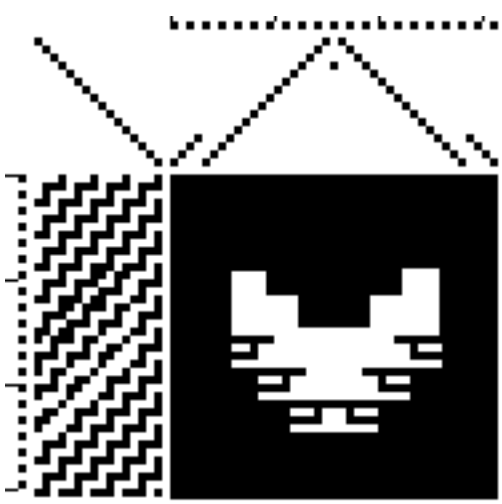




The next two diagrams show how a transition in the peg plan can be introduced either on the bottom of the three blocks labeled B, C, and D as in the diagram on the left or on the top of the blocks as in the diagram on the right. The peg plan is 2-20 from appendix A-1.

Figure 5. Peg Plan Transitions Introduced for Blocks B, C, and D

A. Motif 2-20 on the Bottom of the Blocks



B. Motif 2-20 on the Top of the Blocks

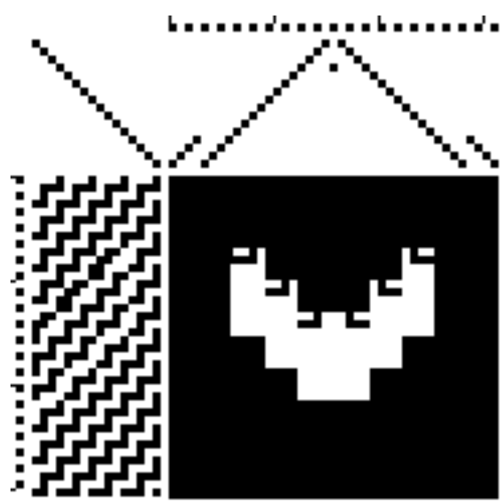


Figure 6. Some Further Variations in the 4 Block Design

A. Motif 2-20 on Top and Bottom of Blocks B. Same Design, Blocks Doubled in Size

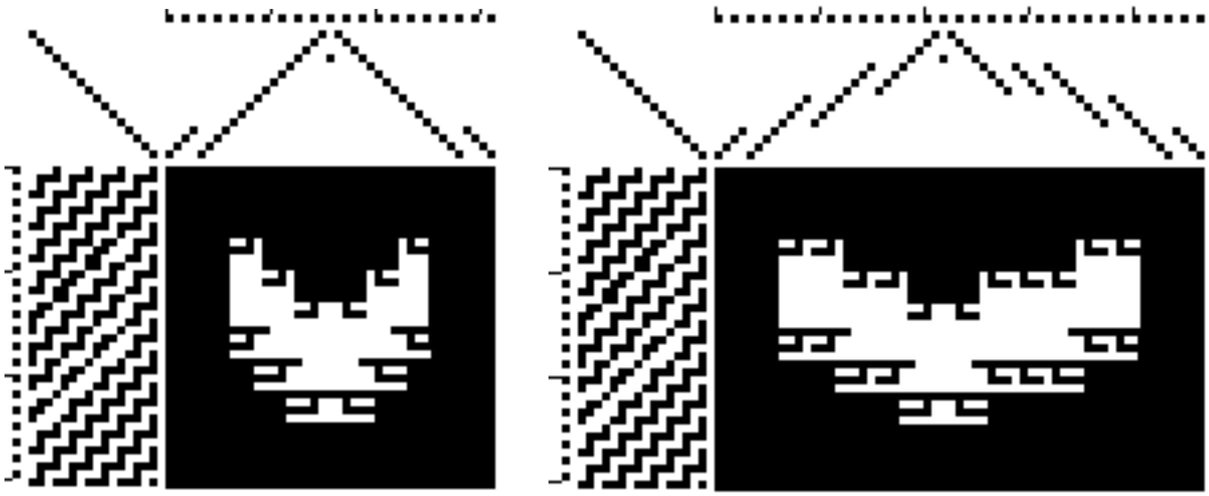
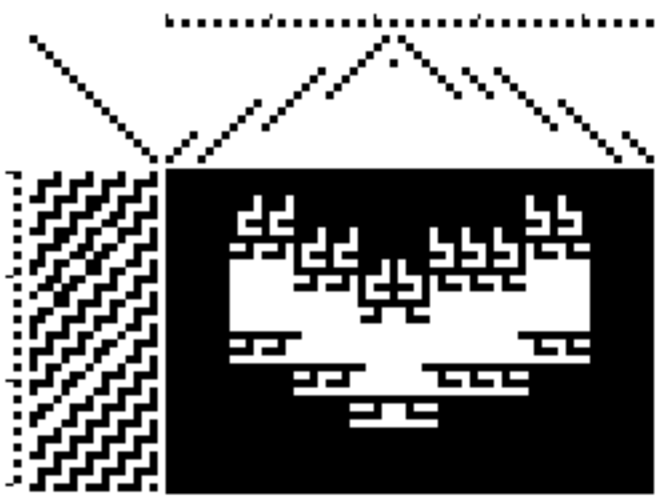
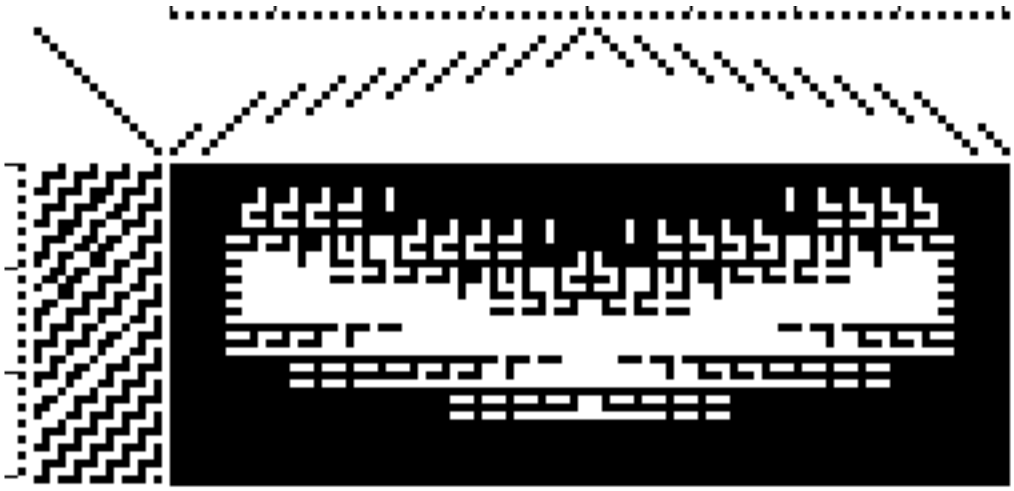


Figure 7. Additional Motif on Top of Blocks



The only transitions introduced to this point are in the peg plans. In network drafting a transition in the threading is a possibility so let's develop that aspect next.

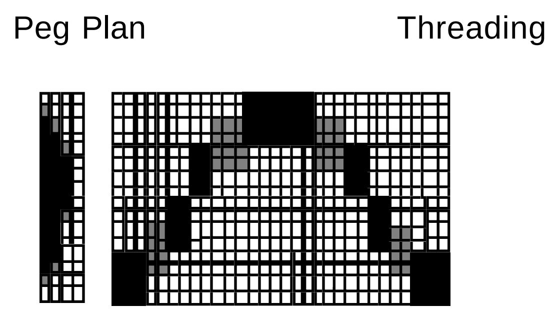
Figure 8. Transition in the Threading Added to Figure 7

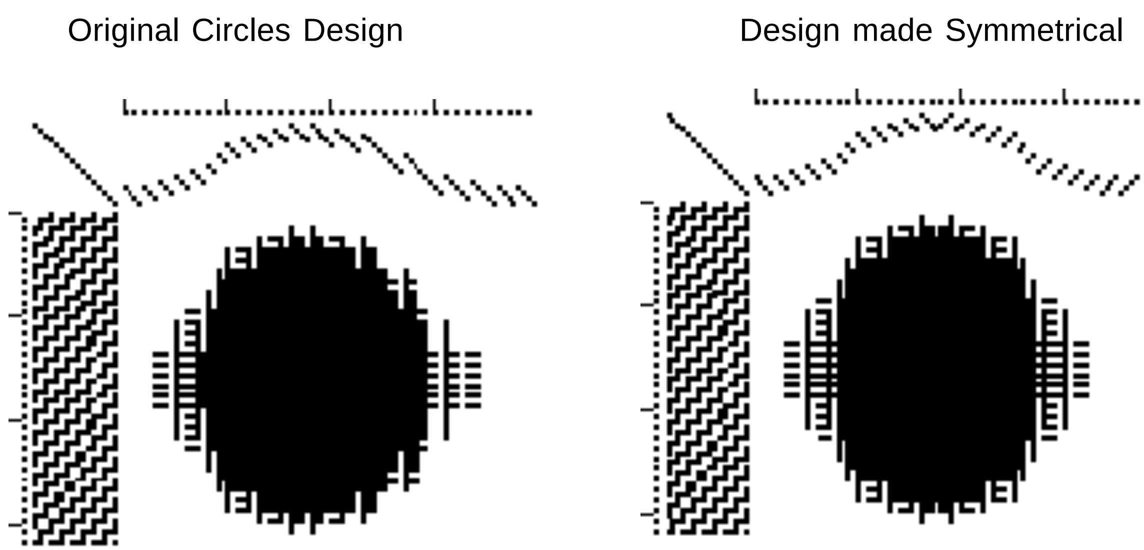


C. Fooling Around With Alice Schlein's "Circles 2" Design

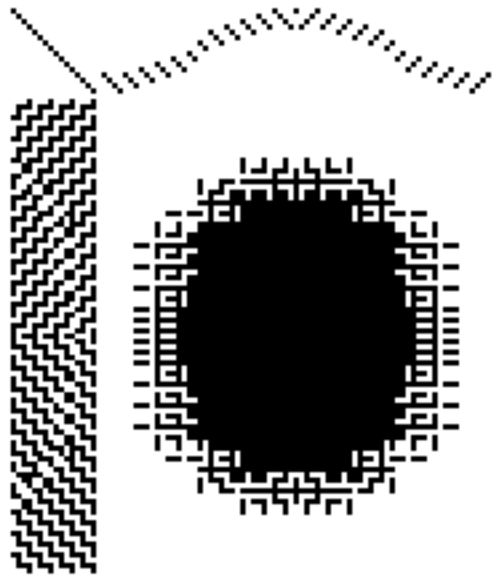
A schematic peg plan and threading are shown in figure 9, with squares in diagonal form representing transition regions either in the peg plan or in the threading diagram.

Figure 9. A Schematic Analysis of "Circles 2"

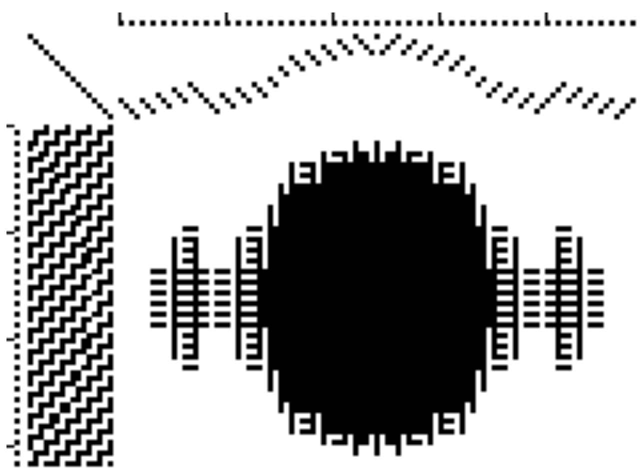




Halo Increased by Changing the Peg Plan

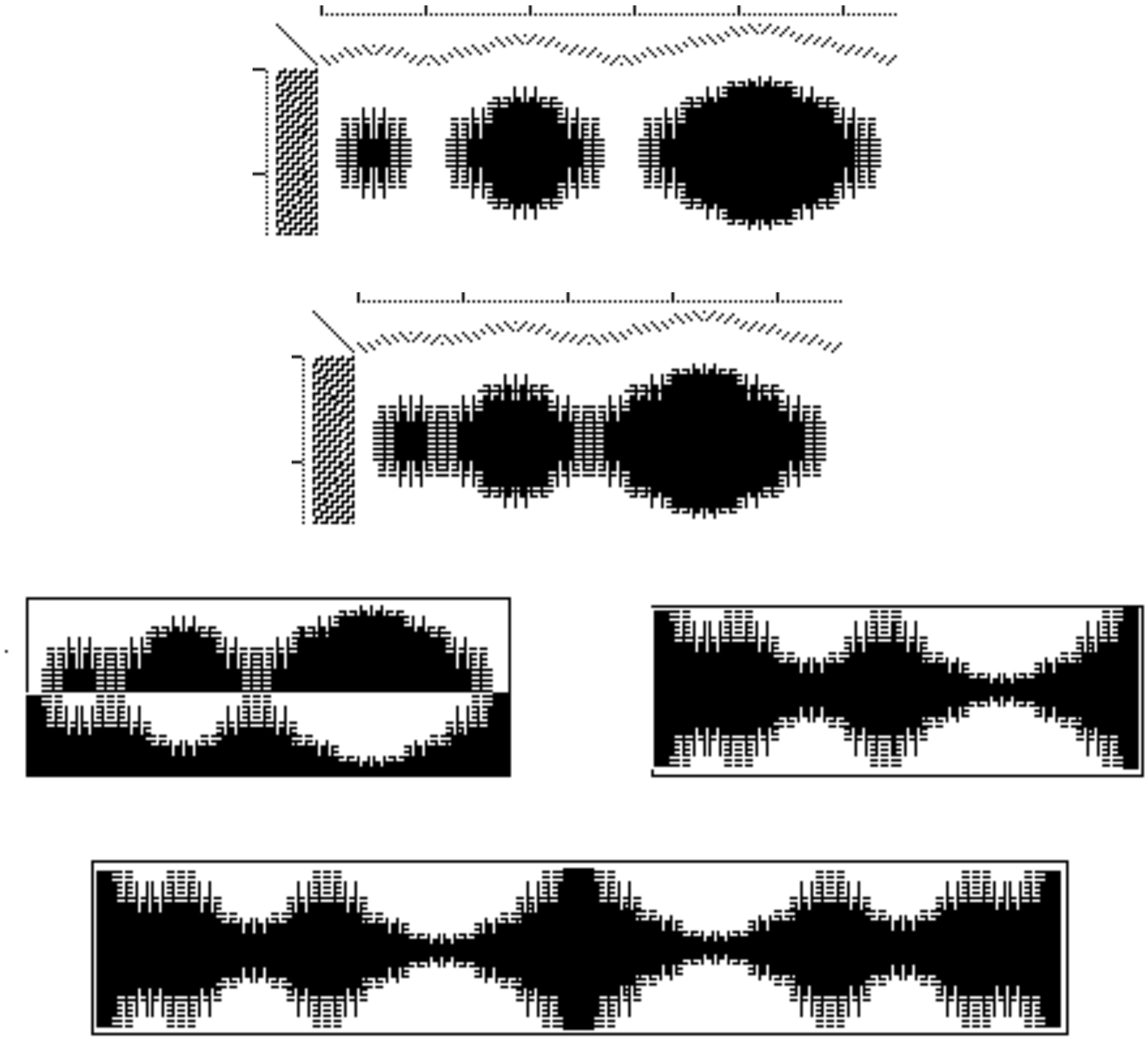


The design can be altered by changing the threading.



I decided to play around even more with this design, first extending the threading and then creating positive-negative images and combining them in various ways.

Figure 10. Additional Changes in the Circles Design

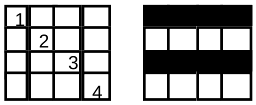


I hope that the material in this book will provide some new ideas and approaches for network drafting, not only for double weave but also for single weave designs. It is meant to complement the approach to network drafting that Alice Schlein has presented in her book and articles

Appendix A-1 Peg Plans and Drawdowns

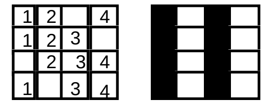
Zero Additional Pegs

0-1



8 Additional Pegs

8-1



1 Additional Peg

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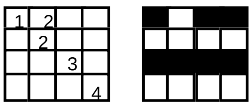
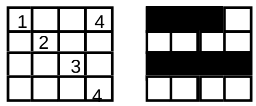


1-2



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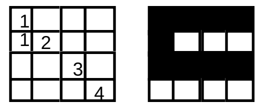

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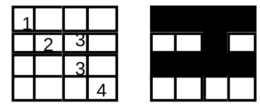

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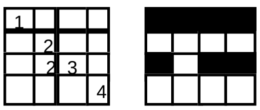

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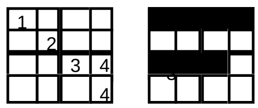

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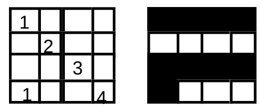

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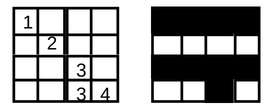

2 Additional Pegs

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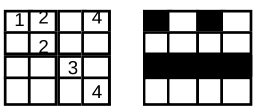

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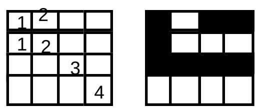

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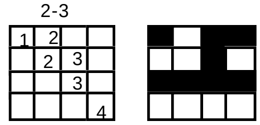

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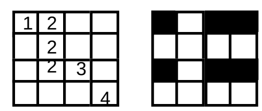

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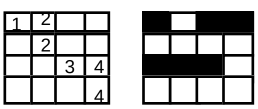

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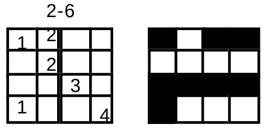

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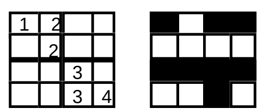

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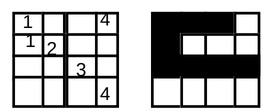

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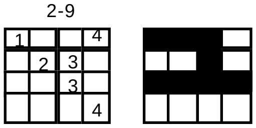

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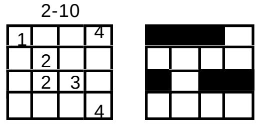

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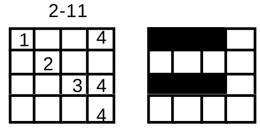

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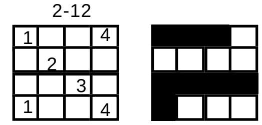

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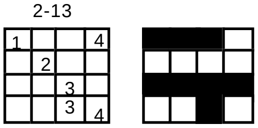

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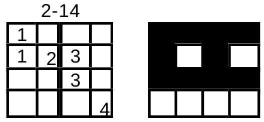

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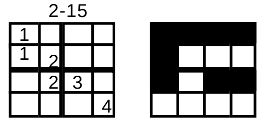

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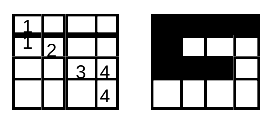

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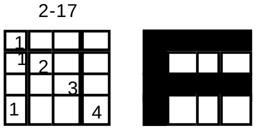

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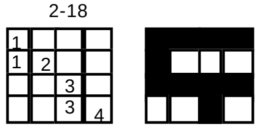

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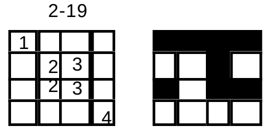

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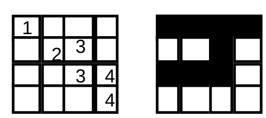

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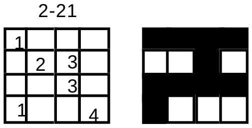

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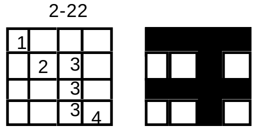

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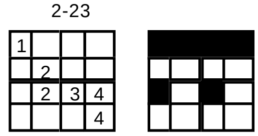

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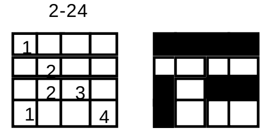

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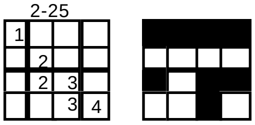

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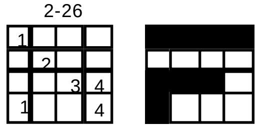

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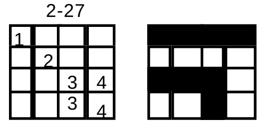

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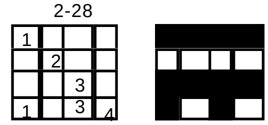
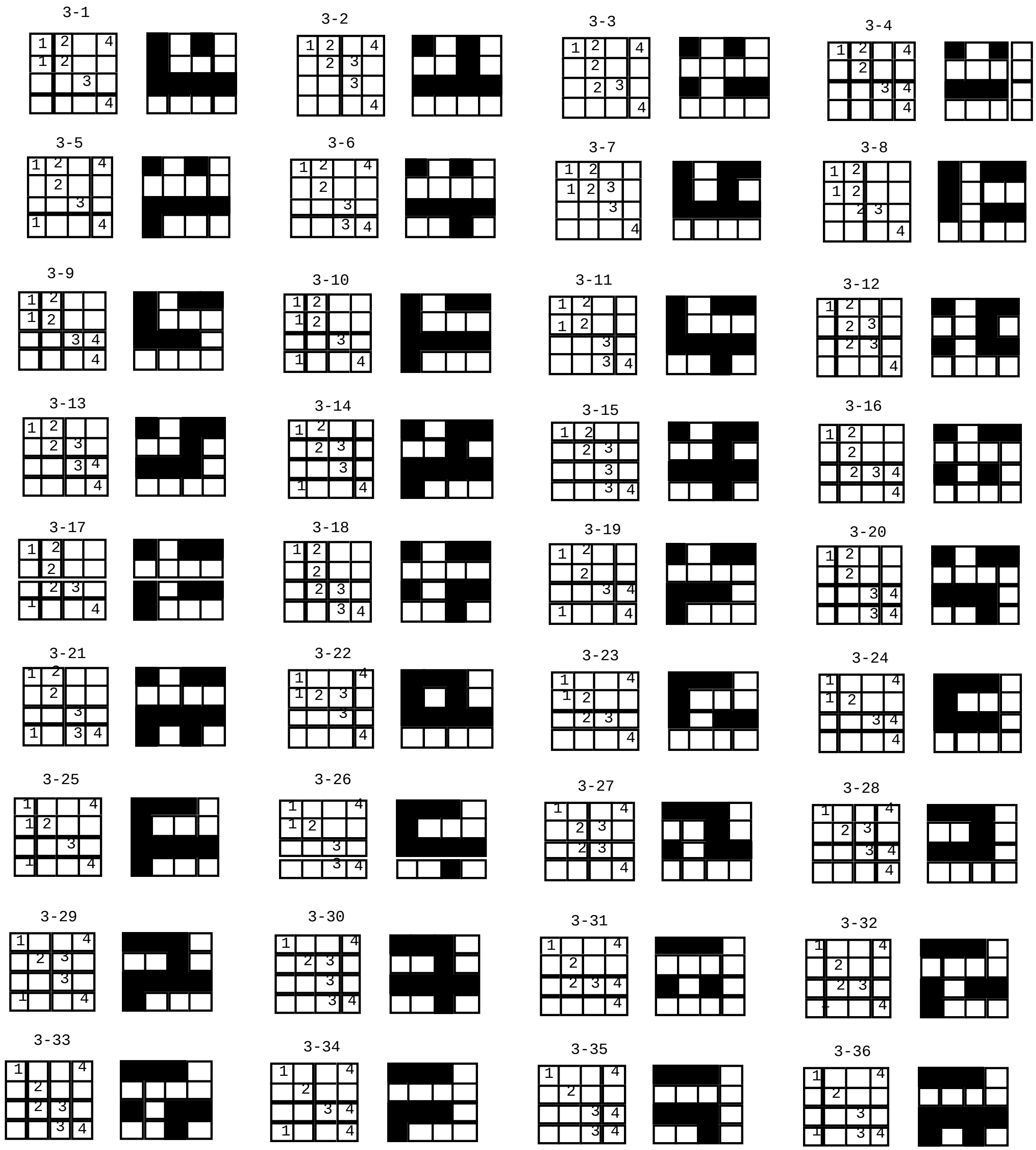


3 Additional Pegs



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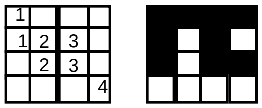

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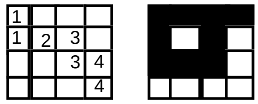

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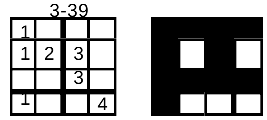

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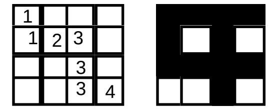

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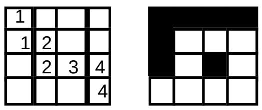

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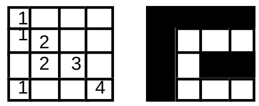

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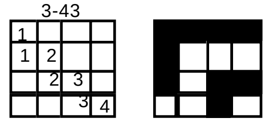

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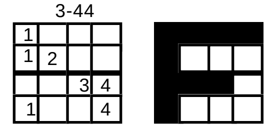

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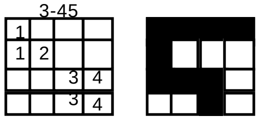

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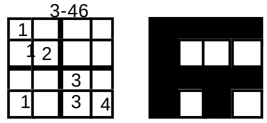

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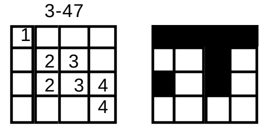

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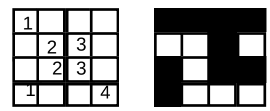

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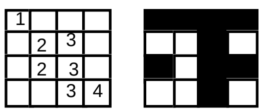

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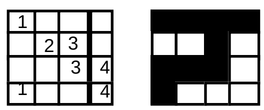

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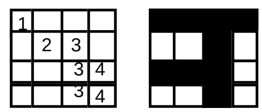

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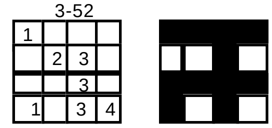

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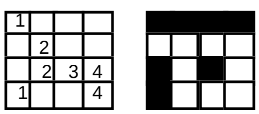

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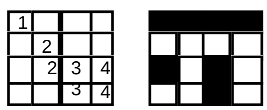

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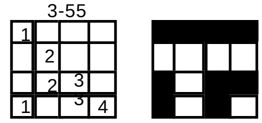

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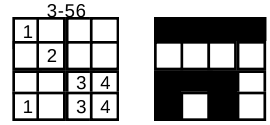
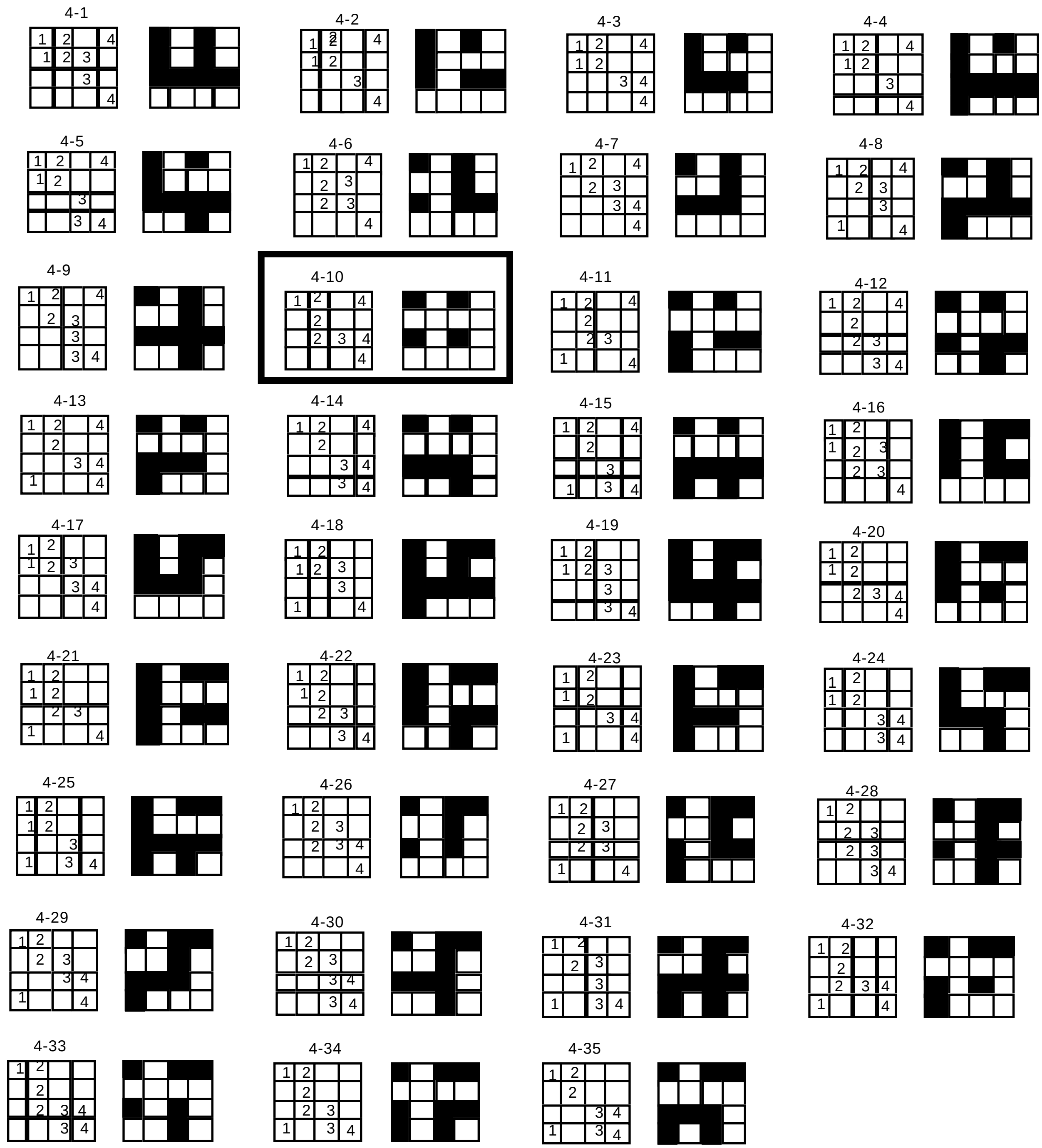
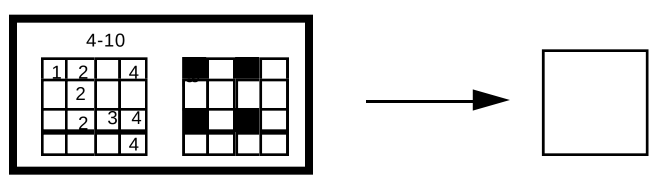
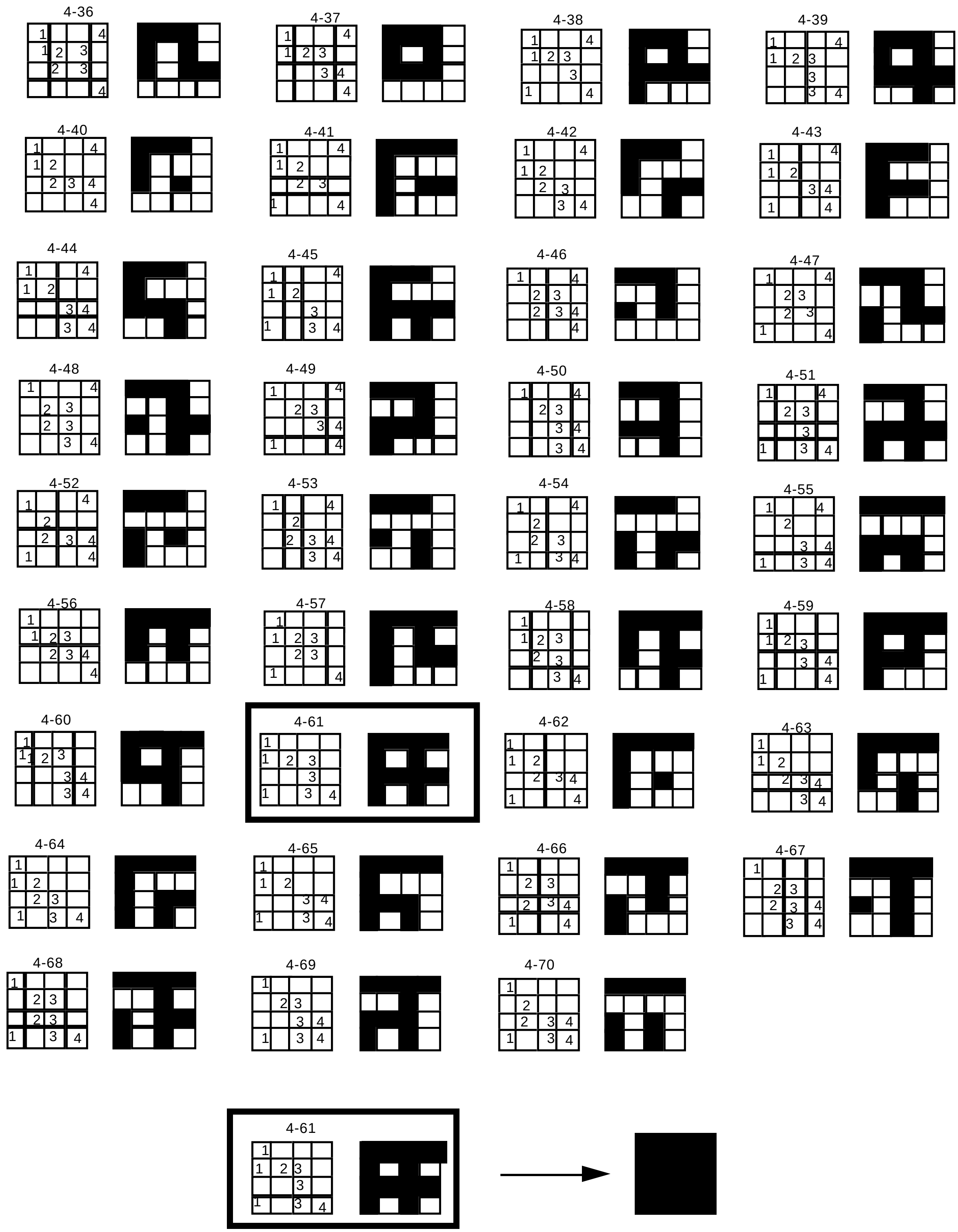


4 Additional Pegs



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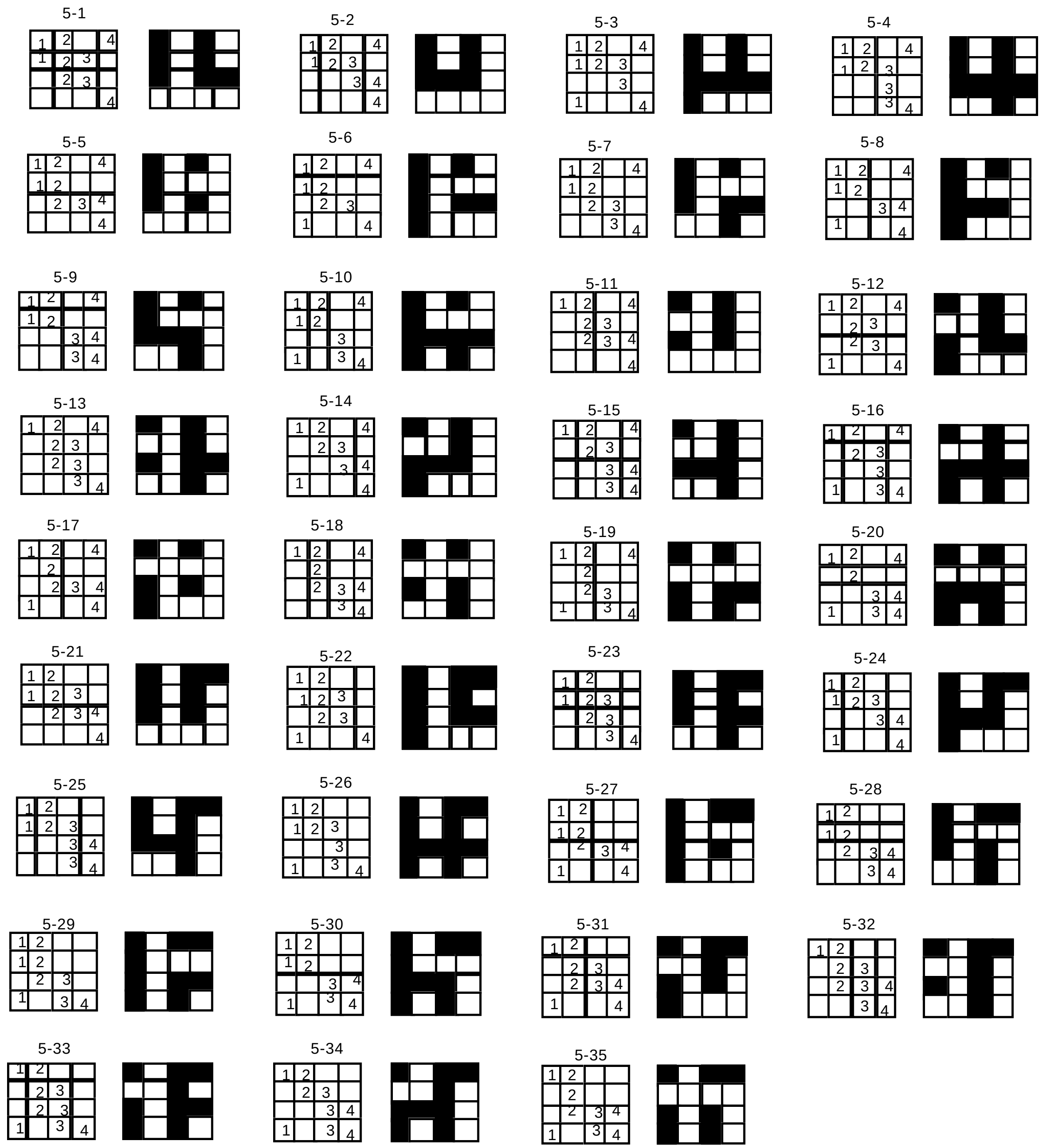
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5 Additional Pegs

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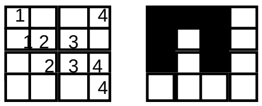

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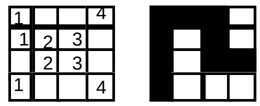

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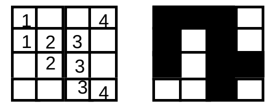

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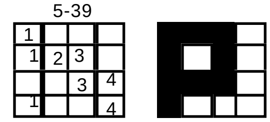

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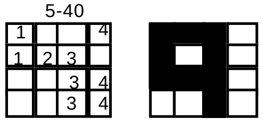

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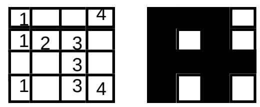

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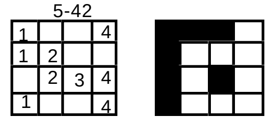

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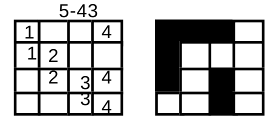

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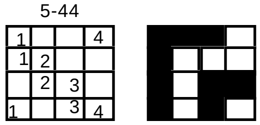

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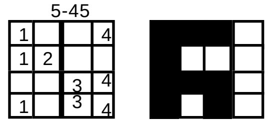

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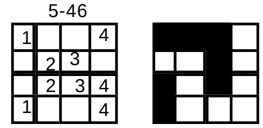

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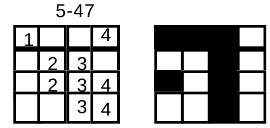

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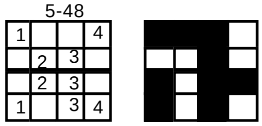

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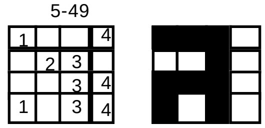

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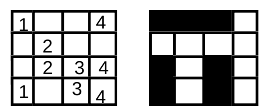

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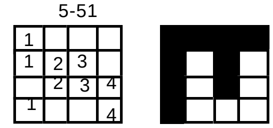

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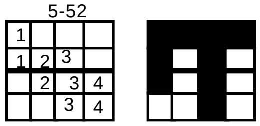

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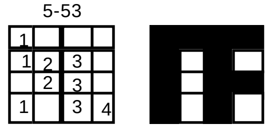

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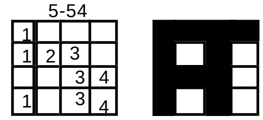

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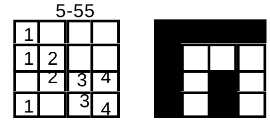

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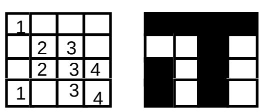
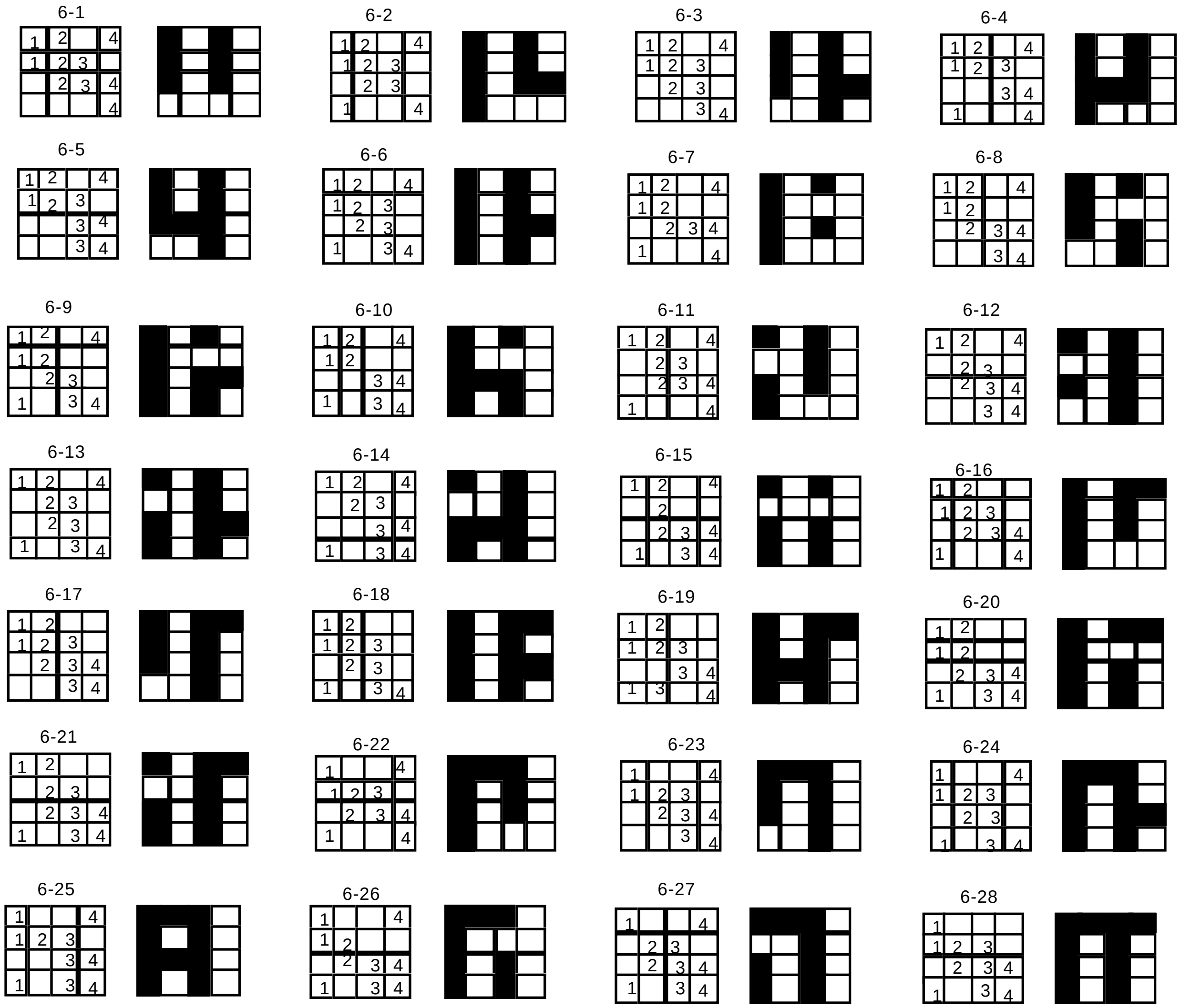


6 Additional Pegs



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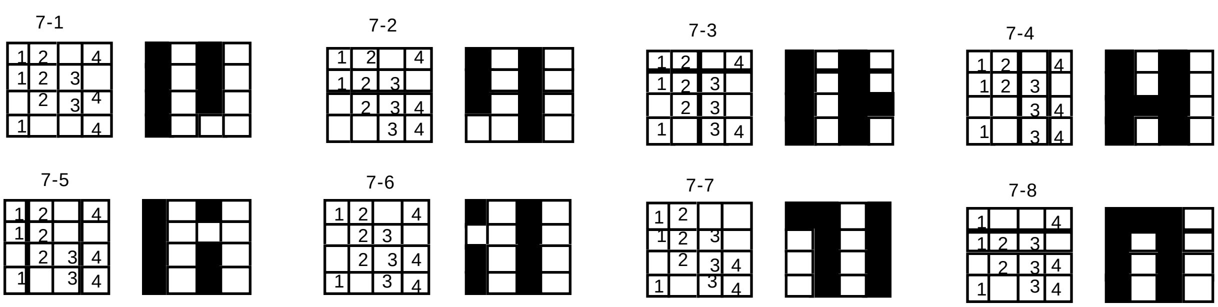
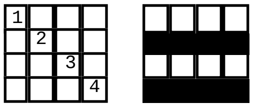


Appendix 2A- Peg Plans and Drawups

Zero Additional Pegs

0-1



8 Additional Peg

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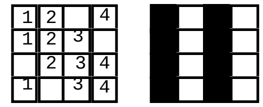

1 Additional Peg

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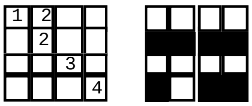

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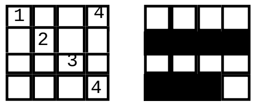

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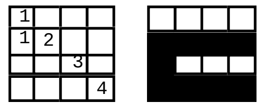

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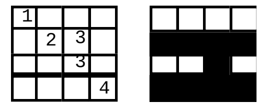

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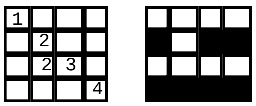

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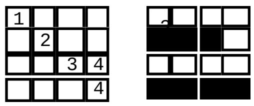

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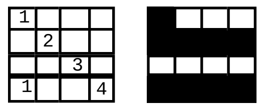

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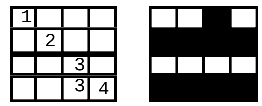

2 Additional Pegs

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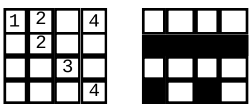

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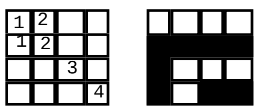

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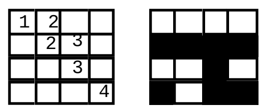

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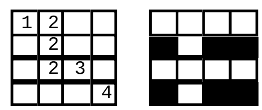

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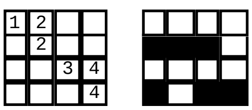

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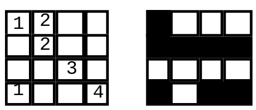

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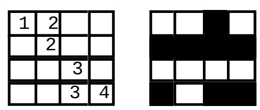

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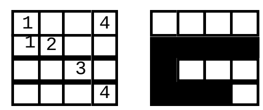

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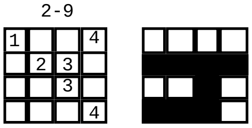

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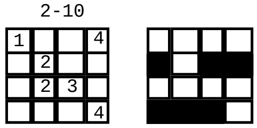

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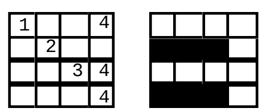

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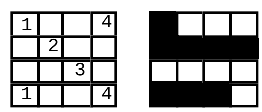

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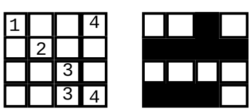

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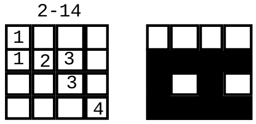

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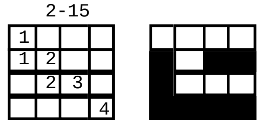

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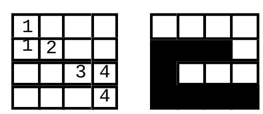

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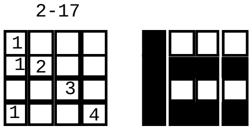

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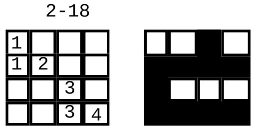

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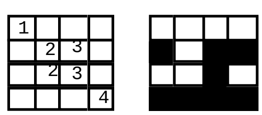

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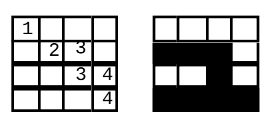

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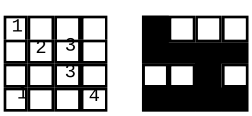

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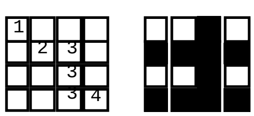

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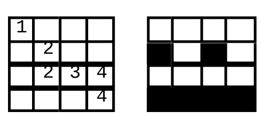

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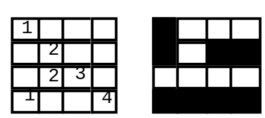

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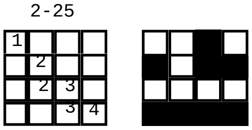

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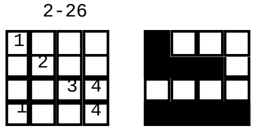

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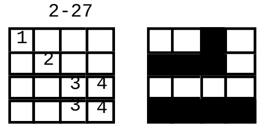

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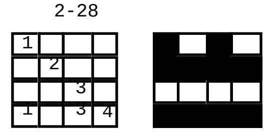

3 Additional Pegs

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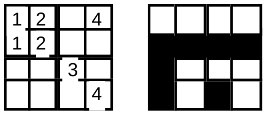

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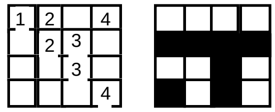

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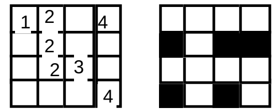

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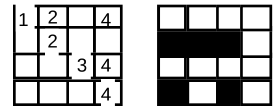

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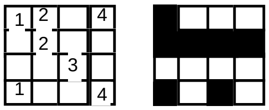

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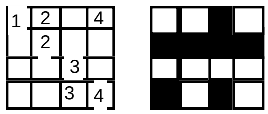

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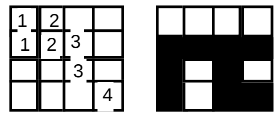

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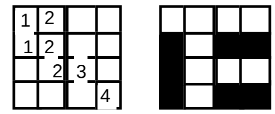

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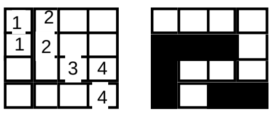

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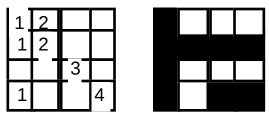

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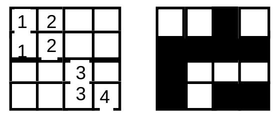

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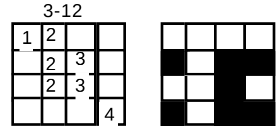

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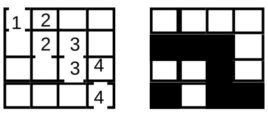

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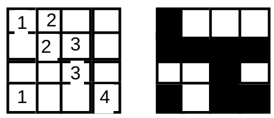

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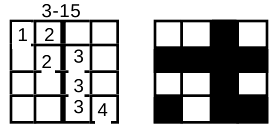

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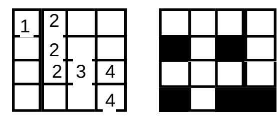

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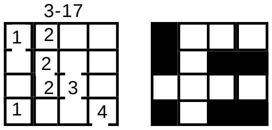

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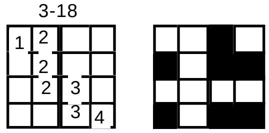

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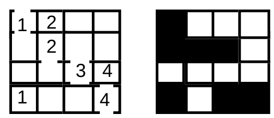

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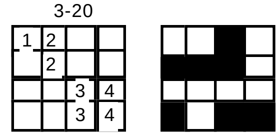

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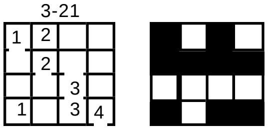

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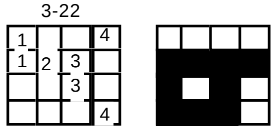

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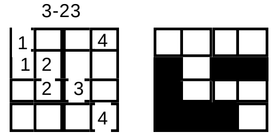

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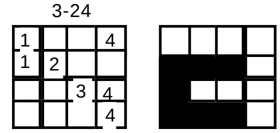

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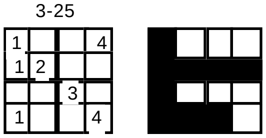

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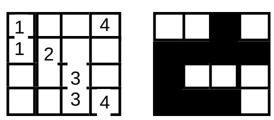

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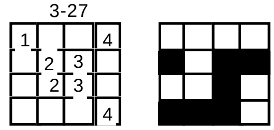

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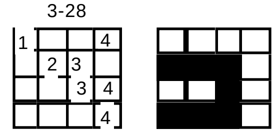

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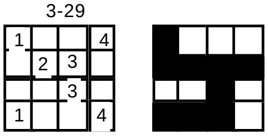

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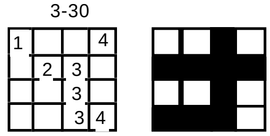

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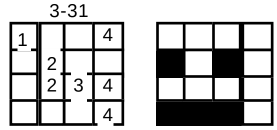

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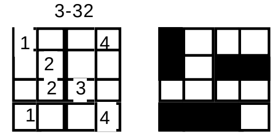

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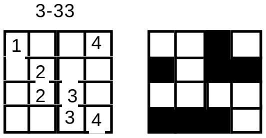

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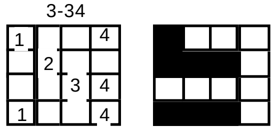

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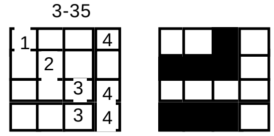

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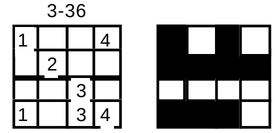

3 Additional Pegs

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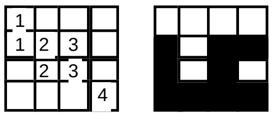

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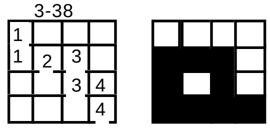

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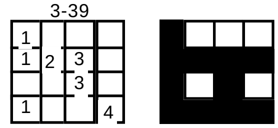

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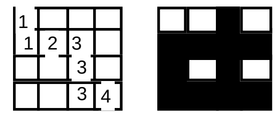

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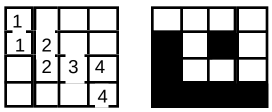

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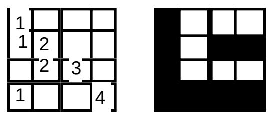

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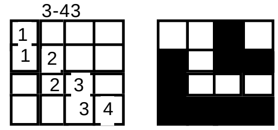

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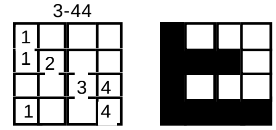

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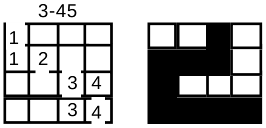

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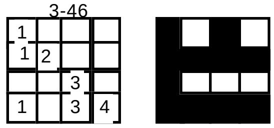

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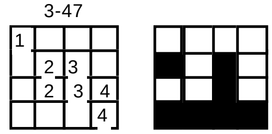

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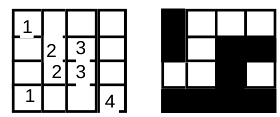

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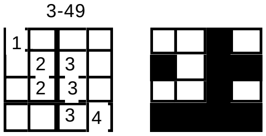

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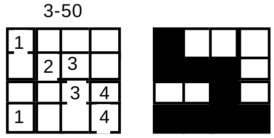

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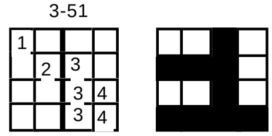

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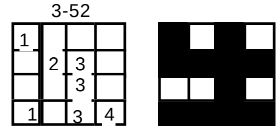

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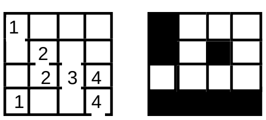

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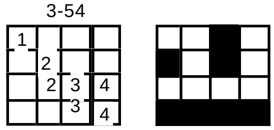

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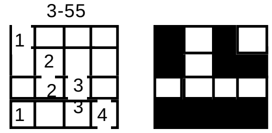

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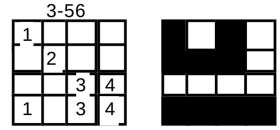
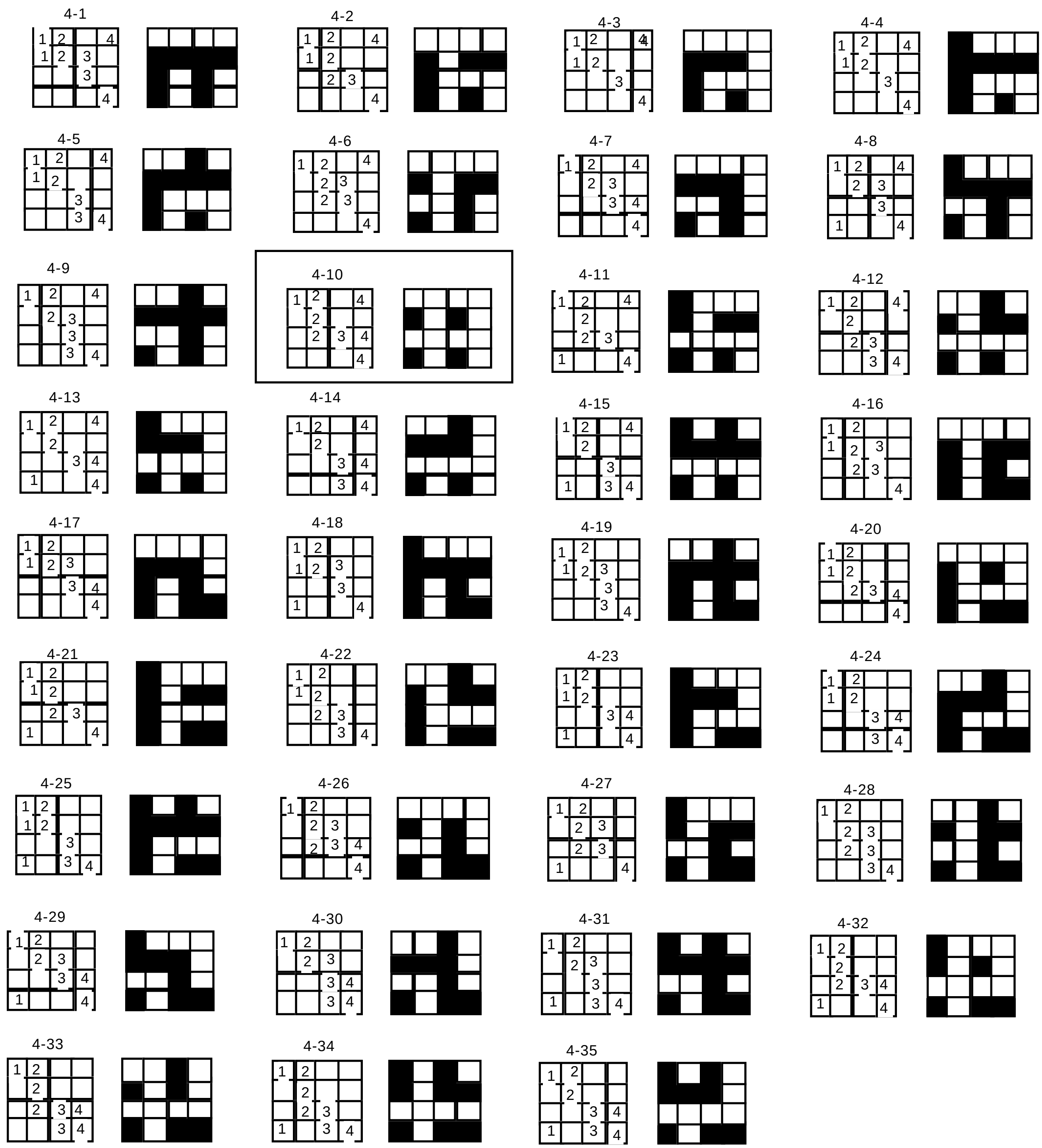
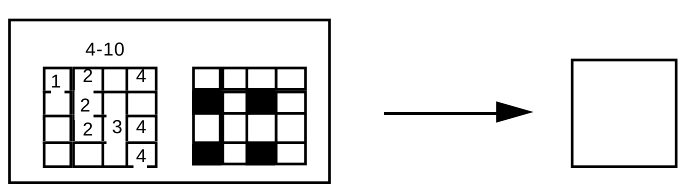


4 Additional Pegs





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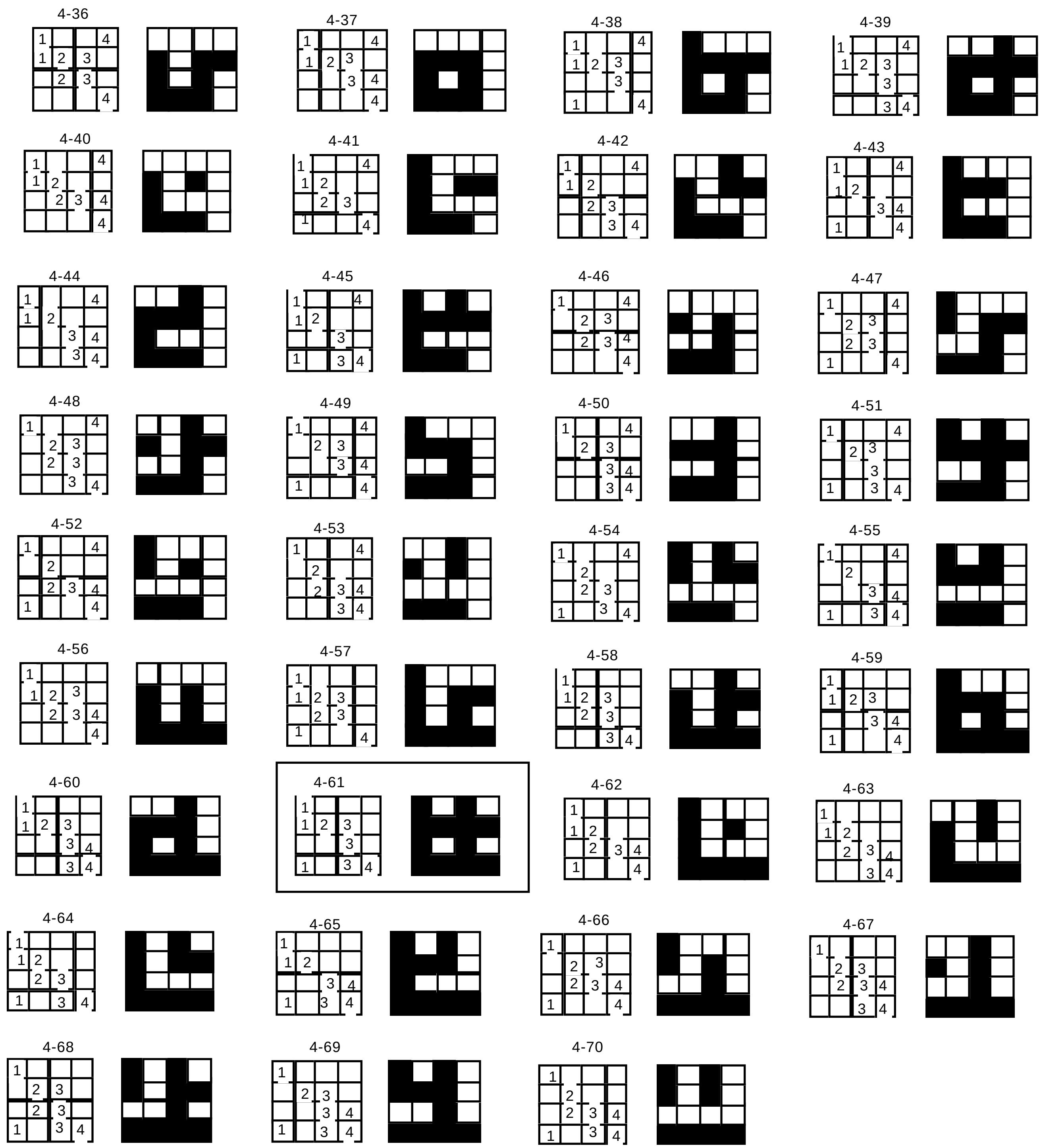

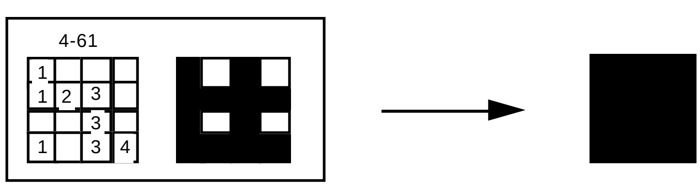

5 Additional Pegs

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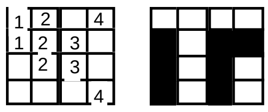

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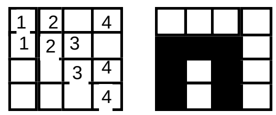

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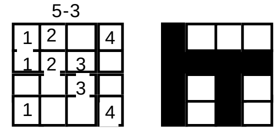

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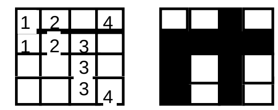

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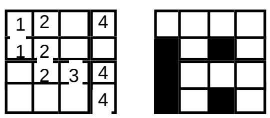

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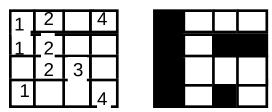

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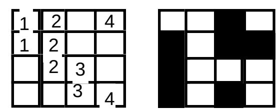

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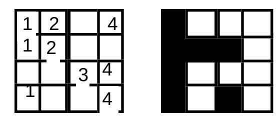

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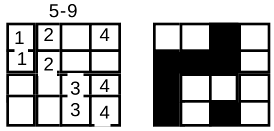

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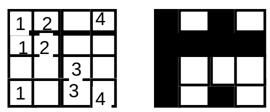

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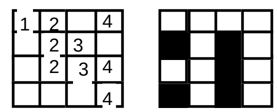

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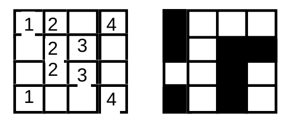

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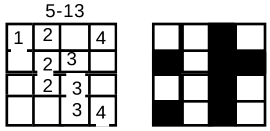

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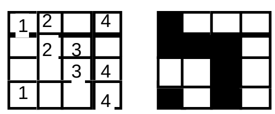

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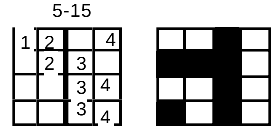

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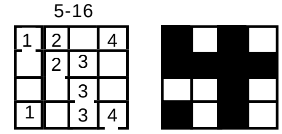

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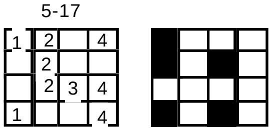

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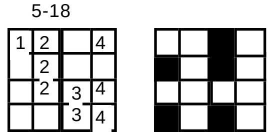

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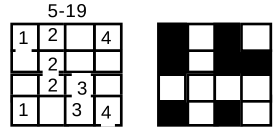

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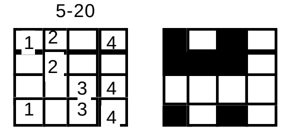

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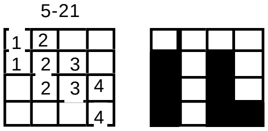

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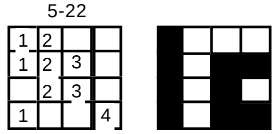

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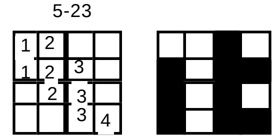

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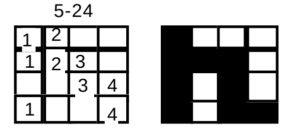

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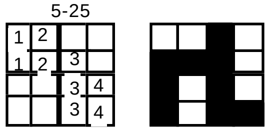

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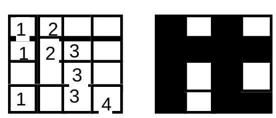

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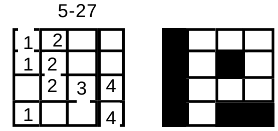

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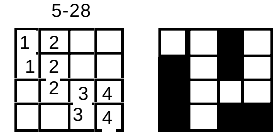

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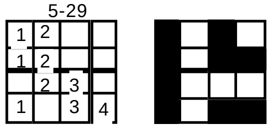

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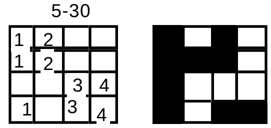

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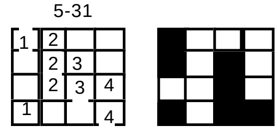

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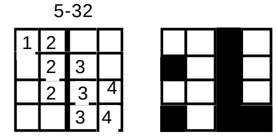

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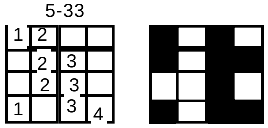

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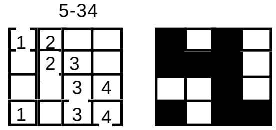

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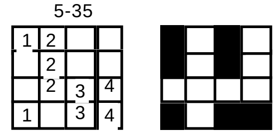

5 Additional Pegs

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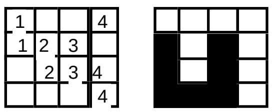

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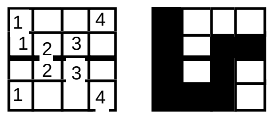

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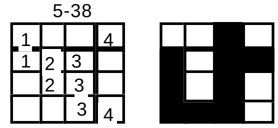

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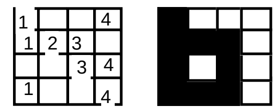

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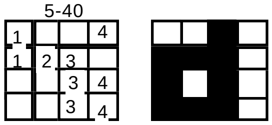

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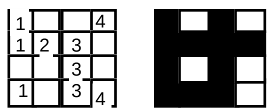

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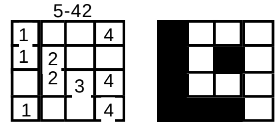

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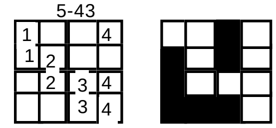

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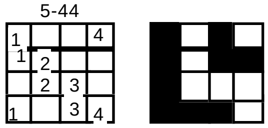

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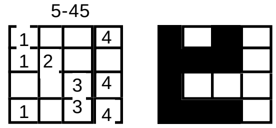

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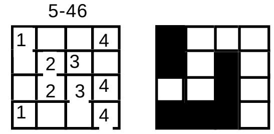

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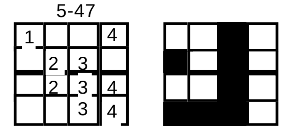

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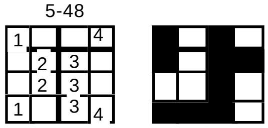

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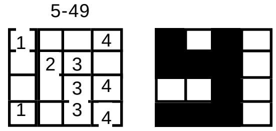

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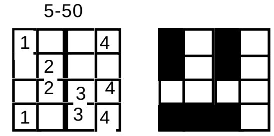

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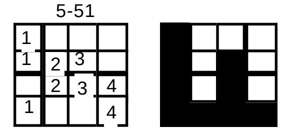

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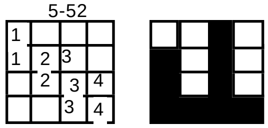

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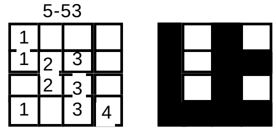

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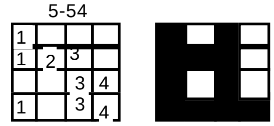

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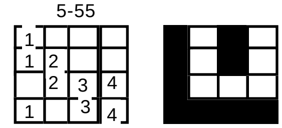

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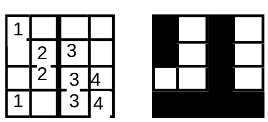

6 Additional Pegs

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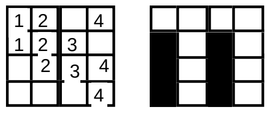

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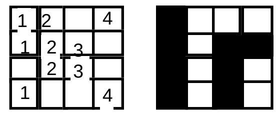

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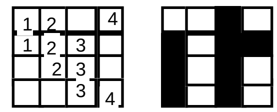

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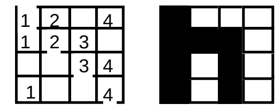

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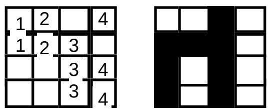

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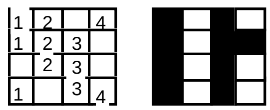

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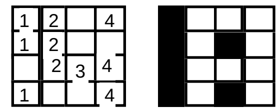

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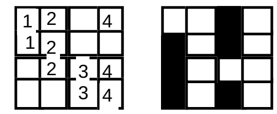

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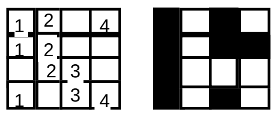

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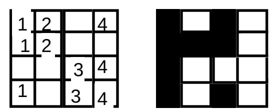

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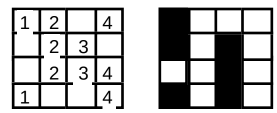

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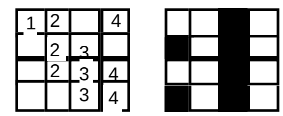

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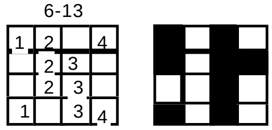

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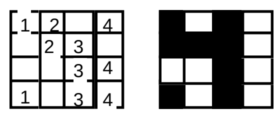

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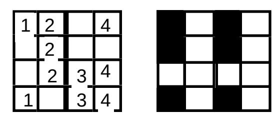

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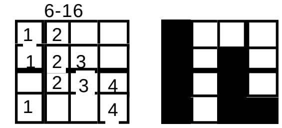

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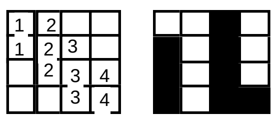

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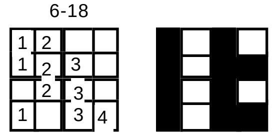

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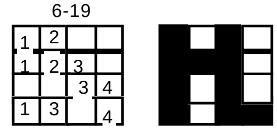

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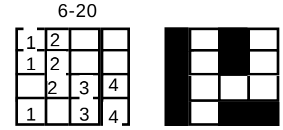

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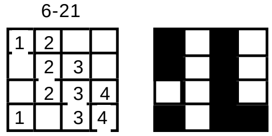

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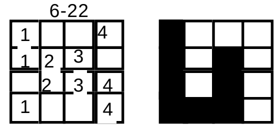

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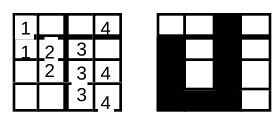

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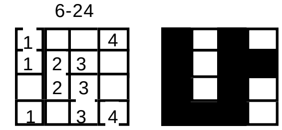

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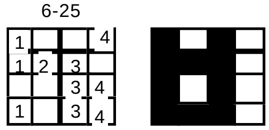

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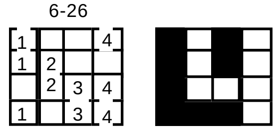

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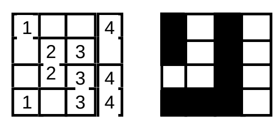

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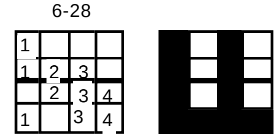

7 Additional Pegs

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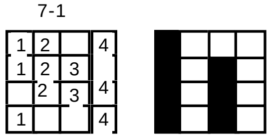

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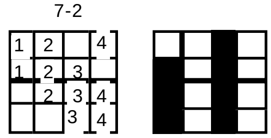

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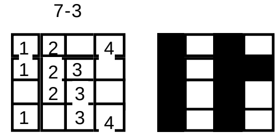

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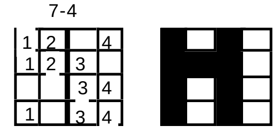

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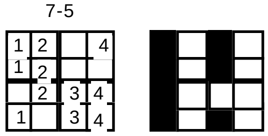

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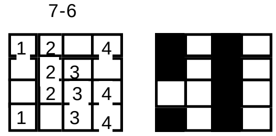

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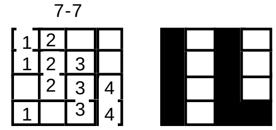

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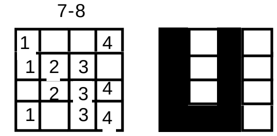
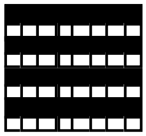


Appendix B-1 4 Unit Motifs as Drawdowns

Drawdown

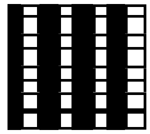
0 Additional Pegs

0-1



8 Addirional Pegs

8-1



1 Additional Peg

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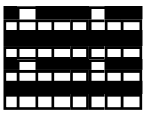

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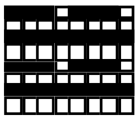

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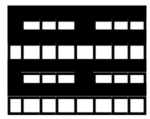

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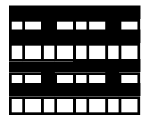

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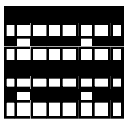

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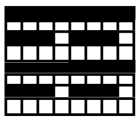

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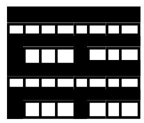

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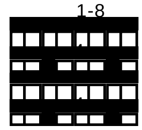

2 Addirional Pegs

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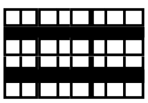

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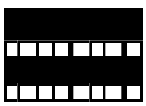

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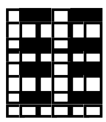

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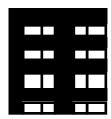

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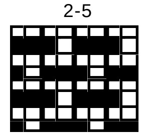

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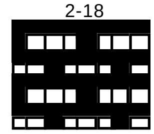

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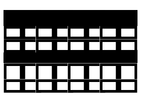

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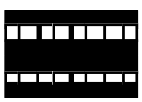

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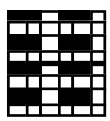

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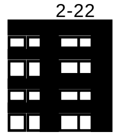

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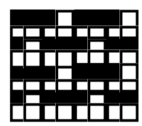

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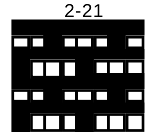

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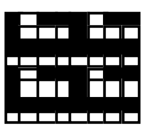

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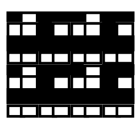

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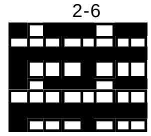

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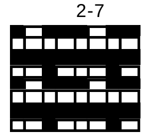

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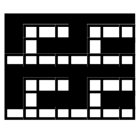

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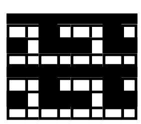

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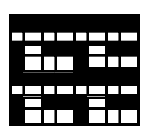

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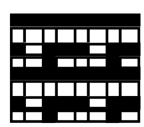

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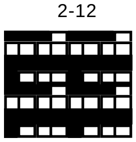

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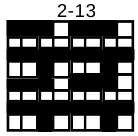

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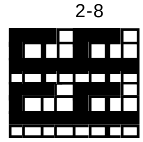

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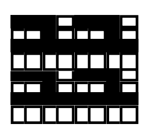

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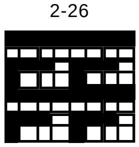

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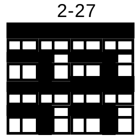

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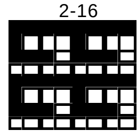

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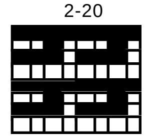
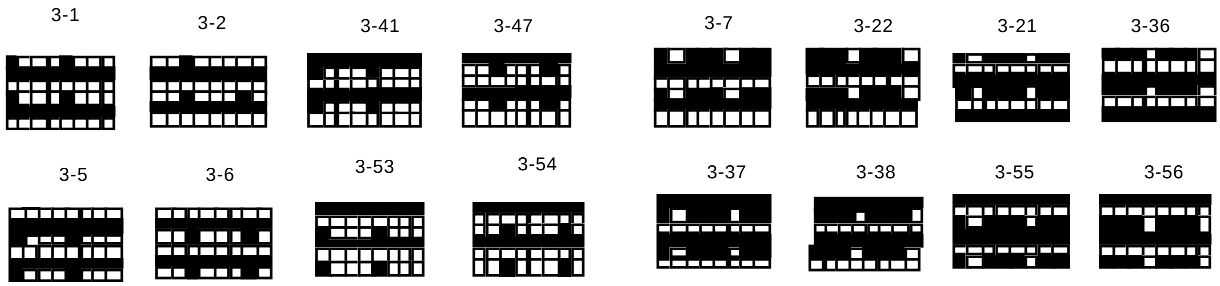
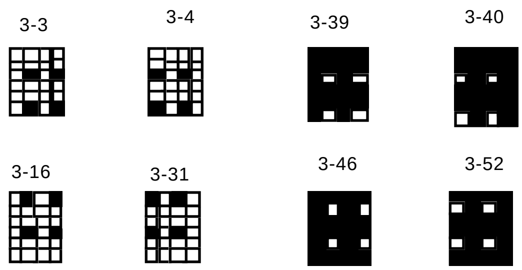
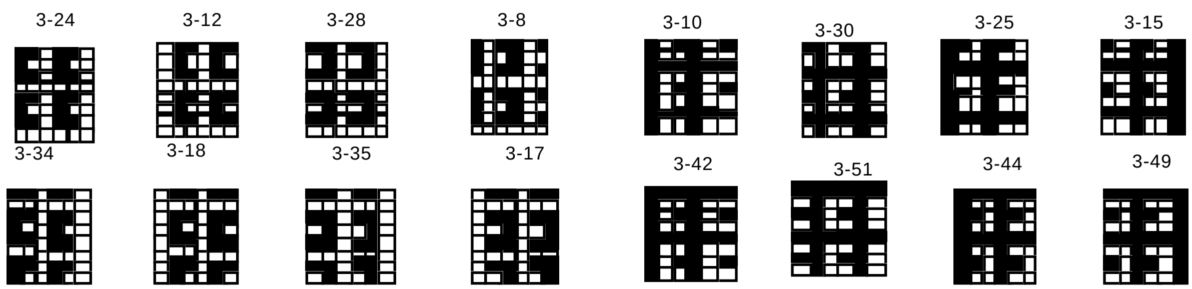


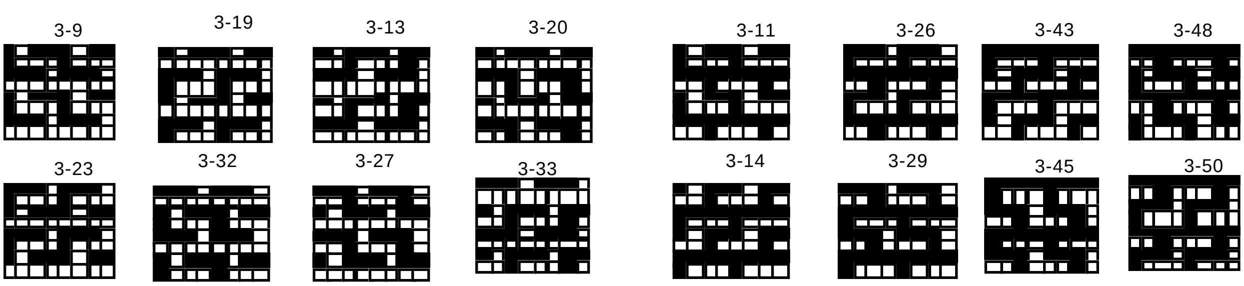
Drawdown

3 Additional Pegs



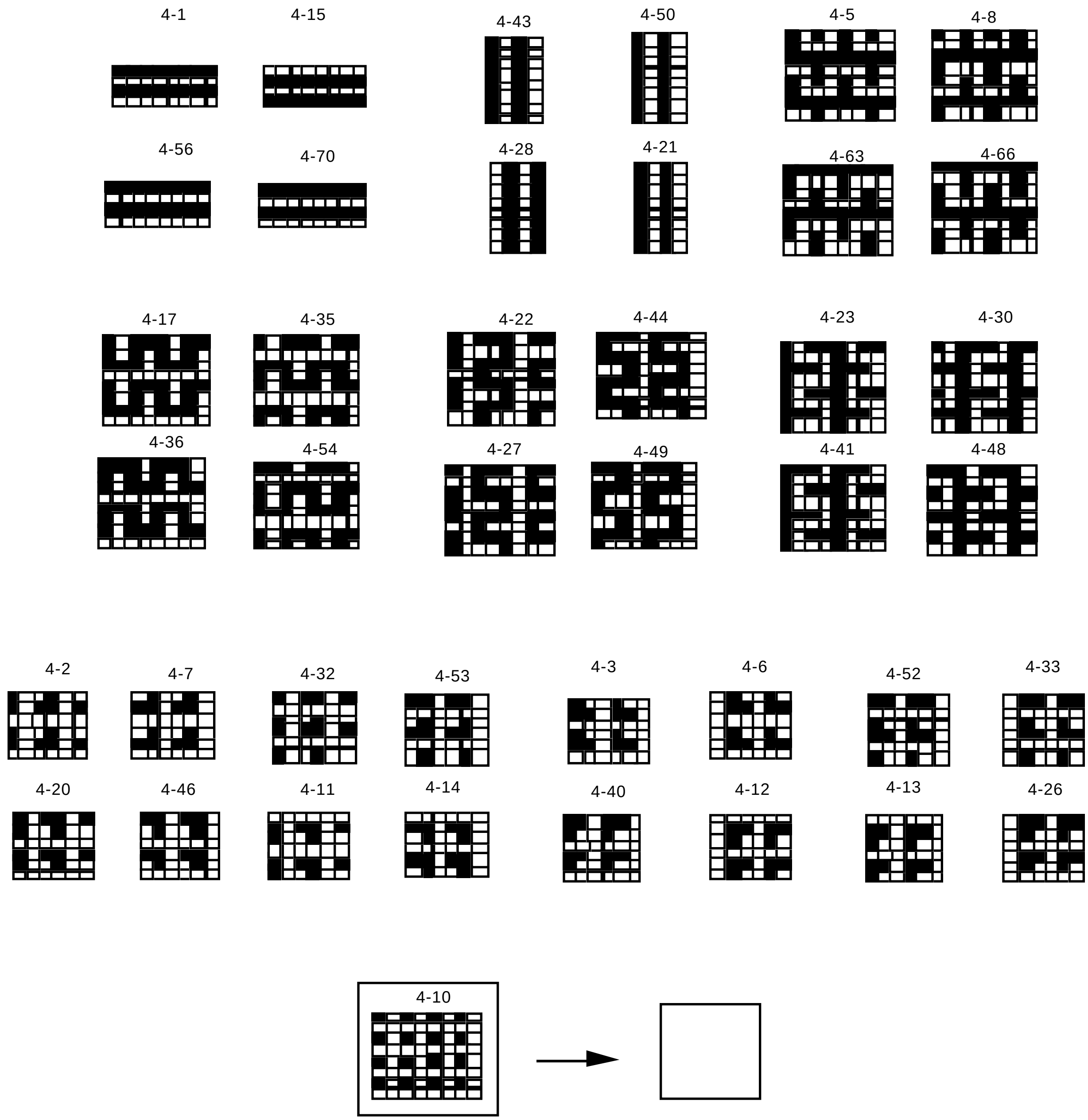






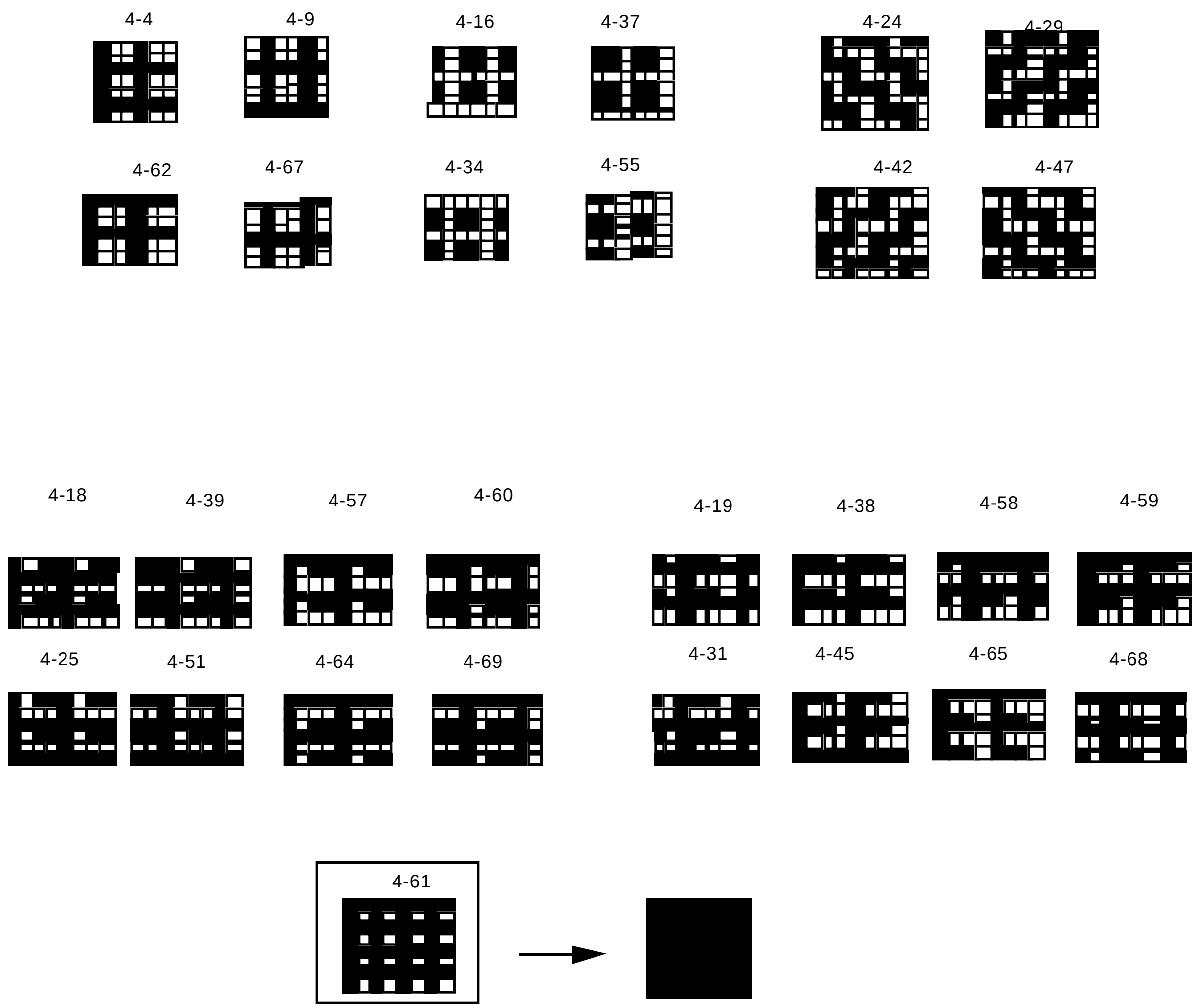
4 Additional Pegs

Drawdown



Drawdown

4 Additional Pegs



Drawdown

5 Additional Pegs

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5-19 5-20 5-21 5-36 5-3 5-4 5-55 5-56

5-7 5-14 5-31 5-43 5-24 5-34 5-38 5-44

5-12 5-9 5-28 5-46 5-30 5-48 5-25 5-37

5-5 5-11 5-17 5-18 5-6 5-15 5-8 5-13

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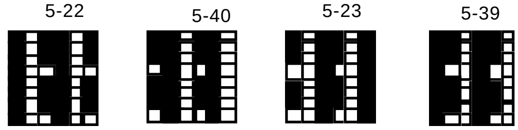

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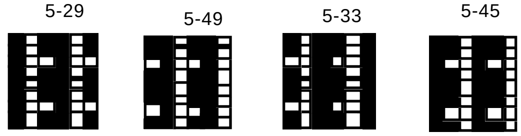

Drawdown

6 Additional Pegs

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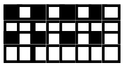
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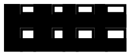
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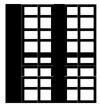
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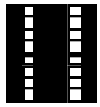
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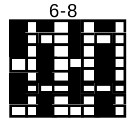
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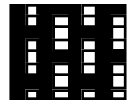

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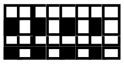
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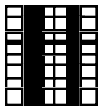
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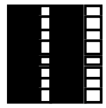
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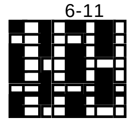
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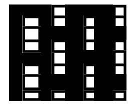

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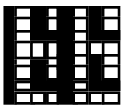
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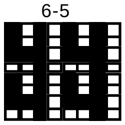
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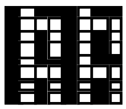
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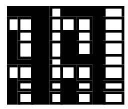
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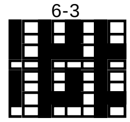
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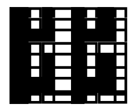
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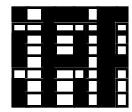
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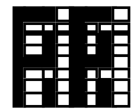

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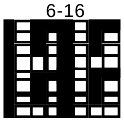
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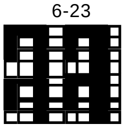
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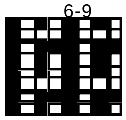
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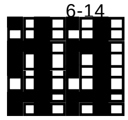
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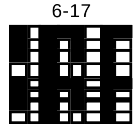
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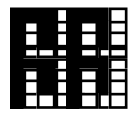
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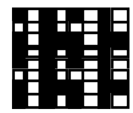
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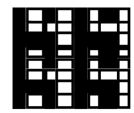

7 Additional Pegs

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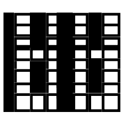
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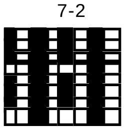
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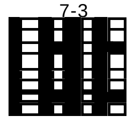
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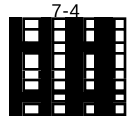

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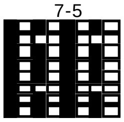
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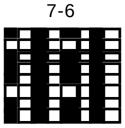
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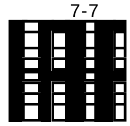
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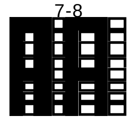


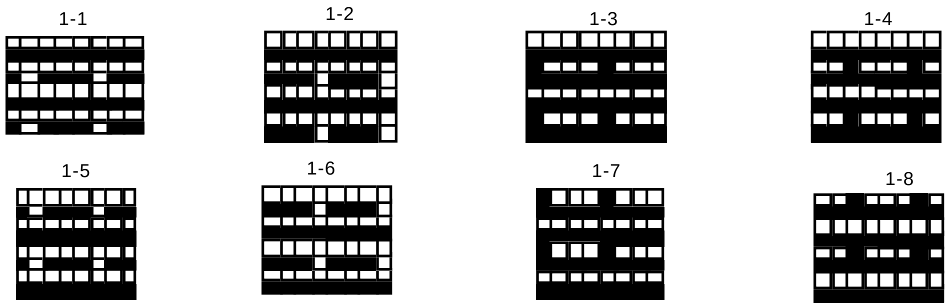
Appendix B-2 4 Unit Motifs as Drawups

Drawup

0 Additional Pegs

8 Addirional Pegs

1 Additional Peg



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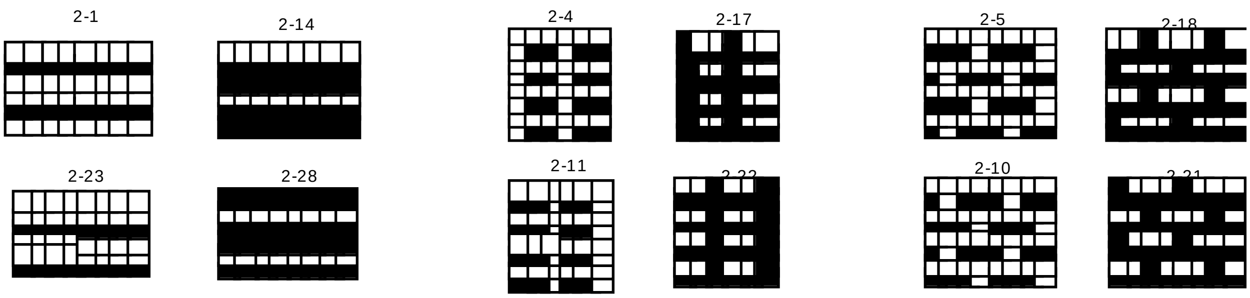

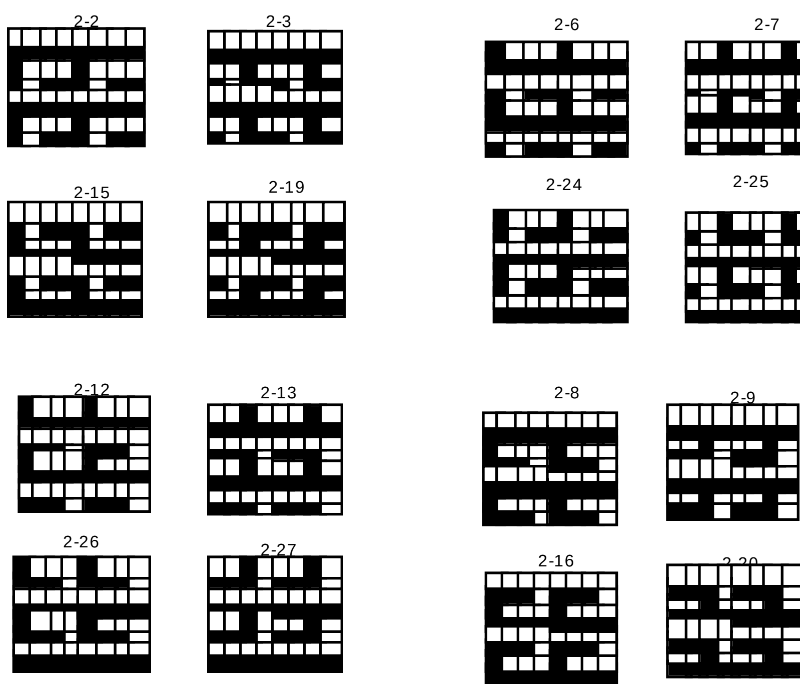

Drawup

3 Additional Pegs

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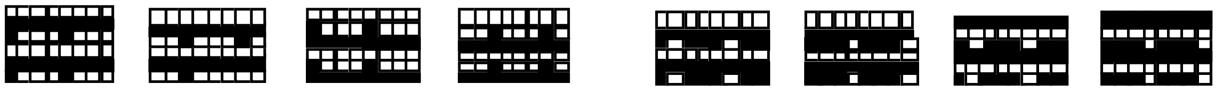

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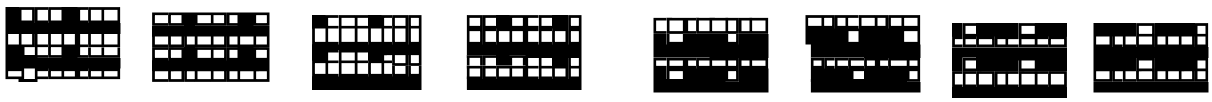

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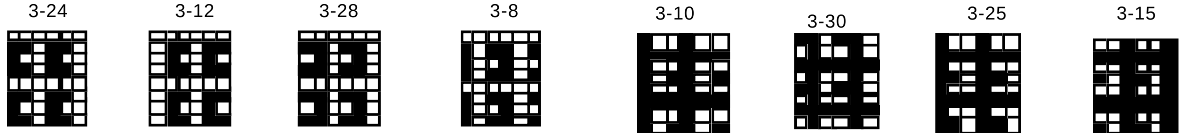

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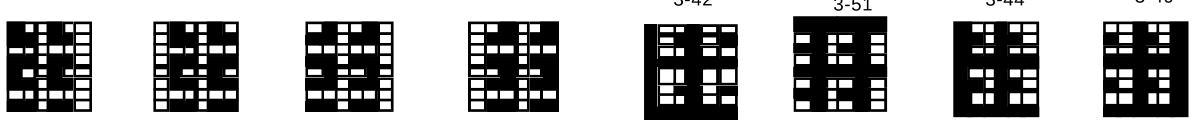

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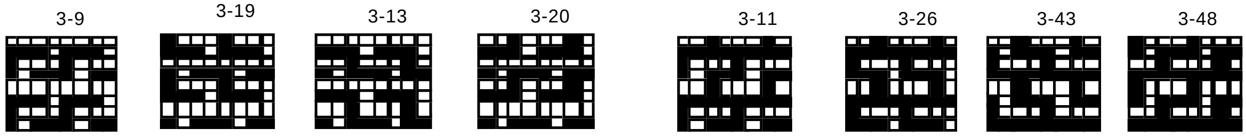

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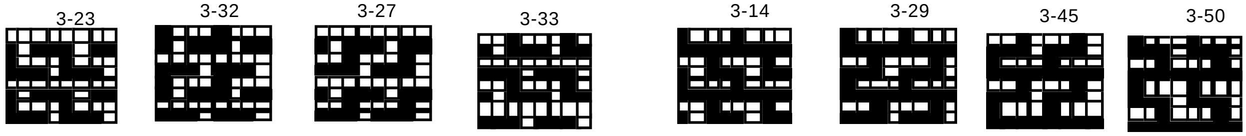

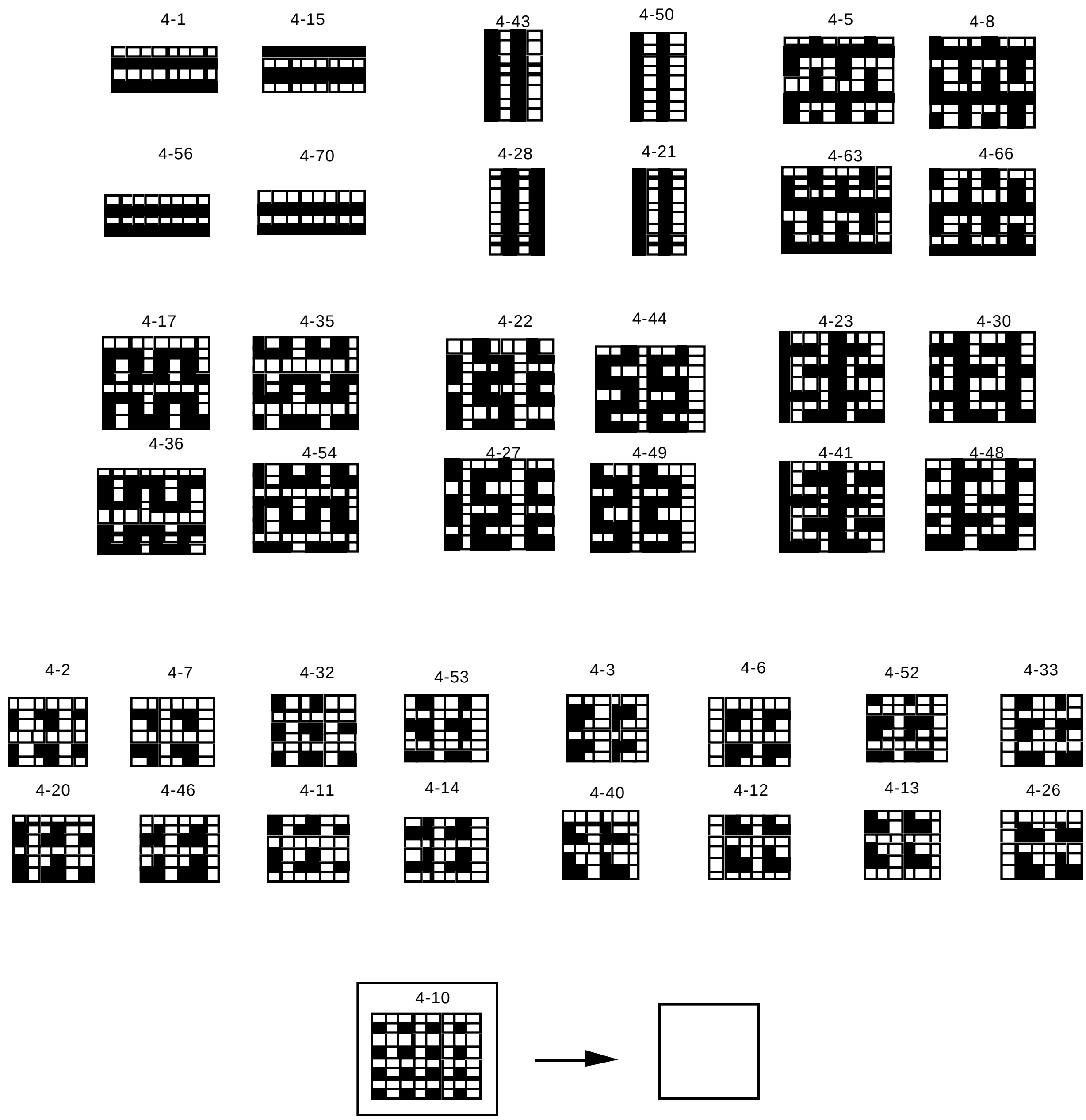
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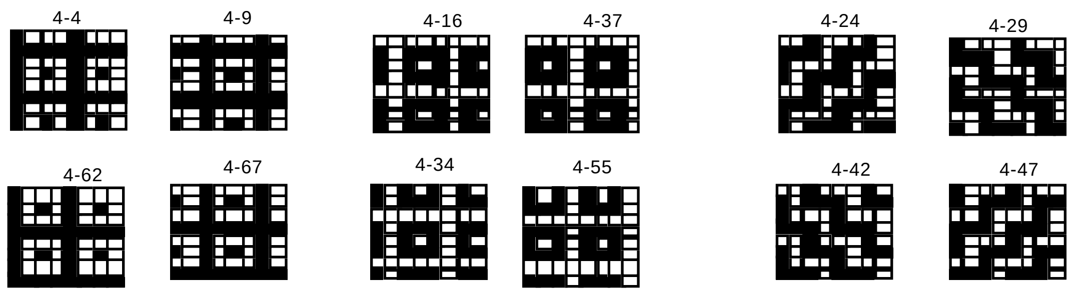
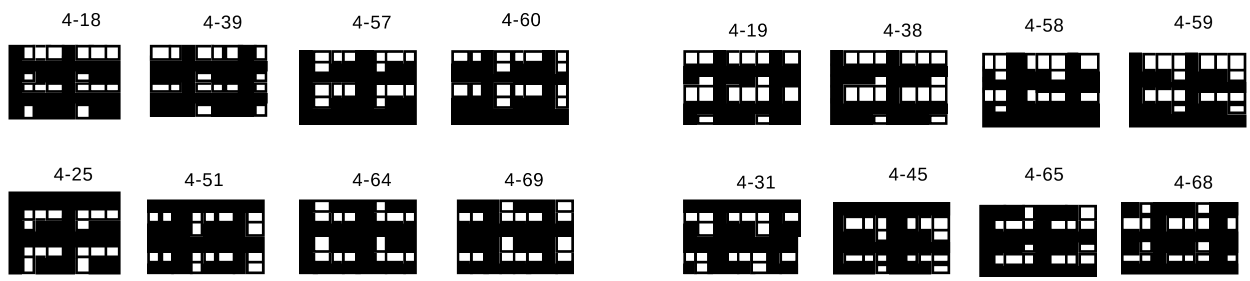
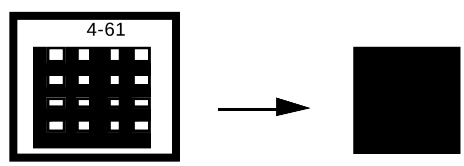
4 Additional Pegs

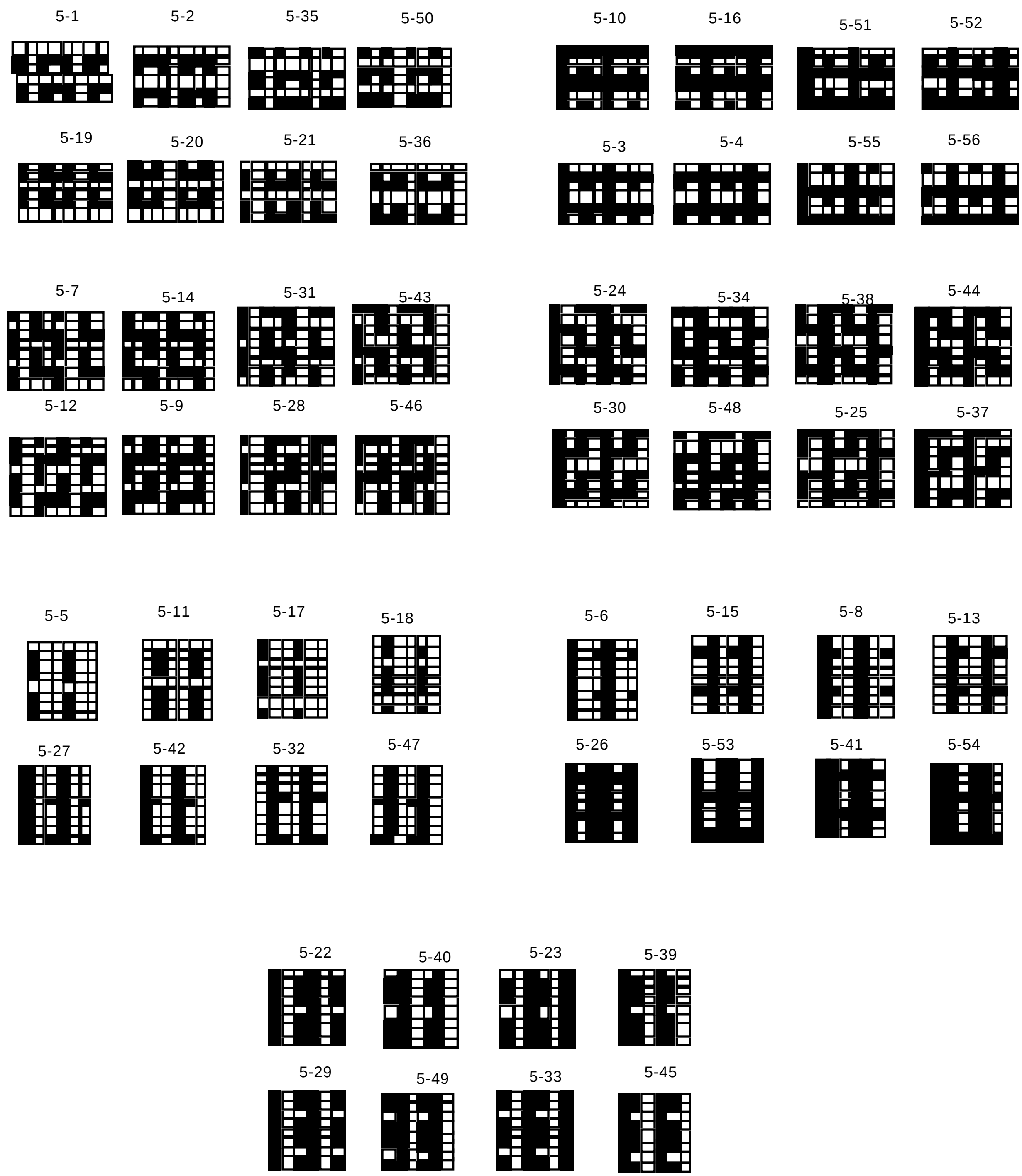






Drawup

5 Additional Pegs



Drawup

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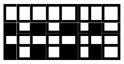
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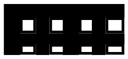
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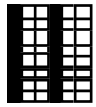
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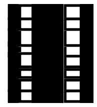
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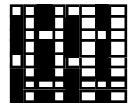
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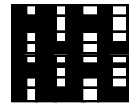

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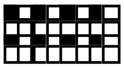
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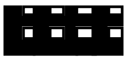
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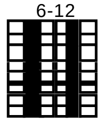
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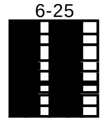
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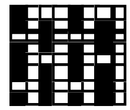
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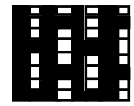

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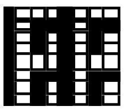
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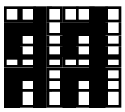
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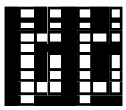
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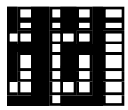
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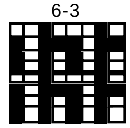
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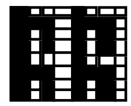
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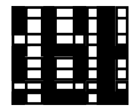
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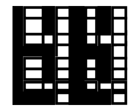

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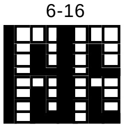
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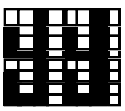
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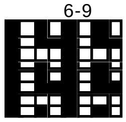
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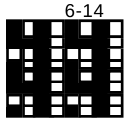
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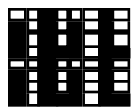
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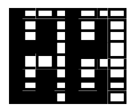
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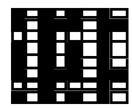
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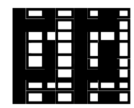

7 Additional Pegs

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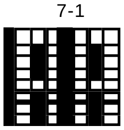
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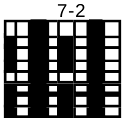
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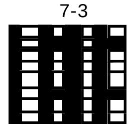
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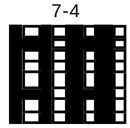

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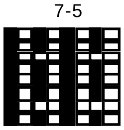
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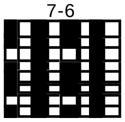
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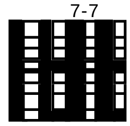
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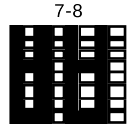
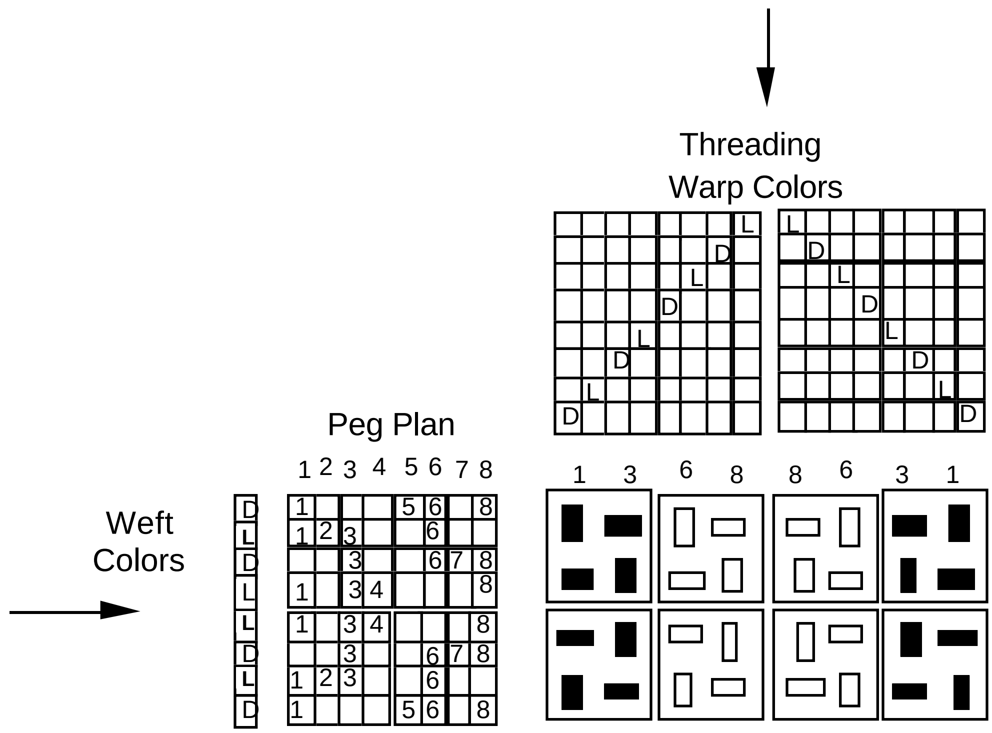


In Chapter II, Section II there is a discussion of how to create horizontal symmetry by adding two extra threads in the threading and how to achieve vertical symmetry by adding two extra treadlings or pegging bars. Three different situations are analyzed in this appendix to justify these statements. In the first, no extra threads or pegging bars are added. In the second, one extra warp thread and one extra pegging bar are added. In the third, two extra warp threads and two extra pegging bars are added. It is the third example that leads to the correct weave structure. For each example, both sides of the double woven fabric will be developed so that you can see that the errors may show up when viewed from above and other errors can be observed when viewed from below the fabric.

I. No added threads or treadlings.

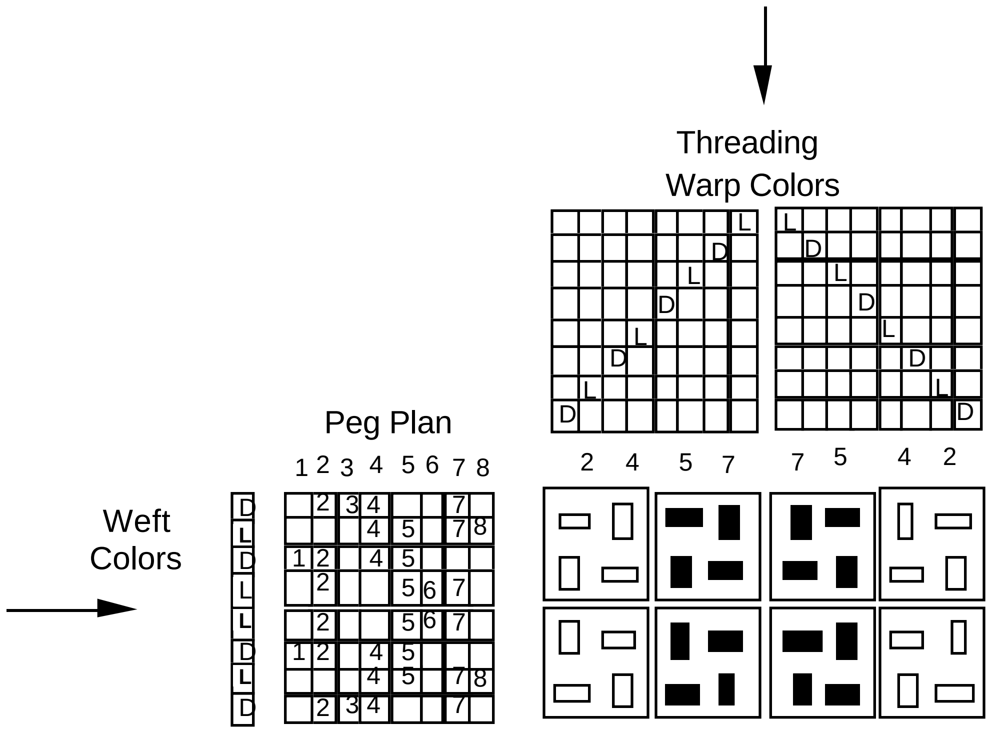
The first half of the threading and the peg plan are reversed at the turning point without any additions to either. In making these weave structure diagrams it is only necessary to deal with the grid points where a single thread is being raised and this is shown across the top of the squares on the right.

A. <u>Looking at the fabric from the above</u>. Notice that the color orders for both the warp and the weft change at the turning points which are marked by the arrows.



Errors clearly occur at each of the turning points. Two warp threads on shaft 8 weave together. The fourth weft pick is repeated which means that two weft picks lie in the same shed.

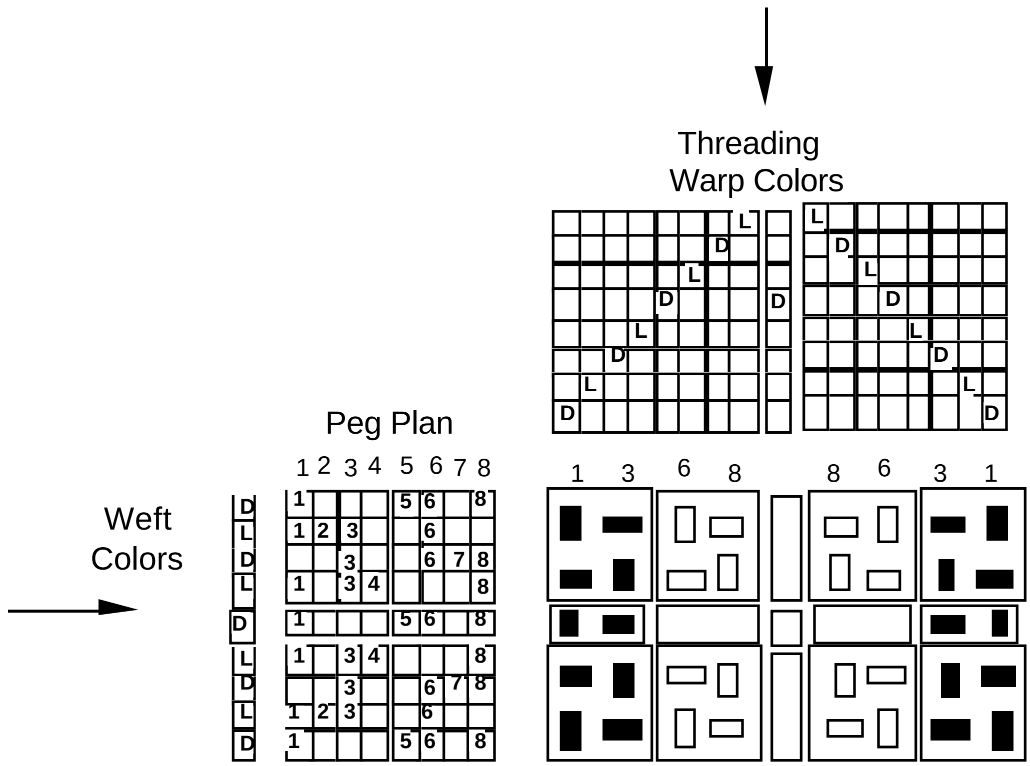
B. <u>Looking at the fabric from below</u>. The peg plans are the complements of the peg plans used when looking at the fabric from above. (The threads not raised when viewed from above are in essence raised when viewed from below.) Those sections that are dark (light) when viewed from above become light (dark) when viewed from below,



The same types of errors are visible when the fabric is viewed from below.

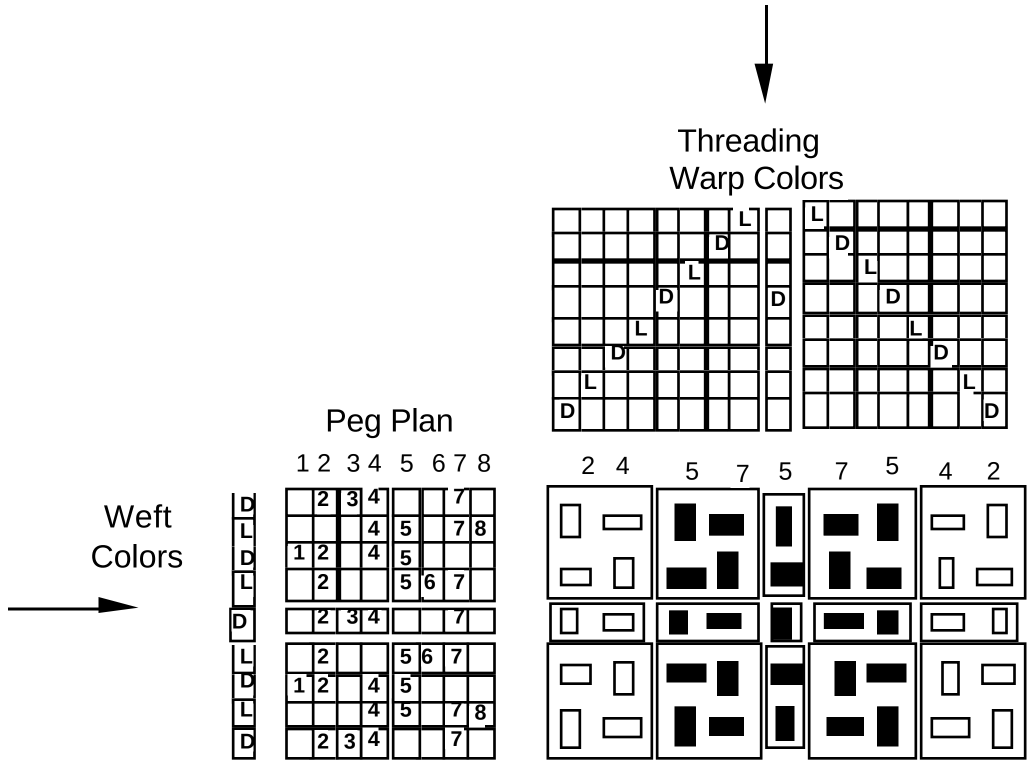
II. One additional thread and one additional peg plan.

A. <u>Looking at the fabric from above</u>. Notice that the color order for both the warp and the weft remains DLDL.



Errors still occur where the sections based on shafts 5-8 join at the turning points in both the warp and weft directions. Notice however that no errors occur in the warp direction where the sections based on shafts 1-4 join. Progress is being made.

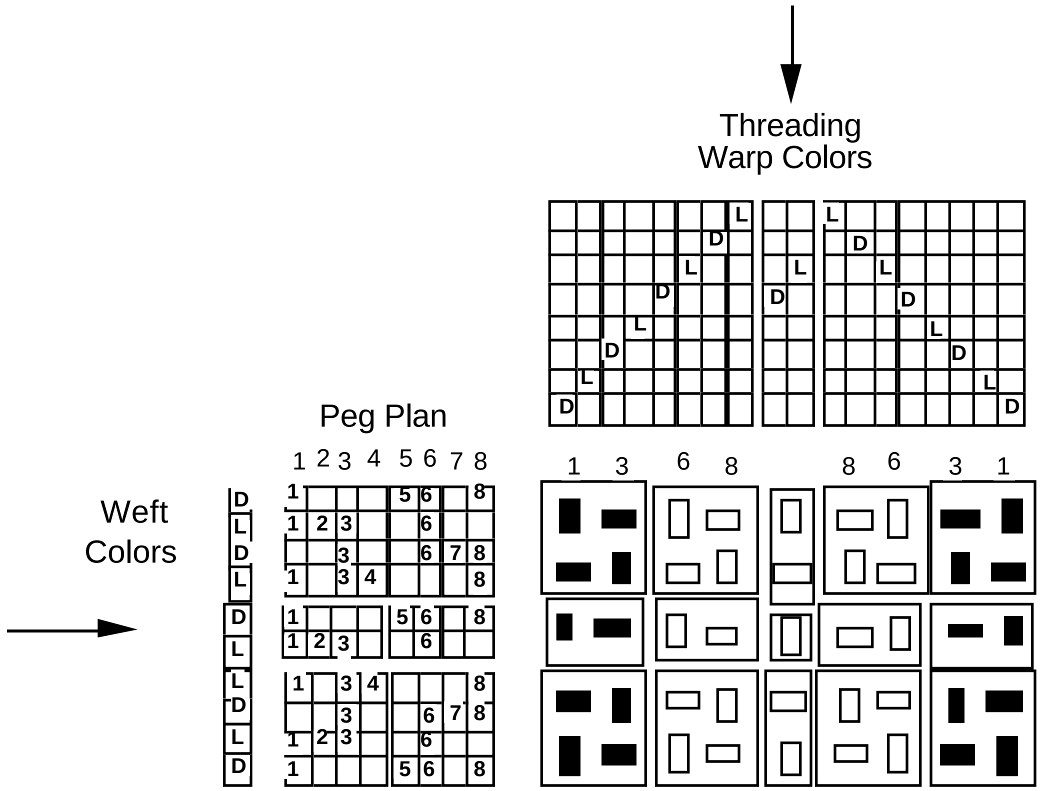
B. Looking at the fabric from below.



There are no errors now looking at the cloth from below. More progress.

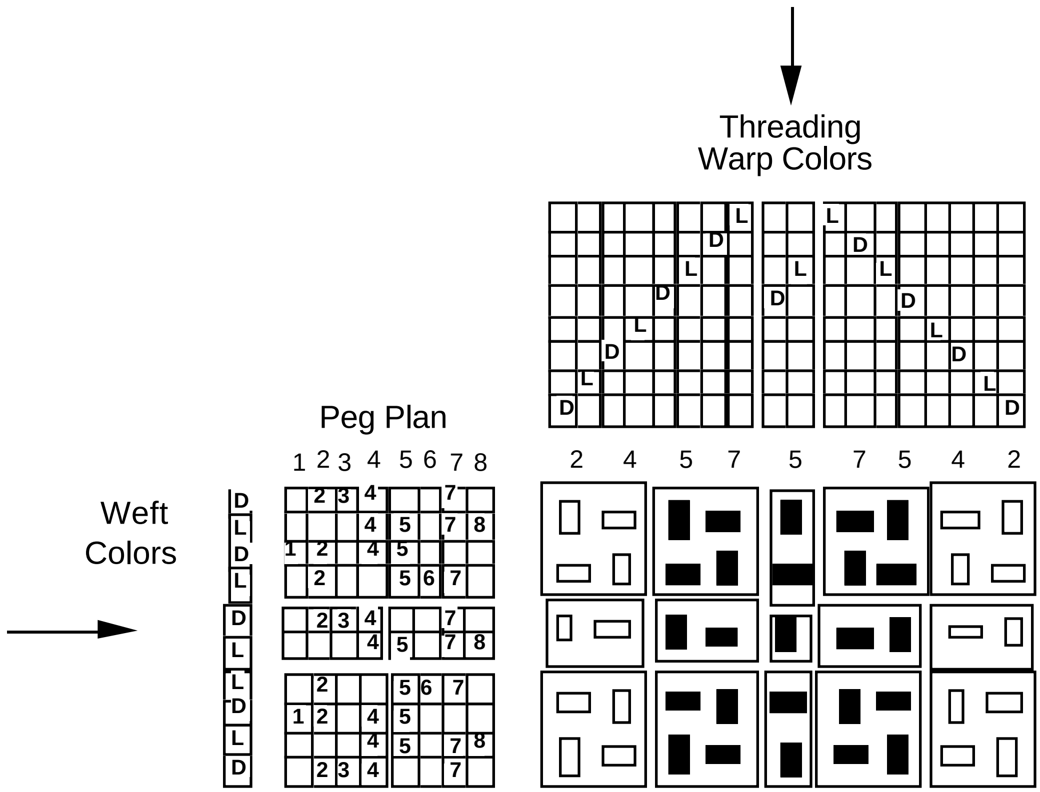
III. Two extra warp threads and two additional peg plans are added. Notice that the color order in both the warp and the weft reverse after the turning points.

A. Looking at the fabric from above.



There are no weaving errors looking at this side of the double woven cloth.

B. Looking at the fabric from below.



There are no weaving errors in the bottom layer of the double weave cloth.

Conclusions:

1. When you want to make a double weave design symmetrical in the horizontal direction, two extra warp threads must be added in order to avoid weaving errors. The color order in the warp changes from DLDL to LDLD after the turning point.
2. When you want to make a double weave design symmetrical in the vertical direction, two extra peg plans must be added to avoid weaving errors. The color order for the weft picks changes from DLDL to LDLD after the turning point.

Appendix D. The Problem of Drawdowns for Double Weave.

In bound weave where the warp is widely spaced, weft threads can be beaten so that they hide the warp entirely. They readily slide down to cover the warp. In rep weave the opposite is true. The warp is so dense that the weft, particularly if it is larger in size than the warp, is completely hidden. The warp threads move together hiding the weft. In many of the lace weaves such as huck or Bronson weave structures, the open lace structure results when the warp and/or the weft threads move or slide towards one another. This is most apparent after the cloth has been removed from the loom and the cloth is washed.

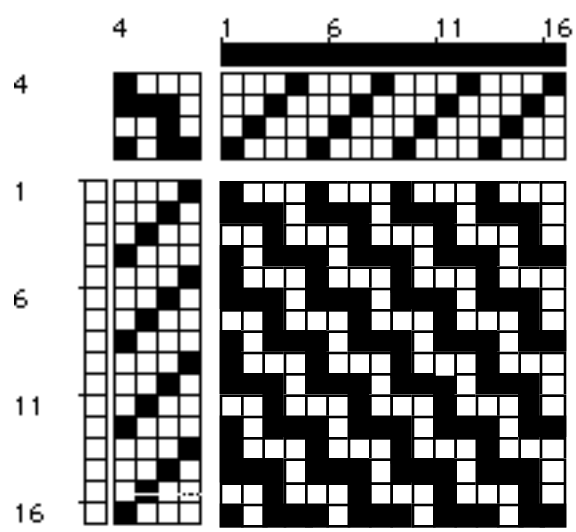
In traditional double weave, the warp and weft threads in the top layer are free to move so that they hide the warp and weft threads in the lower cloth layer. This is not apparent if the usual drawdown is made. In addition some of the computer weave programs do not have the capability of showing how this happens. In integrated double weave, all of the warp and weft threads are in a single cloth layer.

Viewing the two sides of a cloth that has some sections in traditional double weave and other sections in integrated double weave seems impossible with any of the computer weave programs available at this time.

1. <u>Traditional Double Weave with Two Cloth Layers</u>.

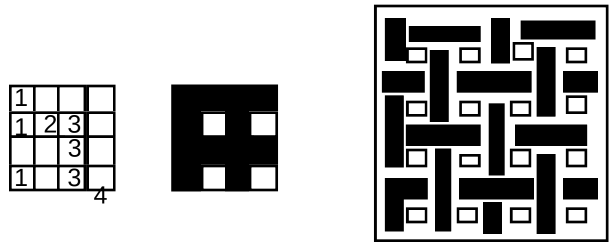
In double weave where two separate cloth layers are formed, there are no interlacings of the threads between the two layers. The problem is that a drawdown made in the usual manner shows all the threads of the two layers at the same time. The result gives a very misleading picture as shown in the next diagram. The diagram is for a 4-shaft loom, the warp is black and the weft is white, and the tieup and treadling are shown on the left.

Figure 1, Drawdown for Double Weave



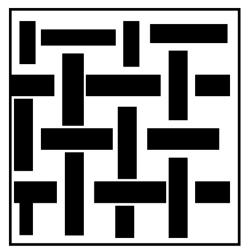
It is helpful to look at the drawdown and the weave structure for the first form of double weave. They both show small white squares underneath a field of black threads.

Figure 2. Peg Plan, Drawdown and Weave Structure



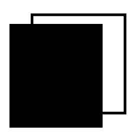
If you look at this diagram for a few minutes, you can convince yourself that the threads in the top layer, black, do not interlace with the threads of the bottom layer, white. Because of this the black threads are free to move together, hiding the white threads. Consequently a much better view of the weaving shows only the black threads of the top layer in a slightly expanded form to correspond to the previous diagram.

Figure 3. Weave Structure Revised



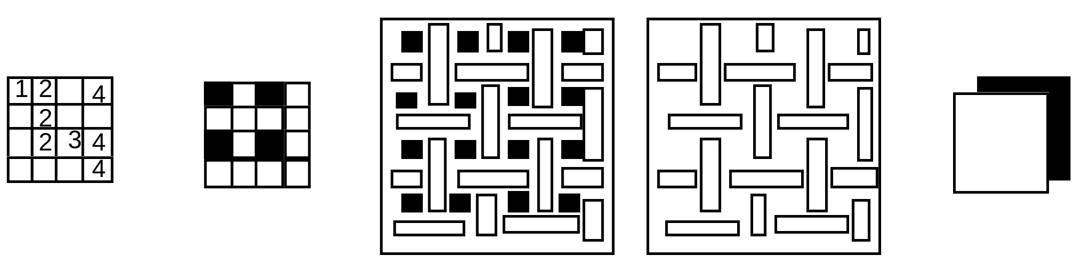
The two cloth layers appear clearly in this perspective view.

Figure 4. The Two Cloth Layers of Double Weave



The same set of diagrams for the other basic peg plan for double weave leads to the white cloth layer on the top and the black in the bottom.

Figure 5. The Development to Show the Lower Layer of Double Weave



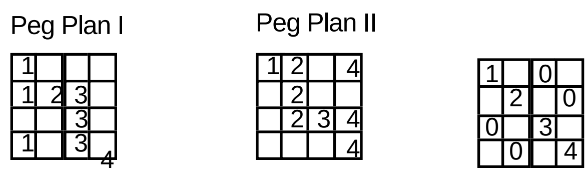
The drawdown with white spots on a black background translates to two cloth layers, black over white, and the drawdown with black spots on a white background is also recognized as two cloth layers, white over black.

Figure 6. A Shortcut View of Double Weave

II. Integrated Double Weave

If the two basic peg plans for double weave are compared, there are certain things in common. Both have pegs in the four positions along the diagonal from upper left to lower right. Moreover there are no pegs in the four positions shown as zeros.

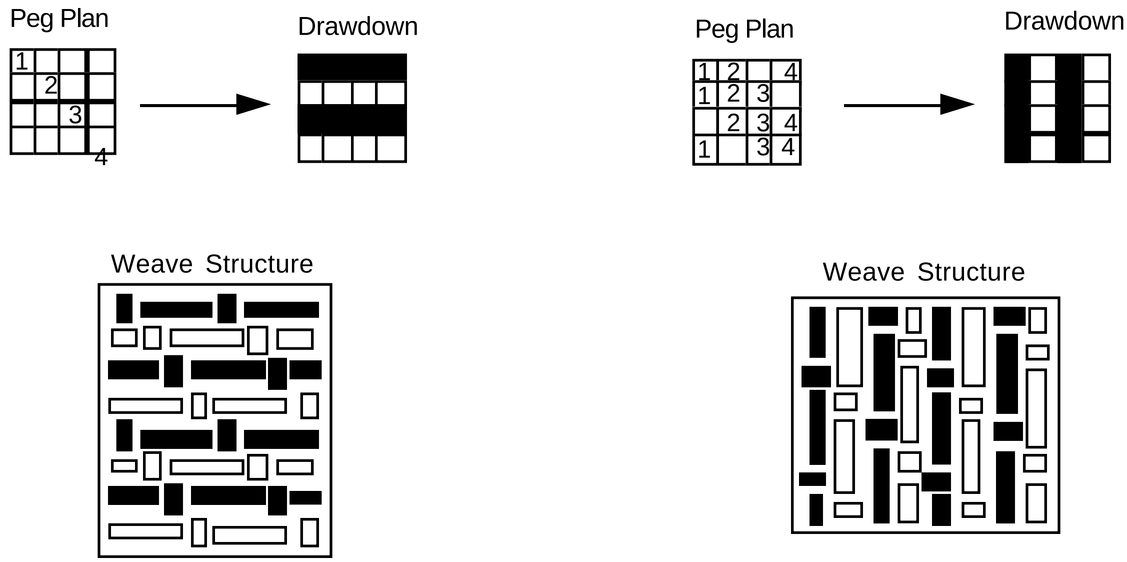
Figure 7. Common Features of the Basic Peg Plans for Double Weave



There are eight squares in the grid that may or may not have a peg which leads to 256 different peg plans that make up the family of double weave peg plans. Two of these correspond to the peg plans of traditional double weave, that have just been discussed, where two cloth layers are formed. The other 254 peg plans give rise to single layer weaves in what I think of as integrated double weave. Once again drawdown problems arise. Let's look at a few examples to understand why this is true. The first example corresponds to no additional pegs in the diagram immediately above and the second example fills the empty squares with 8 pegs. The peg plan, drawdown and weave structure are shown for each example. It is easy to see from the weave structures that the warp and weft threads are interlocked and will not move past one another. The pattern for the first example is alternating dark and light horizontal lines. The pattern for the second is alternating dark and light vertical lines.

When you look at the back of these weavings, the patterns are interchanged. Horizontal lines on the front become vertical lines on the back and vertical lines on the front become horizontal lines on the back. Any peg plan for the front of a cloth becomes its complementary peg plan when viewed from the back. (The direction of the threading reverses when viewed from the back and designs may be shifted horizontally by several threads.)

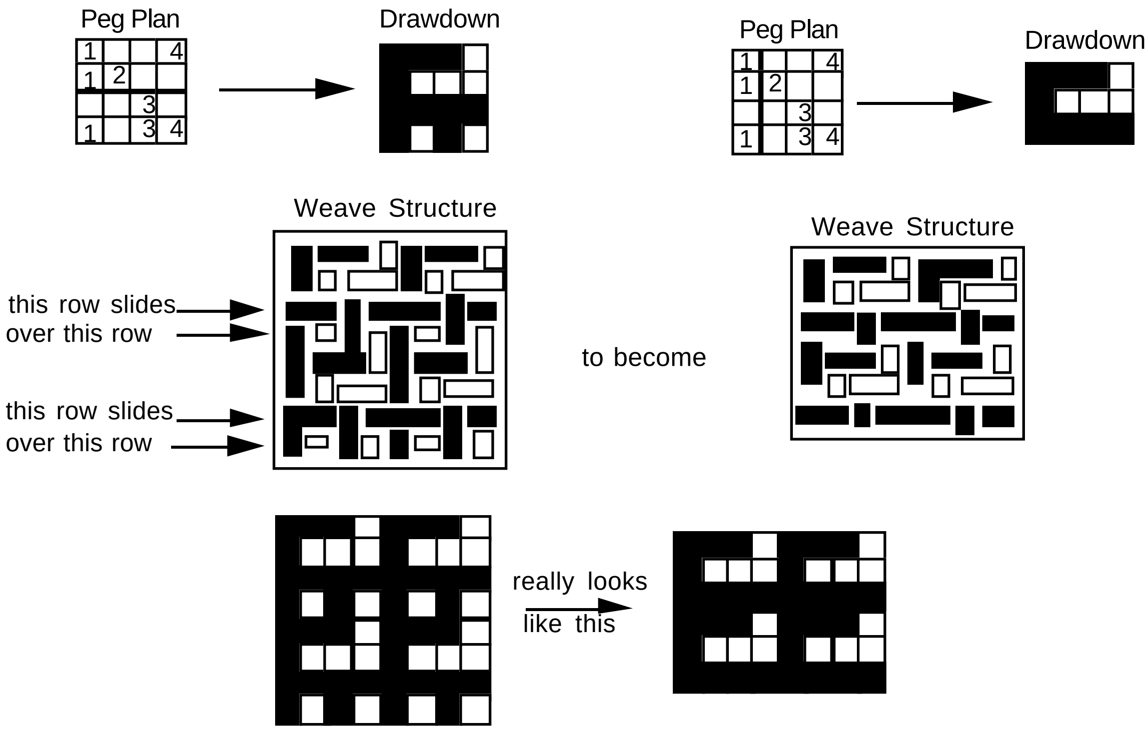
Figure 8. Two Examples of Integrated Double Weave



In about half of the 254 peg plans, the result is similar to these two examples. By that I mean that the threads are interlocked as shown and do not move over one another. However, in many of the 254 peg plans, this is not true. Another example will help you see what is happening.

The drawdown numbered 5-24 from Appendix A serves as the example. The peg plan, drawdown and weave structure help to see what happens. Careful examination of the first weave structure on the left reveals that movement of rows 3 and 7 can occur, covering rows 4 and 8. The appearance of the drawdown and of the weave structure when viewed from above changes.

Figure 9. How Some Threads in Integrated Double Weave Become Hidden



Perhaps the easiest way to cope with these complications is through weaving samples. (How many times have you been told this?). Some threads are smooth enough to change their positions readily. Fuzzy threads may not move at all. In any event good luck.