

Part 4: "New Advanced Study of Magic Squares and Cubes"

Chapert 4. Commentary Articles No.2 by Kanji Setsuda:

"Various Arts and Tools for Studying Magic Squares"

Section 5: Analytical Study of 'Complete Euler Squares' of Simultaneous and Pandiagonal Type: 5x5

1. Analytical Study of 'Complete Euler Squares' 5x5

Let's study 'Complete Euler Squares' analytically about Simultaneous type and Pandiagonal one of order 5. After finding anything interesting, let's invent another way of reconstructing those objects with our new knowledge of combining high layer with low one made of decomposition by Positional Writing System of Numbers of Base 5.

2. Decomposed Layers of 'Complete Euler Squares' 5x5

We know 16 simultaneous squares 5x5 of both self-complementary and pan-diagonal type and 3600 pandiagonal magic squares 5x5 are all 'Complete Euler Squares'.

It makes me think we should study more directly about the two decomposed layers of each solution. Why don't you study about them analytically?

But what could we do? How should we deal with these objects?

I advise you to do the next things first of all:

- (1) Watch the solutions on the decomposed layers intensively, and find anything same and common, and collect everything similar and make a group for them.
- (2) When we could make some groups, then compare each member with others, and extend our comparison to the outside and find anything same and common with the ones in any other group.
- (3) Try to find any transformation method, and you may know any beautiful relations among them.

3. Simultaneous Squares 5x5 of both S-C and P-D type

Let me take the Simultaneous magic squares 5x5 of both self-complementary and pan-diagonal type for our first object. The next list shows the solution set of 16 gems called "Suzuki Squares."

1/ /D5i					2/ /D5i																								
1	15	24	18	7	0	2	4	3	1	1	23	20	14	7	0	4	3	2	1	0	2	4	3	1					
23	17	6	5	14	4	3	1	0	2	2	1	0	4	3	15	9	2	21	18	2	1	0	4	3	4	3	1	0	2
10	4	13	22	16	1	0	2	4	3	4	3	2	1	0	22	16	13	10	4	4	3	2	1	0	1	0	2	4	3
12	21	20	9	3	2	4	3	1	0	1	0	4	3	2	8	5	24	17	11	1	0	4	3	2	2	4	3	1	0
19	8	2	11	25	3	1	0	2	4	3	2	1	0	4	19	12	6	3	25	3	2	1	0	4	3	1	0	2	4
3/ /D5i					4/ /D5i																								
1	15	22	18	9	0	2	4	3	1	0	4	1	2	3	1	23	20	12	9	0	4	3	2	1	0	2	4	1	3
23	19	6	5	12	4	3	1	0	2	2	3	0	4	1	15	7	4	21	18	2	1	0	4	3	4	1	3	0	2
10	2	13	24	16	1	0	2	4	3	4	1	2	3	0	24	16	13	10	2	4	3	2	1	0	3	0	2	4	1
14	21	20	7	3	2	4	3	1	0	3	0	4	1	2	8	5	22	19	11	1	0	4	3	2	2	4	1	3	0
17	8	4	11	25	3	1	0	2	4	1	2	3	0	4	17	14	6	3	25	3	2	1	0	4	1	3	0	2	4
5/ /D5i					6/ /D5i																								
2	14	25	18	6	0	2	4	3	1	1	3	4	2	0	2	23	19	15	6	0	4	3	2	1	1	2	3	4	0
23	16	7	4	15	4	3	1	0	2	2	0	1	3	4	14	10	1	22	18	2	1	0	4	3	3	4	0	1	2
9	5	13	21	17	1	0	2	4	3	3	4	2	0	1	21	17	13	9	5	4	3	2	1	0	0	1	2	3	4
11	22	19	10	3	2	4	3	1	0	0	1	3	4	2	8	4	25	16	12	1	0	4	3	2	2	3	4	0	1
20	8	1	12	24	3	1	0	2	4	4	2	0	1	3	20	11	7	3	24	3	2	1	0	4	4	0	1	2	3

7/ /D5i					8/ /D5i																								
2	14	21	18	10	0	2	4	3	1	1	3	0	2	4	2	23	19	11	10	0	4	3	2	1	1	2	3	0	4
23	20	7	4	11	4	3	1	0	2	2	4	1	3	0	14	6	5	22	18	2	1	0	4	3	3	0	4	1	2
9	1	13	25	17	1	0	2	4	3	3	0	2	4	1	25	17	13	9	1	4	3	2	1	0	4	1	2	3	0
15	22	19	6	3	2	4	3	1	0	4	1	3	0	2	8	4	21	20	12	1	0	4	3	2	2	3	0	4	1
16	8	5	12	24	3	1	0	2	4	0	2	4	1	3	16	15	7	3	24	3	2	1	0	4	0	4	1	2	3
9/ /D5i					10/ /D5i																								
4	12	25	18	6	0	2	4	3	1	3	1	4	2	0	4	23	17	15	6	0	4	3	2	1	3	2	1	4	0
23	16	9	2	15	4	3	1	0	2	2	0	3	1	4	12	10	1	24	18	2	1	0	4	3	1	4	0	3	2
7	5	13	21	19	1	0	2	4	3	1	4	2	0	3	21	19	13	7	5	4	3	2	1	0	0	3	2	1	4
11	24	17	10	3	2	4	3	1	0	0	3	1	4	2	8	2	25	16	14	1	0	4	3	2	2	1	4	0	3
20	8	1	14	22	3	1	0	2	4	4	2	0	3	1	20	11	9	3	22	3	2	1	0	4	4	0	3	2	1
11/ /D5i					12/ /D5i																								
4	12	21	18	10	0	2	4	3	1	3	1	0	2	4	4	23	17	11	10	0	4	3	2	1	3	2	1	0	4
23	20	9	2	11	4	3	1	0	2	2	4	3	1	0	12	6	5	24	18	2	1	0	4	3	1	0	4	3	2
7	1	13	25	19	1	0	2	4	3	1	0	2	4	3	25	19	13	7	1	4	3	2	1	0	4	3	2	1	0
15	24	17	6	3	2	4	3	1	0	4	3	1	0	2	8	2	21	20	14	1	0	4	3	2	2	1	0	4	3
16	8	5	14	22	3	1	0	2	4	0	2	4	3	1	16	15	9	3	22	3	2	1	0	4	0	4	3	2	1
13/ /D5i					14/ /D5i																								
5	11	24	18	7	0	2	4	3	1	4	0	3	2	1	5	23	16	14	7	0	4	3	2	1	4	2	0	3	1
23	17	10	1	14	4	3	1	0	2	2	1	4	0	3	11	9	2	25	18	2	1	0	4	3	0	3	1	4	2
6	4	13	22	20	1	0	2	4	3	0	3	2	1	4	22	20	13	6	4	4	3	2	1	0	1	4	2	0	3
12	25	16	9	3	2	4	3	1	0	1	4	0	3	2	8	1	24	17	15	1	0	4	3	2	2	0	3	1	4
19	8	2	15	21	3	1	0	2	4	3	2	1	4	0	19	12	10	3	21	3	2	1	0	4	3	1	4	2	0
15/ /D5i					16/ /D5i																								
5	11	22	18	9	0	2	4	3	1	4	0	1	2	3	5	23	16	12	9	0	4	3	2	1	4	2	0	1	3
23	19	10	1	12	4	3	1	0	2	2	3	4	0	1	11	7	4	25	18	2	1	0	4	3	0	1	3	4	2
6	2	13	24	20	1	0	2	4	3	0	1	2	3	4	24	20	13	6	2	4	3	2	1	0	3	4	2	0	1
14	25	16	7	3	2	4	3	1	0	3	4	0	1	2	8	1	22	19	15	1	0	4	3	2	2	0	1	3	4
17	8	4	15	21	3	1	0	2	4	1	2	3	4	0	17	14	10	3	21	3	2	1	0	4	1	3	4	2	0

[Count = 16]

Could you find anything interesting among those decomposed layers?

I found there are only two forms of high layers, and the solutions could be classified into two groups with 8 members in each.

I actually made such two groups as follows, changing a little bit of solution form and of list order. I reformed and listed them under the new conditions: $n1 < n25$; $n1 < n5$; $n1 < n21$; and $n2 > n6$, in place of $n1 < n25$; $n1 < n5 < n21$.

[Group 1]

1/ /D5i					2/ /D5i																								
1	23	20	12	9	0	4	3	2	1	0	2	4	1	3	1	23	20	14	7	0	4	3	2	1	0	2	4	3	1
15	7	4	21	18	2	1	0	4	3	4	1	3	0	2	15	9	2	21	18	2	1	0	4	3	4	3	1	0	2
24	16	13	10	2	4	3	2	1	0	3	0	2	4	1	22	16	13	10	4	4	3	2	1	0	1	0	2	4	3
8	5	22	19	11	1	0	4	3	2	2	4	1	3	0	8	5	24	17	11	1	0	4	3	2	2	4	3	1	0
17	14	6	3	25	3	2	1	0	4	1	3	0	2	4	19	12	6	3	25	3	2	1	0	4	3	1	0	2	4
6/ /D5i					5/ /D5i																								
2	23	19	15	6	0	4	3	2	1	1	2	3	4	0	2	23	19	11	10	0	4	3	2	1	1	2	3	0	4
14	10	1	22	18	2	1	0	4	3	3	4	0	1	2	14	6	5	22	18	2	1	0	4	3	3	0	4	1	2
21	17	13	9	5	4	3	2	1	0	0	1	2	3	4	25	17	13	9	1	4	3	2	1	0	4	1	2	3	0
8	4	25	16	12	1	0	4	3	2	2	3	4	0	1	8	4	21	20	12	1	0	4	3	2	2	3	0	4	1
20	11	7	3	24	3	2	1	0	4	4	0	1	2	3	16	15	7	3	24	3	2	1	0	4	0	4	1	2	3
9/ /D5i					10/ /D5i																								
4	23	17	11	10	0	4	3	2	1	3	2	1	0	4	4	23	17	15	6	0	4	3	2	1	3	2	1	4	0
12	6	5	24	18	2	1	0	4	3	1	0	4	3	2	12	10	1	24	18	2	1	0	4	3	1	4	0	3	2
25	19	13	7	1	4	3	2	1	0	4	3	2	1	0	21	19	13	7	5	4	3	2	1	0	0	3	2	1	4
8	2	21	20	14	1	0	4	3	2	2	1	0	4	3	8	2	25	16	14	1	0	4	3	2	2	1	4	0	3
16	15	9	3	22	3	2	1	0	4	0	4	3	2	1	20	11	9	3	22	3	2	1	0	4	4	0	3	2	1

14/				/D5i				1/H				14/L				13/				/D5i				1/H				13/L			
5	23	16	14	7	0	4	3	2	1	4	2	0	3	1	5	23	16	12	9	0	4	3	2	1	4	2	0	1	3		
11	9	2	25	18	2	1	0	4	3	0	3	1	4	2	11	7	4	25	18	2	1	0	4	3	0	1	3	4	2		
22	20	13	6	4	4	3	2	1	0	1	4	2	0	3	24	20	13	6	2	4	3	2	1	0	3	4	2	0	1		
8	1	24	17	15	1	0	4	3	2	2	0	3	1	4	8	1	22	19	15	1	0	4	3	2	2	0	1	3	4		
19	12	10	3	21	3	2	1	0	4	3	1	4	2	0	17	14	10	3	21	3	2	1	0	4	1	3	4	2	0		

[Group 2]

3/				/D5i				3/H				1/L				4/				/D5i				3/H				2/L			
1	23	10	12	19	0	4	1	2	3	0	2	4	1	3	1	23	10	14	17	0	4	1	2	3	0	2	4	3	1		
15	17	4	21	8	2	3	0	4	1	4	1	3	0	2	15	19	2	21	8	2	3	0	4	1	4	3	1	0	2		
24	6	13	20	2	4	1	2	3	0	3	0	2	4	1	22	6	13	20	4	4	1	2	3	0	1	0	2	4	3		
18	5	22	9	11	3	0	4	1	2	2	4	1	3	0	18	5	24	7	11	3	0	4	1	2	2	4	3	1	0		
7	14	16	3	25	1	2	3	0	4	1	3	0	2	4	9	12	16	3	25	1	2	3	0	4	3	1	0	2	4		

8/				/D5i				3/H				6/L				7/				/D5i				3/H				5/L			
2	23	9	15	16	0	4	1	2	3	1	2	3	4	0	2	23	9	11	20	0	4	1	2	3	1	2	3	0	4		
14	20	1	22	8	2	3	0	4	1	3	4	0	1	2	14	16	5	22	8	2	3	0	4	1	3	0	4	1	2		
21	7	13	19	5	4	1	2	3	0	0	1	2	3	4	25	7	13	19	1	4	1	2	3	0	4	1	2	3	0		
18	4	25	6	12	3	0	4	1	2	2	3	4	0	1	18	4	21	10	12	3	0	4	1	2	2	3	0	4	1		
10	11	17	3	24	1	2	3	0	4	4	0	1	2	3	6	15	17	3	24	1	2	3	0	4	0	4	1	2	3		

11/				/D5i				3/H				9/L				12/				/D5i				3/H				10/L			
4	23	7	11	20	0	4	1	2	3	3	2	1	0	4	4	23	7	15	16	0	4	1	2	3	3	2	1	4	0		
12	16	5	24	8	2	3	0	4	1	1	0	4	3	2	12	20	1	24	8	2	3	0	4	1	1	4	0	3	2		
25	9	13	17	1	4	1	2	3	0	4	3	2	1	0	21	9	13	17	5	4	1	2	3	0	0	3	2	1	4		
18	2	21	10	14	3	0	4	1	2	2	1	0	4	3	18	2	25	6	14	3	0	4	1	2	2	1	4	0	3		
6	15	19	3	22	1	2	3	0	4	0	4	3	2	1	10	11	19	3	22	1	2	3	0	4	4	0	3	2	1		

16/				/D5i				3/H				14/L				15/				/D5i				3/H				13/L			
5	23	6	14	17	0	4	1	2	3	4	2	0	3	1	5	23	6	12	19	0	4	1	2	3	4	2	0	1	3		
11	19	2	25	8	2	3	0	4	1	0	3	1	4	2	11	17	4	25	8	2	3	0	4	1	0	1	3	4	2		
22	10	13	16	4	4	1	2	3	0	1	4	2	0	3	24	10	13	16	2	4	1	2	3	0	3	4	2	0	1		
18	1	24	7	15	3	0	4	1	2	2	0	3	1	4	18	1	22	9	15	3	0	4	1	2	2	0	1	3	4		
9	12	20	3	21	1	2	3	0	4	3	1	4	2	0	7	14	20	3	21	1	2	3	0	4	1	3	4	2	0		

[Count = 16]

Can you see the beautiful relationship between the low layers of all solutions?
 Of course, every high layer in each group has the same form, since I have made it so.
 How about low layers?
 Could you find the one-to-one-correspondence between two groups?
 Each low layer is just the same with the corresponding one in the other group.
 Eight low layers in one group are just the same with the eight ones of the other.
 We now know the real meaning of the equation: $2 \times 8 = 16$.

4. Rotation of Low Layers Makes 4 Groups

Go on further analysis on the list above to find the beautiful relations among low layers.
 Look carefully at the 4 solution groups as follows:

- (1){1, 6, 9, 14} has {1L, 6L, 9L, 14L}, (2){2, 5, 10, 13} has {2L, 5L, 10L, 13L},
 (3){3, 8, 11, 16} has {1L, 6L, 9L, 14L}, (4){4, 7, 12, 15} has {2L, 5L, 10L, 13L}

We could see rotation movement by 90 degrees clockwise between 1L and 6L, and also the same between 2L and 10L. We could see 180 degree rotation between 1L and 14L and between 2L and 13L, and 270 degree rotation clockwise between 1L and 9L, and between 2L and 5L.

If you want to invent any transformation method about them, you may well think of the only one rotation transformation by 90 degrees clockwise, since you could repeat it

	1/L	->	6/L	->	14/L	->	9/L												
0	2	4	1	3	1	2	3	4	0	4	2	0	3	1	3	2	1	0	4
4	1	3	0	2	3	4	0	1	2	0	3	1	4	2	1	0	4	3	2
3	0	2	4	1	0	1	2	3	4	1	4	2	0	3	4	3	2	1	0
2	4	1	3	0	2	3	4	0	1	2	0	3	1	4	2	1	0	4	3
1	3	0	2	4	4	0	1	2	3	3	1	4	2	0	0	4	3	2	1

twice to obtain 180 degree rotation, and three times to get 270 degree rotation.

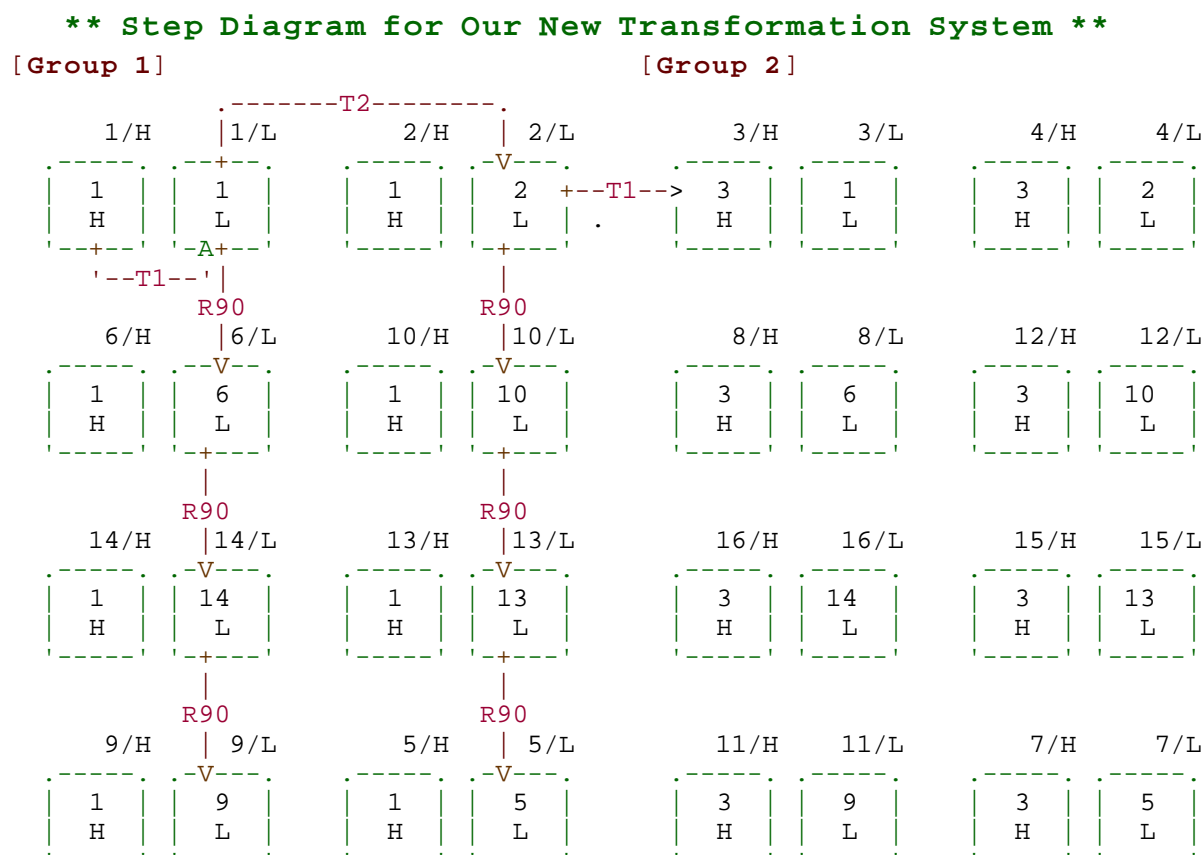
How could we have 2L transformed from 1L, then?

	1/L		2/L						
0	2	4	1	3	0	2	4	3	1
4	1	3	0	2	4	3	1	0	2
3	0	2	4	1	1	0	2	4	3
2	4	1	3	0	2	4	3	1	0
1	3	0	2	4	3	1	0	2	4

We could obtain 2L just by replacing all 1 with 3 and all 3 with 1 of 1L.

5. Transformation System for Simultaneous Type of CES 5x5

Let me skip all my trivial explanations and come to my conclusion. I invented such a transformation system as follows:



Almost all layers of Group 2 could be made by just copying the ones of Group 1. I dictated the next transformation rules for my computer program listed below:

/* Transformation Rules: */

```

/* Transform Type01: Mirror Reflection */
void trns01() {
    d[1]=c[1];    d[2]=c[6];    d[3]=c[11];    d[4]=c[16];    d[5]=c[21];
    d[6]=c[2];    d[7]=c[7];    d[8]=c[12];    d[9]=c[17];    d[10]=c[22];
    d[11]=c[3];   d[12]=c[8];    d[13]=c[13];   d[14]=c[18];   d[15]=c[23];
    d[16]=c[4];   d[17]=c[9];    d[18]=c[14];   d[19]=c[19];   d[20]=c[24];
    d[21]=c[5];   d[22]=c[10];   d[23]=c[15];   d[24]=c[20];   d[25]=c[25];
}
/**/
/* Transform Type02: Data Exchange */
void trns02() {
    short n;
    for(n=1; n<26; n++) {d[n]=c[n];}
    for(n=1; n<26; n++) {
        if(c[n]==1){d[n]=3;}
        if(c[n]==3){d[n]=1;}
    }
}
/**/
/* Transform Rotat90: Rotation */
void rotat90() {
    d[1]=c[21];    d[2]=c[16];    d[3]=c[11];    d[4]=c[6];    d[5]=c[1];
    d[6]=c[22];    d[7]=c[17];    d[8]=c[12];    d[9]=c[7];    d[10]=c[2];
    d[11]=c[23];   d[12]=c[18];   d[13]=c[13];   d[14]=c[8];   d[15]=c[3];
    d[16]=c[24];   d[17]=c[19];   d[18]=c[14];   d[19]=c[9];   d[20]=c[4];
    d[21]=c[25];   d[22]=c[20];   d[23]=c[15];   d[24]=c[10];   d[25]=c[5];
}
/**/
/* Give the Initial Data */
short dlh[26]={
    0, 4, 3, 2, 1,
    2, 1, 0, 4, 3,
    4, 3, 2, 1, 0,
    1, 0, 4, 3, 2,
    3, 2, 1, 0, 4};
/**/
/* Convert it into the Classical Notation */
/* short dh[17][26], dl[17][26], df[17][26]; */
void convrt() {
    short m, n;
    for(m=0; m<16; m++) {
        for(n=1; n<26; n++) {
            df[m][n]=dh[m][n]*5+dl[m][n]+1;
        }
    }
}
/**/

```

If you only give the initial data to 1H as shown above, then you can reconstruct all the objects automatically by our new transformation system.

The next list demonstrates the result of my reconstruction.

**** Reconstruction List of Simultaneous Magic Type of CES 5x5 ****

[Group 1]

D5i: 1/H	1/L	1/	D5i: 1/H	2/L	2/
0 4 3 2 1	0 2 4 1 3	1 23 20 12 9	0 4 3 2 1	0 2 4 3 1	1 23 20 14 7
2 1 0 4 3	4 1 3 0 2	15 7 4 21 18	2 1 0 4 3	4 3 1 0 2	15 9 2 21 18
4 3 2 1 0	3 0 2 4 1	24 16 13 10 2	4 3 2 1 0	1 0 2 4 3	22 16 13 10 4
1 0 4 3 2	2 4 1 3 0	8 5 22 19 11	1 0 4 3 2	2 4 3 1 0	8 5 24 17 11
3 2 1 0 4	1 3 0 2 4	17 14 6 3 25	3 2 1 0 4	3 1 0 2 4	19 12 6 3 25

D5i: 1/H	6/L	6/	D5i: 1/H	10/L	10/
0 4 3 2 1	1 2 3 4 0	2 23 19 15 6	0 4 3 2 1	3 2 1 4 0	4 23 17 15 6
2 1 0 4 3	3 4 0 1 2	14 10 1 22 18	2 1 0 4 3	1 4 0 3 2	12 10 1 24 18
4 3 2 1 0	0 1 2 3 4	21 17 13 9 5	4 3 2 1 0	0 3 2 1 4	21 19 13 7 5
1 0 4 3 2	2 3 4 0 1	8 4 25 16 12	1 0 4 3 2	2 1 4 0 3	8 2 25 16 14
3 2 1 0 4	4 0 1 2 3	20 11 7 3 24	3 2 1 0 4	4 0 3 2 1	20 11 9 3 22

D5i: 1/H	14/L	14/	D5i: 1/H	13/L	13/
0 4 3 2 1	4 2 0 3 1	5 23 16 14 7	0 4 3 2 1	4 2 0 1 3	5 23 16 12 9
2 1 0 4 3	0 3 1 4 2	11 9 2 25 18	2 1 0 4 3	0 1 3 4 2	11 7 4 25 18
4 3 2 1 0	1 4 2 0 3	22 20 13 6 4	4 3 2 1 0	3 4 2 0 1	24 20 13 6 2
1 0 4 3 2	2 0 3 1 4	8 1 24 17 15	1 0 4 3 2	2 0 1 3 4	8 1 22 19 15
3 2 1 0 4	3 1 4 2 0	19 12 10 3 21	3 2 1 0 4	1 3 4 2 0	17 14 10 3 21

D5i: 1/H	9/L	9/	D5i: 1/H	5/L	5/
0 4 3 2 1	3 2 1 0 4	4 23 17 11 10	0 4 3 2 1	1 2 3 0 4	2 23 19 11 10
2 1 0 4 3	1 0 4 3 2	12 6 5 24 18	2 1 0 4 3	3 0 4 1 2	14 6 5 22 18
4 3 2 1 0	4 3 2 1 0	25 19 13 7 1	4 3 2 1 0	4 1 2 3 0	25 17 13 9 1
1 0 4 3 2	2 1 0 4 3	8 2 21 20 14	1 0 4 3 2	2 3 0 4 1	8 4 21 20 12
3 2 1 0 4	0 4 3 2 1	16 15 9 3 22	3 2 1 0 4	0 4 1 2 3	16 15 7 3 24

[Group 2]

D5i: 3/H	1/L	3/	D5i: 3/H	2/L	4/
0 4 1 2 3	0 2 4 1 3	1 23 10 12 19	0 4 1 2 3	0 2 4 3 1	1 23 10 14 17
2 3 0 4 1	4 1 3 0 2	15 17 4 21 8	2 3 0 4 1	4 3 1 0 2	15 19 2 21 8
4 1 2 3 0	3 0 2 4 1	24 6 13 20 2	4 1 2 3 0	1 0 2 4 3	22 6 13 20 4
3 0 4 1 2	2 4 1 3 0	18 5 22 9 11	3 0 4 1 2	2 4 3 1 0	18 5 24 7 11
1 2 3 0 4	1 3 0 2 4	7 14 16 3 25	1 2 3 0 4	3 1 0 2 4	9 12 16 3 25

D5i: 3/H	6/L	8/	D5i: 3/H	10/L	12/
0 4 1 2 3	1 2 3 4 0	2 23 9 15 16	0 4 1 2 3	3 2 1 4 0	4 23 7 15 16
2 3 0 4 1	3 4 0 1 2	14 20 1 22 8	2 3 0 4 1	1 4 0 3 2	12 20 1 24 8
4 1 2 3 0	0 1 2 3 4	21 7 13 19 5	4 1 2 3 0	0 3 2 1 4	21 9 13 17 5
3 0 4 1 2	2 3 4 0 1	18 4 25 6 12	3 0 4 1 2	2 1 4 0 3	18 2 25 6 14
1 2 3 0 4	4 0 1 2 3	10 11 17 3 24	1 2 3 0 4	4 0 3 2 1	10 11 19 3 22

D5i: 3/H	14/L	16/	D5i: 3/H	13/L	15/
0 4 1 2 3	4 2 0 3 1	5 23 6 14 17	0 4 1 2 3	4 2 0 1 3	5 23 6 12 19
2 3 0 4 1	0 3 1 4 2	11 19 2 25 8	2 3 0 4 1	0 1 3 4 2	11 17 4 25 8
4 1 2 3 0	1 4 2 0 3	22 10 13 16 4	4 1 2 3 0	3 4 2 0 1	24 10 13 16 2
3 0 4 1 2	2 0 3 1 4	18 1 24 7 15	3 0 4 1 2	2 0 1 3 4	18 1 22 9 15
1 2 3 0 4	3 1 4 2 0	9 12 20 3 21	1 2 3 0 4	1 3 4 2 0	7 14 20 3 21

D5i: 3/H	9/L	11/	D5i: 3/H	5/L	7/
0 4 1 2 3	3 2 1 0 4	4 23 7 11 20	0 4 1 2 3	1 2 3 0 4	2 23 9 11 20
2 3 0 4 1	1 0 4 3 2	12 16 5 24 8	2 3 0 4 1	3 0 4 1 2	14 16 5 22 8
4 1 2 3 0	4 3 2 1 0	25 9 13 17 1	4 1 2 3 0	4 1 2 3 0	25 7 13 19 1
3 0 4 1 2	2 1 0 4 3	18 2 21 10 14	3 0 4 1 2	2 3 0 4 1	18 4 21 10 12
1 2 3 0 4	0 4 3 2 1	6 15 19 3 22	1 2 3 0 4	0 4 1 2 3	6 15 17 3 24

[Count = 16]

Each number on the right shoulder of each classical notation was referred to the number of our old solution list we got before.

6. Analytical Study of Pandiagonal Magic Squares 5x5

The next job we have to do is making analysis on the decomposed layers of 3600 pandiagonal magic squares 5x5(another "Suzuki Squares").

But it sounds horrible that we have to deal with so many solutions as 3600. Imagine we have to put out every list on this page. It is acutually too hard.

Let me take the 144 fundamental solutions of those objects only for our study here.

We now know what a job we have to do:

- (1) Try to find any solution whose high layer is the same, and collect all of them to make a group for them.
- (2) Compare each member with the others or with the ones in other groups, and find any correspondences among them.
- (3) Try to find any transformation method we can reconstruct all 144 objects with.

The next list shows the 6 groups each of wich has the same high layer.

[Group 1]

<p>1/ 1H 1L</p> <p>1 24 10 18 12 04132 03421</p> <p>20 13 2 21 9 32041 42103</p> <p>22 6 19 15 3 41320 10342</p> <p>14 5 23 7 16 20413 34210</p> <p>8 17 11 4 25 13204 21034</p>	<p>2/ 1H 2L</p> <p>1 24 10 17 13 04132 03412</p> <p>20 12 3 21 9 32041 41203</p> <p>23 6 19 15 2 41320 20341</p> <p>14 5 22 8 16 20413 34120</p> <p>7 18 11 4 25 13204 12034</p>	<p>5/ 1H 5L</p> <p>1 23 10 19 12 04132 02431</p> <p>20 14 2 21 8 32041 43102</p> <p>22 6 18 15 4 41320 10243</p> <p>13 5 24 7 16 20413 24310</p> <p>9 17 11 3 25 13204 31024</p>
<p>6/ 1H 6L</p> <p>1 23 10 17 14 04132 02413</p> <p>20 12 4 21 8 32041 41302</p> <p>24 6 18 15 2 41320 30241</p> <p>13 5 22 9 16 20413 24130</p> <p>7 19 11 3 25 13204 13024</p>	<p>9/ 1H 9L</p> <p>1 22 10 19 13 04132 01432</p> <p>20 14 3 21 7 32041 43201</p> <p>23 6 17 15 4 41320 20143</p> <p>12 5 24 8 16 20413 14320</p> <p>9 18 11 2 25 13204 32014</p>	<p>10/ 1H 10L</p> <p>1 22 10 18 14 04132 01423</p> <p>20 13 4 21 7 32041 42301</p> <p>24 6 17 15 3 41320 30142</p> <p>12 5 23 9 16 20413 14230</p> <p>8 19 11 2 25 13204 23014</p>
<p>19/ 1H 19L</p> <p>1 25 9 18 12 04132 04321</p> <p>19 13 2 21 10 32041 32104</p> <p>22 6 20 14 3 41320 10432</p> <p>15 4 23 7 16 20413 43210</p> <p>8 17 11 5 24 13204 21043</p>	<p>20/ 1H 20L</p> <p>1 25 9 17 13 04132 04312</p> <p>19 12 3 21 10 32041 31204</p> <p>23 6 20 14 2 41320 20431</p> <p>15 4 22 8 16 20413 43120</p> <p>7 18 11 5 24 13204 12043</p>	<p>23/ 1H 23L</p> <p>1 23 9 20 12 04132 02341</p> <p>19 15 2 21 8 32041 34102</p> <p>22 6 18 14 5 41320 10234</p> <p>13 4 25 7 16 20413 23410</p> <p>10 17 11 3 24 13204 41023</p>
<p>24/ 1H 24L</p> <p>1 23 9 17 15 04132 02314</p> <p>19 12 5 21 8 32041 31402</p> <p>25 6 18 14 2 41320 40231</p> <p>13 4 22 10 16 20413 23140</p> <p>7 20 11 3 24 13204 14023</p>	<p>27/ 1H 27L</p> <p>1 22 9 20 13 04132 01342</p> <p>19 15 3 21 7 32041 34201</p> <p>23 6 17 14 5 41320 20134</p> <p>12 4 25 8 16 20413 13420</p> <p>10 18 11 2 24 13204 42013</p>	<p>28/ 1H 28L</p> <p>1 22 9 18 15 04132 01324</p> <p>19 13 5 21 7 32041 32401</p> <p>25 6 17 14 3 41320 40132</p> <p>12 4 23 10 16 20413 13240</p> <p>8 20 11 2 24 13204 24013</p>
<p>37/ 1H 37L</p> <p>1 25 8 19 12 04132 04231</p> <p>18 14 2 21 10 32041 23104</p> <p>22 6 20 13 4 41320 10423</p> <p>15 3 24 7 16 20413 42310</p> <p>9 17 11 5 23 13204 31042</p>	<p>38/ 1H 38L</p> <p>1 25 8 17 14 04132 04213</p> <p>18 12 4 21 10 32041 21304</p> <p>24 6 20 13 2 41320 30421</p> <p>15 3 22 9 16 20413 42130</p> <p>7 19 11 5 23 13204 13042</p>	<p>41/ 1H 41L</p> <p>1 24 8 20 12 04132 03241</p> <p>18 15 2 21 9 32041 24103</p> <p>22 6 19 13 5 41320 10324</p> <p>14 3 25 7 16 20413 32410</p> <p>10 17 11 4 23 13204 41032</p>
<p>42/ 1H 42L</p> <p>1 24 8 17 15 04132 03214</p> <p>18 12 5 21 9 32041 21403</p> <p>25 6 19 13 2 41320 40321</p> <p>14 3 22 10 16 20413 32140</p> <p>7 20 11 4 23 13204 14032</p>	<p>45/ 1H 45L</p> <p>1 22 8 20 14 04132 01243</p> <p>18 15 4 21 7 32041 24301</p> <p>24 6 17 13 5 41320 30124</p> <p>12 3 25 9 16 20413 12430</p> <p>10 19 11 2 23 13204 43012</p>	<p>46/ 1H 46L</p> <p>1 22 8 19 15 04132 01234</p> <p>18 14 5 21 7 32041 23401</p> <p>25 6 17 13 4 41320 40123</p> <p>12 3 24 10 16 20413 12340</p> <p>9 20 11 2 23 13204 34012</p>

55/	1H	55L	56/	1H	56L	59/	1H	59L
1 25 7 19 13	04132	04132	1 25 7 18 14	04132	04123	1 24 7 20 13	04132	03142
17 14 3 21 10	32041	13204	17 13 4 21 10	32041	12304	17 15 3 21 9	32041	14203
23 6 20 12 4	41320	20413	24 6 20 12 3	41320	30412	23 6 19 12 5	41320	20314
15 2 24 8 16	20413	41320	15 2 23 9 16	20413	41230	14 2 25 8 16	20413	31420
9 18 11 5 22	13204	32041	8 19 11 5 22	13204	23041	10 18 11 4 22	13204	42031

60/	1H	60L	63/	1H	63L	64/	1H	64L
1 24 7 18 15	04132	03124	1 23 7 20 14	04132	02143	1 23 7 19 15	04132	02134
17 13 5 21 9	32041	12403	17 15 4 21 8	32041	14302	17 14 5 21 8	32041	13402
25 6 19 12 3	41320	40312	24 6 18 12 5	41320	30214	25 6 18 12 4	41320	40213
14 2 23 10 16	20413	31240	13 2 25 9 16	20413	21430	13 2 24 10 16	20413	21340
8 20 11 4 22	13204	24031	10 19 11 3 22	13204	43021	9 20 11 3 22	13204	34021

[Group 2]

3/	3H	1L	4/	3H	2L	7/	3H	5L
1 24 15 18 7	04231	03421	1 24 15 17 8	04231	03412	1 23 15 19 7	04231	02431
20 8 2 21 14	31042	42103	20 7 3 21 14	31042	41203	20 9 2 21 13	31042	43102
22 11 19 10 3	42310	10342	23 11 19 10 2	42310	20341	22 11 18 10 4	42310	10243
9 5 23 12 16	10423	34210	9 5 22 13 16	10423	34120	8 5 24 12 16	10423	24310
13 17 6 4 25	23104	21034	12 18 6 4 25	23104	12034	14 17 6 3 25	23104	31024

8/	3H	6L	11/	3H	9L	12/	3H	10L
1 23 15 17 9	04231	02413	1 22 15 19 8	04231	01432	1 22 15 18 9	04231	01423
20 7 4 21 13	31042	41302	20 9 3 21 12	31042	43201	20 8 4 21 12	31042	42301
24 11 18 10 2	42310	30241	23 11 17 10 4	42310	20143	24 11 17 10 3	42310	30142
8 5 22 14 16	10423	24130	7 5 24 13 16	10423	14320	7 5 23 14 16	10423	14230
12 19 6 3 25	23104	13024	14 18 6 2 25	23104	32014	13 19 6 2 25	23104	23014

21/	3H	19L	22/	3H	20L	25/	3H	23L
1 25 14 18 7	04231	04321	1 25 14 17 8	04231	04312	1 23 14 20 7	04231	02341
19 8 2 21 15	31042	32104	19 7 3 21 15	31042	31204	19 10 2 21 13	31042	34102
22 11 20 9 3	42310	10432	23 11 20 9 2	42310	20431	22 11 18 9 5	42310	10234
10 4 23 12 16	10423	43210	10 4 22 13 16	10423	43120	8 4 25 12 16	10423	23410
13 17 6 5 24	23104	21043	12 18 6 5 24	23104	12043	15 17 6 3 24	23104	41023

26/	3H	24L	29/	3H	27L	30/	3H	28L
1 23 14 17 10	04231	02314	1 22 14 20 8	04231	01342	1 22 14 18 10	04231	01324
19 7 5 21 13	31042	31402	19 10 3 21 12	31042	34201	19 8 5 21 12	31042	32401
25 11 18 9 2	42310	40231	23 11 17 9 5	42310	20134	25 11 17 9 3	42310	40132
8 4 22 15 16	10423	23140	7 4 25 13 16	10423	13420	7 4 23 15 16	10423	13240
12 20 6 3 24	23104	14023	15 18 6 2 24	23104	42013	13 20 6 2 24	23104	24013

39/	3H	37L	40/	3H	38L	43/	3H	41L
1 25 13 19 7	04231	04231	1 25 13 17 9	04231	04213	1 24 13 20 7	04231	03241
18 9 2 21 15	31042	23104	18 7 4 21 15	31042	21304	18 10 2 21 14	31042	24103
22 11 20 8 4	42310	10423	24 11 20 8 2	42310	30421	22 11 19 8 5	42310	10324
10 3 24 12 16	10423	42310	10 3 22 14 16	10423	42130	9 3 25 12 16	10423	32410
14 17 6 5 23	23104	31042	12 19 6 5 23	23104	13042	15 17 6 4 23	23104	41032

44/	3H	42L	47/	3H	45L	48/	3H	46L
1 24 13 17 10	04231	03214	1 22 13 20 9	04231	01243	1 22 13 19 10	04231	01234
18 7 5 21 14	31042	21403	18 10 4 21 12	31042	24301	18 9 5 21 12	31042	23401
25 11 19 8 2	42310	40321	24 11 17 8 5	42310	30124	25 11 17 8 4	42310	40123
9 3 22 15 16	10423	32140	7 3 25 14 16	10423	12430	7 3 24 15 16	10423	12340
12 20 6 4 23	23104	14032	15 19 6 2 23	23104	43012	14 20 6 2 23	23104	34012

57/	3H	55L	58/	3H	56L	61/	3H	59L
1 25 12 19 8	04231	04132	1 25 12 18 9	04231	04123	1 24 12 20 8	04231	03142
17 9 3 21 15	31042	13204	17 8 4 21 15	31042	12304	17 10 3 21 14	31042	14203
23 11 20 7 4	42310	20413	24 11 20 7 3	42310	30412	23 11 19 7 5	42310	20314
10 2 24 13 16	10423	41320	10 2 23 14 16	10423	41230	9 2 25 13 16	10423	31420
14 18 6 5 22	23104	32041	13 19 6 5 22	23104	23041	15 18 6 4 22	23104	42031

62/	3H	60L	65/	3H	63L	66/	3H	64L
1 24 12 18 10	04231	03124	1 23 12 20 9	04231	02143	1 23 12 19 10	04231	02134
17 8 5 21 14	31042	12403	17 10 4 21 13	31042	14302	17 9 5 21 13	31042	13402
25 11 19 7 3	42310	40312	24 11 18 7 5	42310	30214	25 11 18 7 4	42310	40213
9 2 23 15 16	10423	31240	8 2 25 14 16	10423	21430	8 2 24 15 16	10423	21340
13 20 6 4 22	23104	24031	15 19 6 3 22	23104	43021	14 20 6 3 22	23104	34021

[Group 3]

13/			13H			1L			14/			13H			2L			15/			13H			5L		
1	24	10	13	17	04123	03421	1	24	10	12	18	04123	03412	1	23	10	14	17	04123	02431						
15	18	2	21	9	23041	42103	15	17	3	21	9	23041	41203	15	19	2	21	8	23041	43102						
22	6	14	20	3	41230	10342	23	6	14	20	2	41230	20341	22	6	13	20	4	41230	10243						
19	5	23	7	11	30412	34210	19	5	22	8	11	30412	34120	18	5	24	7	11	30412	24310						
8	12	16	4	25	12304	21034	7	13	16	4	25	12304	12034	9	12	16	3	25	12304	31024						
16/			13H			6L			17/			13H			9L			18/			13H			10L		
1	23	10	12	19	04123	02413	1	22	10	14	18	04123	01432	1	22	10	13	19	04123	01423						
15	17	4	21	8	23041	41302	15	19	3	21	7	23041	43201	15	18	4	21	7	23041	42301						
24	6	13	20	2	41230	30241	23	6	12	20	4	41230	20143	24	6	12	20	3	41230	30142						
18	5	22	9	11	30412	24130	17	5	24	8	11	30412	14320	17	5	23	9	11	30412	14230						
7	14	16	3	25	12304	13024	9	13	16	2	25	12304	32014	8	14	16	2	25	12304	23014						
31/			13H			19L			32/			13H			20L			33/			13H			23L		
1	25	9	13	17	04123	04321	1	25	9	12	18	04123	04312	1	23	9	15	17	04123	02341						
14	18	2	21	10	23041	32104	14	17	3	21	10	23041	31204	14	20	2	21	8	23041	34102						
22	6	15	19	3	41230	10432	23	6	15	19	2	41230	20431	22	6	13	19	5	41230	10234						
20	4	23	7	11	30412	43210	20	4	22	8	11	30412	43120	18	4	25	7	11	30412	23410						
8	12	16	5	24	12304	21043	7	13	16	5	24	12304	12043	10	12	16	3	24	12304	41023						
34/			13H			24L			35/			13H			27L			36/			13H			28L		
1	23	9	12	20	04123	02314	1	22	9	15	18	04123	01342	1	22	9	13	20	04123	01324						
14	17	5	21	8	23041	31402	14	20	3	21	7	23041	34201	14	18	5	21	7	23041	32401						
25	6	13	19	2	41230	40231	23	6	12	19	5	41230	20134	25	6	12	19	3	41230	40132						
18	4	22	10	11	30412	23140	17	4	25	8	11	30412	13420	17	4	23	10	11	30412	13240						
7	15	16	3	24	12304	14023	10	13	16	2	24	12304	42013	8	15	16	2	24	12304	24013						
49/			13H			37L			50/			13H			38L			51/			13H			41L		
1	25	8	14	17	04123	04231	1	25	8	12	19	04123	04213	1	24	8	15	17	04123	03241						
13	19	2	21	10	23041	23104	13	17	4	21	10	23041	21304	13	20	2	21	9	23041	24103						
22	6	15	18	4	41230	10423	24	6	15	18	2	41230	30421	22	6	14	18	5	41230	10324						
20	3	24	7	11	30412	42310	20	3	22	9	11	30412	42130	19	3	25	7	11	30412	32410						
9	12	16	5	23	12304	31042	7	14	16	5	23	12304	13042	10	12	16	4	23	12304	41032						
52/			13H			42L			53/			13H			45L			54/			13H			46L		
1	24	8	12	20	04123	03214	1	22	8	15	19	04123	01243	1	22	8	14	20	04123	01234						
13	17	5	21	9	23041	21403	13	20	4	21	7	23041	24301	13	19	5	21	7	23041	23401						
25	6	14	18	2	41230	40321	24	6	12	18	5	41230	30124	25	6	12	18	4	41230	40123						
19	3	22	10	11	30412	32140	17	3	25	9	11	30412	12430	17	3	24	10	11	30412	12340						
7	15	16	4	23	12304	14032	10	14	16	2	23	12304	43012	9	15	16	2	23	12304	34012						
67/			13H			55L			68/			13H			56L			69/			13H			59L		
1	25	7	14	18	04123	04132	1	25	7	13	19	04123	04123	1	24	7	15	18	04123	03142						
12	19	3	21	10	23041	13204	12	18	4	21	10	23041	12304	12	20	3	21	9	23041	14203						
23	6	15	17	4	41230	20413	24	6	15	17	3	41230	30412	23	6	14	17	5	41230	20314						
20	2	24	8	11	30412	41320	20	2	23	9	11	30412	41230	19	2	25	8	11	30412	31420						
9	13	16	5	22	12304	32041	8	14	16	5	22	12304	23041	10	13	16	4	22	12304	42031						
70/			13H			60L			71/			13H			63L			72/			13H			64L		
1	24	7	13	20	04123	03124	1	23	7	15	19	04123	02143	1	23	7	14	20	04123	02134						
12	18	5	21	9	23041	12403	12	20	4	21	8	23041	14302	12	19	5	21	8	23041	13402						
25	6	14	17	3	41230	40312	24	6	13	17	5	41230	30214	25	6	13	17	4	41230	40213						
19	2	23	10	11	30412	31240	18	2	25	9	11	30412	21430	18	2	24	10	11	30412	21340						
8	15	16	4	22	12304	24031	10	14	16	3	22	12304	43021	9	15	16	3	22	12304	34021						

[Group 4]

73/			73H			73L			74/			73H			74L			77/			73H			77L		
1	25	17	14	8	04321	04132	1	25	18	14	7	04321	04231	1	25	17	13	9	04321	04123						
19	13	6	5	22	32104	32041	19	12	6	5	23	32104	31042	18	14	6	5	22	32104	23041						
10	2	24	18	11	10432	41320	10	3	24	17	11	10432	42310	10	2	23	19	11	10432	41230						
23	16	15	7	4	43210	20413	22	16	15	8	4	43210	10423	24	16	15	7	3	43210	30412						
12	9	3	21	20	21043	13204	13	9	2	21	20	21043	23104	12	8	4	21	20	21043	12304						
78/			73H			78L			81/			73H			81L			82/			73H			82L		
1	25	19	13	7	04321	04321	1	25	18	12	9	04321	04213	1	25	19	12	8	04321	04312						
18	12	6	5	24	32104	21043	17	14	6	5	23	32104	13042	17	13	6	5	24	32104	12043						
10	4	23	17	11	10432	43210	10	3	22	19	11	10432	42130	10	4	22	18	11	10432	43120						
22	16	15	9	3	43210	10432	24	16	15	8	2	43210	30421	23	16	15	9	2	43210	20431						
14	8	2	21	20	21043	32104	13	7	4	21	20	21043	21304	14	7	3	21	20	21043	31204						

85/	73H	85L	86/	73H	86L	89/	73H	89L
1 24 17 15 8	04321	03142	1 24 18 15 7	04321	03241	1 24 17 13 10	04321	03124
20 13 6 4 22	32104	42031	20 12 6 4 23	32104	41032	18 15 6 4 22	32104	24031
9 2 25 18 11	10432	31420	9 3 25 17 11	10432	32410	9 2 23 20 11	10432	31240
23 16 14 7 5	43210	20314	22 16 14 8 5	43210	10324	25 16 14 7 3	43210	40312
12 10 3 21 19	21043	14203	13 10 2 21 19	21043	24103	12 8 5 21 19	21043	12403
90/	73H	90L	93/	73H	93L	94/	73H	94L
1 24 20 13 7	04321	03421	1 24 18 12 10	04321	03214	1 24 20 12 8	04321	03412
18 12 6 4 25	32104	21034	17 15 6 4 23	32104	14032	17 13 6 4 25	32104	12034
9 5 23 17 11	10432	34210	9 3 22 20 11	10432	32140	9 5 22 18 11	10432	34120
22 16 14 10 3	43210	10342	25 16 14 8 2	43210	40321	23 16 14 10 2	43210	20341
15 8 2 21 19	21043	42103	13 7 5 21 19	21043	21403	15 7 3 21 19	21043	41203
97/	73H	97L	98/	73H	98L	101/	73H	101L
1 23 17 15 9	04321	02143	1 23 19 15 7	04321	02341	1 23 17 14 10	04321	02134
20 14 6 3 22	32104	43021	20 12 6 3 24	32104	41023	19 15 6 3 22	32104	34021
8 2 25 19 11	10432	21430	8 4 25 17 11	10432	23410	8 2 24 20 11	10432	21340
24 16 13 7 5	43210	30214	22 16 13 9 5	43210	10234	25 16 13 7 4	43210	40213
12 10 4 21 18	21043	14302	14 10 2 21 18	21043	34102	12 9 5 21 18	21043	13402
102/	73H	102L	105/	73H	105L	106/	73H	106L
1 23 20 14 7	04321	02431	1 23 19 12 10	04321	02314	1 23 20 12 9	04321	02413
19 12 6 3 25	32104	31024	17 15 6 3 24	32104	14023	17 14 6 3 25	32104	13024
8 5 24 17 11	10432	24310	8 4 22 20 11	10432	23140	8 5 22 19 11	10432	24130
22 16 13 10 4	43210	10243	25 16 13 9 2	43210	40231	24 16 13 10 2	43210	30241
15 9 2 21 18	21043	43102	14 7 5 21 18	21043	31402	15 7 4 21 18	21043	41302
109/	73H	109L	110/	73H	110L	113/	73H	113L
1 22 18 15 9	04321	01243	1 22 19 15 8	04321	01342	1 22 18 14 10	04321	01234
20 14 6 2 23	32104	43012	20 13 6 2 24	32104	42013	19 15 6 2 23	32104	34012
7 3 25 19 11	10432	12430	7 4 25 18 11	10432	13420	7 3 24 20 11	10432	12340
24 16 12 8 5	43210	30124	23 16 12 9 5	43210	20134	25 16 12 8 4	43210	40123
13 10 4 21 17	21043	24301	14 10 3 21 17	21043	34201	13 9 5 21 17	21043	23401
114/	73H	114L	117/	73H	117L	118/	73H	118L
1 22 20 14 8	04321	01432	1 22 19 13 10	04321	01324	1 22 20 13 9	04321	01423
19 13 6 2 25	32104	32014	18 15 6 2 24	32104	24013	18 14 6 2 25	32104	23014
7 5 24 18 11	10432	14320	7 4 23 20 11	10432	13240	7 5 23 19 11	10432	14230
23 16 12 10 4	43210	20143	25 16 12 9 3	43210	40132	24 16 12 10 3	43210	30142
15 9 3 21 17	21043	43201	14 8 5 21 17	21043	32401	15 8 4 21 17	21043	42301

[Group 5]

75/	75H	73L	76/	75H	74L	79/	75H	77L
1 25 17 9 13	04312	04132	1 25 18 9 12	04312	04231	1 25 17 8 14	04312	04123
19 8 11 5 22	31204	32041	19 7 11 5 23	31204	31042	18 9 11 5 22	31204	23041
15 2 24 18 6	20431	41320	15 3 24 17 6	20431	42310	15 2 23 19 6	20431	41230
23 16 10 12 4	43120	20413	22 16 10 13 4	43120	10423	24 16 10 12 3	43120	30412
7 14 3 21 20	12043	13204	8 14 2 21 20	12043	23104	7 13 4 21 20	12043	12304
80/	75H	78L	83/	75H	81L	84/	75H	82L
1 25 19 8 12	04312	04321	1 25 18 7 14	04312	04213	1 25 19 7 13	04312	04312
18 7 11 5 24	31204	21043	17 9 11 5 23	31204	13042	17 8 11 5 24	31204	12043
15 4 23 17 6	20431	43210	15 3 22 19 6	20431	42130	15 4 22 18 6	20431	43120
22 16 10 14 3	43120	10432	24 16 10 13 2	43120	30421	23 16 10 14 2	43120	20431
9 13 2 21 20	12043	32104	8 12 4 21 20	12043	21304	9 12 3 21 20	12043	31204
87/	75H	85L	88/	75H	86L	91/	75H	89L
1 24 17 10 13	04312	03142	1 24 18 10 12	04312	03241	1 24 17 8 15	04312	03124
20 8 11 4 22	31204	42031	20 7 11 4 23	31204	41032	18 10 11 4 22	31204	24031
14 2 25 18 6	20431	31420	14 3 25 17 6	20431	32410	14 2 23 20 6	20431	31240
23 16 9 12 5	43120	20314	22 16 9 13 5	43120	10324	25 16 9 12 3	43120	40312
7 15 3 21 19	12043	14203	8 15 2 21 19	12043	24103	7 13 5 21 19	12043	12403
92/	75H	90L	95/	75H	93L	96/	75H	94L
1 24 20 8 12	04312	03421	1 24 18 7 15	04312	03214	1 24 20 7 13	04312	03412
18 7 11 4 25	31204	21034	17 10 11 4 23	31204	14032	17 8 11 4 25	31204	12034
14 5 23 17 6	20431	34210	14 3 22 20 6	20431	32140	14 5 22 18 6	20431	34120
22 16 9 15 3	43120	10342	25 16 9 13 2	43120	40321	23 16 9 15 2	43120	20341
10 13 2 21 19	12043	42103	8 12 5 21 19	12043	21403	10 12 3 21 19	12043	41203

1 23 17 10 14	99/ 75H 97L	04312 02143	1 23 19 10 12	100/ 75H 98L	04312 02341	1 23 17 9 15	103/ 75H 101L	04312 02134
20 9 11 3 22		31204 43021	20 7 11 3 24		31204 41023	19 10 11 3 22		31204 34021
13 2 25 19 6		20431 21430	13 4 25 17 6		20431 23410	13 2 24 20 6		20431 21340
24 16 8 12 5		43120 30214	22 16 8 14 5		43120 10234	25 16 8 12 4		43120 40213
7 15 4 21 18		12043 14302	9 15 2 21 18		12043 34102	7 14 5 21 18		12043 13402
1 23 20 9 12	104/ 75H 102L	04312 02431	1 23 19 7 15	107/ 75H 105L	04312 02314	1 23 20 7 14	108/ 75H 106L	04312 02413
19 7 11 3 25		31204 31024	17 10 11 3 24		31204 14023	17 9 11 3 25		31204 13024
13 5 24 17 6		20431 24310	13 4 22 20 6		20431 23140	13 5 22 19 6		20431 24130
22 16 8 15 4		43120 10243	25 16 8 14 2		43120 40231	24 16 8 15 2		43120 30241
10 14 2 21 18		12043 43102	9 12 5 21 18		12043 31402	10 12 4 21 18		12043 41302
1 22 18 10 14	111/ 75H 109L	04312 01243	1 22 19 10 13	112/ 75H 110L	04312 01342	1 22 18 9 15	115/ 75H 113L	04312 01234
20 9 11 2 23		31204 43012	20 8 11 2 24		31204 42013	19 10 11 2 23		31204 34012
12 3 25 19 6		20431 12430	12 4 25 18 6		20431 13420	12 3 24 20 6		20431 12340
24 16 7 13 5		43120 30124	23 16 7 14 5		43120 20134	25 16 7 13 4		43120 40123
8 15 4 21 17		12043 24301	9 15 3 21 17		12043 34201	8 14 5 21 17		12043 23401
1 22 20 9 13	116/ 75H 114L	04312 01432	1 22 19 8 15	119/ 75H 117L	04312 01324	1 22 20 8 14	120/ 75H 118L	04312 01423
19 8 11 2 25		31204 32014	18 10 11 2 24		31204 24013	18 9 11 2 25		31204 23014
12 5 24 18 6		20431 14320	12 4 23 20 6		20431 13240	12 5 23 19 6		20431 14230
23 16 7 15 4		43120 20143	25 16 7 14 3		43120 40132	24 16 7 15 3		43120 30142
10 14 3 21 17		12043 43201	9 13 5 21 17		12043 32401	10 13 4 21 17		12043 42301

[Group 6]

1 25 12 9 18	121/ 121H 73L	04213 04132	1 25 13 9 17	122/ 121H 74L	04213 04231	1 25 12 8 19	123/ 121H 77L	04213 04123
14 8 16 5 22		21304 32041	14 7 16 5 23		21304 31042	13 9 16 5 22		21304 23041
20 2 24 13 6		30421 41320	20 3 24 12 6		30421 42310	20 2 23 14 6		30421 41230
23 11 10 17 4		42130 20413	22 11 10 18 4		42130 10423	24 11 10 17 3		42130 30412
7 19 3 21 15		13042 13204	8 19 2 21 15		13042 23104	7 18 4 21 15		13042 12304
1 25 14 8 17	124/ 121H 78L	04213 04321	1 25 13 7 19	125/ 121H 81L	04213 04213	1 25 14 7 18	126/ 121H 82L	04213 04312
13 7 16 5 24		21304 21043	12 9 16 5 23		21304 13042	12 8 16 5 24		21304 12043
20 4 23 12 6		30421 43210	20 3 22 14 6		30421 42130	20 4 22 13 6		30421 43120
22 11 10 19 3		42130 10432	24 11 10 18 2		42130 30421	23 11 10 19 2		42130 20431
9 18 2 21 15		13042 32104	8 17 4 21 15		13042 21304	9 17 3 21 15		13042 31204
1 24 12 10 18	127/ 121H 85L	04213 03142	1 24 13 10 17	128/ 121H 86L	04213 03241	1 24 12 8 20	129/ 121H 89L	04213 03124
15 8 16 4 22		21304 42031	15 7 16 4 23		21304 41032	13 10 16 4 22		21304 24031
19 2 25 13 6		30421 31420	19 3 25 12 6		30421 32410	19 2 23 15 6		30421 31240
23 11 9 17 5		42130 20314	22 11 9 18 5		42130 10324	25 11 9 17 3		42130 40312
7 20 3 21 14		13042 14203	8 20 2 21 14		13042 24103	7 18 5 21 14		13042 12403
1 24 15 8 17	130/ 121H 90L	04213 03421	1 24 13 7 20	131/ 121H 93L	04213 03214	1 24 15 7 18	132/ 121H 94L	04213 03412
13 7 16 4 25		21304 21034	12 10 16 4 23		21304 14032	12 8 16 4 25		21304 12034
19 5 23 12 6		30421 34210	19 3 22 15 6		30421 32140	19 5 22 13 6		30421 34120
22 11 9 20 3		42130 10342	25 11 9 18 2		42130 40321	23 11 9 20 2		42130 20341
10 18 2 21 14		13042 42103	8 17 5 21 14		13042 21403	10 17 3 21 14		13042 41203
1 23 12 10 19	133/ 121H 97L	04213 02143	1 23 14 10 17	134/ 121H 98L	04213 02341	1 23 12 9 20	135/ 121H 101L	04213 02134
15 9 16 3 22		21304 43021	15 7 16 3 24		21304 41023	14 10 16 3 22		21304 34021
18 2 25 14 6		30421 21430	18 4 25 12 6		30421 23410	18 2 24 15 6		30421 21340
24 11 8 17 5		42130 30214	22 11 8 19 5		42130 10234	25 11 8 17 4		42130 40213
7 20 4 21 13		13042 14302	9 20 2 21 13		13042 34102	7 19 5 21 13		13042 13402
1 23 15 9 17	136/ 121H 102L	04213 02431	1 23 14 7 20	137/ 121H 105L	04213 02314	1 23 15 7 19	138/ 121H 106L	04213 02413
14 7 16 3 25		21304 31024	12 10 16 3 24		21304 14023	12 9 16 3 25		21304 13024
18 5 24 12 6		30421 24310	18 4 22 15 6		30421 23140	18 5 22 14 6		30421 24130
22 11 8 20 4		42130 10243	25 11 8 19 2		42130 40231	24 11 8 20 2		42130 30241
10 19 2 21 13		13042 43102	9 17 5 21 13		13042 31402	10 17 4 21 13		13042 41302

139/	121H	109L	140/	121H	110L	141/	121H	113L
1 22 13 10 19	04213	01243	1 22 14 10 18	04213	01342	1 22 13 9 20	04213	01234
15 9 16 2 23	21304	43012	15 8 16 2 24	21304	42013	14 10 16 2 23	21304	34012
17 3 25 14 6	30421	12430	17 4 25 13 6	30421	13420	17 3 24 15 6	30421	12340
24 11 7 18 5	42130	30124	23 11 7 19 5	42130	20134	25 11 7 18 4	42130	40123
8 20 4 21 12	13042	24301	9 20 3 21 12	13042	34201	8 19 5 21 12	13042	23401
142/	121H	114L	143/	121H	117L	144/	121H	118L
1 22 15 9 18	04213	01432	1 22 14 8 20	04213	01324	1 22 15 8 19	04213	01423
14 8 16 2 25	21304	32014	13 10 16 2 24	21304	24013	13 9 16 2 25	21304	23014
17 5 24 13 6	30421	14320	17 4 23 15 6	30421	13240	17 5 23 14 6	30421	14230
23 11 7 20 4	42130	20143	25 11 7 19 3	42130	40132	24 11 7 20 3	42130	30142
10 19 3 21 12	13042	43201	9 18 5 21 12	13042	32401	10 18 4 21 12	13042	42301

The first three groups have the same set of 24 low layers, and the last three ones have another set of 24 low layers. We could classify 144 objects into 2 x 3 groups.

2 x 3 x 24 = 144

To my great surprise every low layer of the second three groups is corresponding to every low layer in the first three groups by one to one . See (1L, 73L), (2L, 74L) and (5L, 77L) in the next list below. They could be transformed by the same manner, simple 'mirror reflection', symmetrical with respect to the first primary diagonal.

[Group 1]

1/	1H	1L	2/	1H	2L	5/	1H	5L
1 24 10 18 12	04132	03421	1 24 10 17 13	04132	03412	1 23 10 19 12	04132	02431
20 13 2 21 9	32041	42103	20 12 3 21 9	32041	41203	20 14 2 21 8	32041	43102
22 6 19 15 3	41320	10342	23 6 19 15 2	41320	20341	22 6 18 15 4	41320	10243
14 5 23 7 16	20413	34210	14 5 22 8 16	20413	34120	13 5 24 7 16	20413	24310
8 17 11 4 25	13204	21034	7 18 11 4 25	13204	12034	9 17 11 3 25	13204	31024

[Group 4]

73/	73H	73L	74/	73H	74L	77/	73H	77L
1 25 17 14 8	04321	04132	1 25 18 14 7	04321	04231	1 25 17 13 9	04321	04123
19 13 6 5 22	32104	32041	19 12 6 5 23	32104	31042	18 14 6 5 22	32104	23041
10 2 24 18 11	10432	41320	10 3 24 17 11	10432	42310	10 2 23 19 11	10432	41230
23 16 15 7 4	43210	20413	22 16 15 8 4	43210	10423	24 16 15 7 3	43210	30412
12 9 3 21 20	21043	13204	13 9 2 21 20	21043	23104	12 8 4 21 20	21043	12304

Therefore we could concentrate our analytical study only to the next list of object.

[Group 1] D5i

1/	1/H	1/L	2/L	5/L	6/L	9/L	10/L
0 4 1 3 2	0 3 4 2 1	0 3 4 1 2	0 2 4 3 1	0 2 4 1 3	0 1 4 3 2	0 1 4 2 3	
3 2 0 4 1	4 2 1 0 3	4 1 2 0 3	4 3 1 0 2	4 1 3 0 2	4 3 2 0 1	4 2 3 0 1	
4 1 3 2 0	1 0 3 4 2	2 0 3 4 1	1 0 2 4 3	3 0 2 4 1	2 0 1 4 3	3 0 1 4 2	
2 0 4 1 3	3 4 2 1 0	3 4 1 2 0	2 4 3 1 0	2 4 1 3 0	1 4 3 2 0	1 4 2 3 0	
1 3 2 0 4	2 1 0 3 4	1 2 0 3 4	3 1 0 2 4	1 3 0 2 4	3 2 0 1 4	2 3 0 1 4	
19/	1/H	19/L	20/L	23/L	24/L	27/L	28/L
0 4 1 3 2	0 4 3 2 1	0 4 3 1 2	0 2 3 4 1	0 2 3 1 4	0 1 3 4 2	0 1 3 2 4	
3 2 0 4 1	3 2 1 0 4	3 1 2 0 4	3 4 1 0 2	3 1 4 0 2	3 4 2 0 1	3 2 4 0 1	
4 1 3 2 0	1 0 4 3 2	2 0 4 3 1	1 0 2 3 4	4 0 2 3 1	2 0 1 3 4	4 0 1 3 2	
2 0 4 1 3	4 3 2 1 0	4 3 1 2 0	2 3 4 1 0	2 3 1 4 0	1 3 4 2 0	1 3 2 4 0	
1 3 2 0 4	2 1 0 4 3	1 2 0 4 3	4 1 0 2 3	1 4 0 2 3	4 2 0 1 3	2 4 0 1 3	
37/	1/H	37/L	38/L	41/L	42/L	45/L	46/L
0 4 1 3 2	0 4 2 3 1	0 4 2 1 3	0 3 2 4 1	0 3 2 1 4	0 1 2 4 3	0 1 2 3 4	
3 2 0 4 1	2 3 1 0 4	2 1 3 0 4	2 4 1 0 3	2 1 4 0 3	2 4 3 0 1	2 3 4 0 1	
4 1 3 2 0	1 0 4 2 3	3 0 4 2 1	1 0 3 2 4	4 0 3 2 1	3 0 1 2 4	4 0 1 2 3	
2 0 4 1 3	4 2 3 1 0	4 2 1 3 0	3 2 4 1 0	3 2 1 4 0	1 2 4 3 0	1 2 3 4 0	
1 3 2 0 4	3 1 0 4 2	1 3 0 4 2	4 1 0 3 2	1 4 0 3 2	4 3 0 1 2	3 4 0 1 2	

55/	1/H	55/L	56/L	59/L	60/L	63/L	64/L
0 4 1 3 2		0 4 1 3 2	0 4 1 2 3	0 3 1 4 2	0 3 1 2 4	0 2 1 4 3	0 2 1 3 4
3 2 0 4 1		1 3 2 0 4	1 2 3 0 4	1 4 2 0 3	1 2 4 0 3	1 4 3 0 2	1 3 4 0 2
4 1 3 2 0		2 0 4 1 3	3 0 4 1 2	2 0 3 1 4	4 0 3 1 2	3 0 2 1 4	4 0 2 1 3
2 0 4 1 3		4 1 3 2 0	4 1 2 3 0	3 1 4 2 0	3 1 2 4 0	2 1 4 3 0	2 1 3 4 0
1 3 2 0 4		3 2 0 4 1	2 3 0 4 1	4 2 0 3 1	2 4 0 3 1	4 3 0 2 1	3 4 0 2 1

[Group 2] D5i

3/	3/H	1/L	2/L	5/L	6/L	9/L	10/L
0 4 2 3 1		0 3 4 2 1	0 3 4 1 2	0 2 4 3 1	0 2 4 1 3	0 1 4 3 2	0 1 4 2 3
3 1 0 4 2		4 2 1 0 3	4 1 2 0 3	4 3 1 0 2	4 1 3 0 2	4 3 2 0 1	4 2 3 0 1
4 2 3 1 0		1 0 3 4 2	2 0 3 4 1	1 0 2 4 3	3 0 2 4 1	2 0 1 4 3	3 0 1 4 2
1 0 4 2 3		3 4 2 1 0	3 4 1 2 0	2 4 3 1 0	2 4 1 3 0	1 4 3 2 0	1 4 2 3 0
2 3 1 0 4		2 1 0 3 4	1 2 0 3 4	3 1 0 2 4	1 3 0 2 4	3 2 0 1 4	2 3 0 1 4

[Group 3] D5i

13/	13/H	1/L	2/L	5/L	6/L	9/L	10/L
0 4 1 2 3		0 3 4 2 1	0 3 4 1 2	0 2 4 3 1	0 2 4 1 3	0 1 4 3 2	0 1 4 2 3
2 3 0 4 1		4 2 1 0 3	4 1 2 0 3	4 3 1 0 2	4 1 3 0 2	4 3 2 0 1	4 2 3 0 1
4 1 2 3 0		1 0 3 4 2	2 0 3 4 1	1 0 2 4 3	3 0 2 4 1	2 0 1 4 3	3 0 1 4 2
3 0 4 1 2		3 4 2 1 0	3 4 1 2 0	2 4 3 1 0	2 4 1 3 0	1 4 3 2 0	1 4 2 3 0
1 2 3 0 4		2 1 0 3 4	1 2 0 3 4	3 1 0 2 4	1 3 0 2 4	3 2 0 1 4	2 3 0 1 4

[Group 4] D5i

73/	73/H	73/L	74/L	77/L	78/L	81/L	82/L
0 4 3 2 1		0 4 1 3 2	0 4 2 3 1	0 4 1 2 3	0 4 3 2 1	0 4 2 1 3	0 4 3 1 2
3 2 1 0 4		3 2 0 4 1	3 1 0 4 2	2 3 0 4 1	2 1 0 4 3	1 3 0 4 2	1 2 0 4 3
1 0 4 3 2		4 1 3 2 0	4 2 3 1 0	4 1 2 3 0	4 3 2 1 0	4 2 1 3 0	4 3 1 2 0
4 3 2 1 0		2 0 4 1 3	1 0 4 2 3	3 0 4 1 2	1 0 4 3 2	3 0 4 2 1	2 0 4 3 1
2 1 0 4 3		1 3 2 0 4	2 3 1 0 4	1 2 3 0 4	3 2 1 0 4	2 1 3 0 4	3 1 2 0 4

85/	73/H	85/L	86/L	89/L	90/L	93/L	94/L
0 4 3 2 1		0 3 1 4 2	0 3 2 4 1	0 3 1 2 4	0 3 4 2 1	0 3 2 1 4	0 3 4 1 2
3 2 1 0 4		4 2 0 3 1	4 1 0 3 2	2 4 0 3 1	2 1 0 3 4	1 4 0 3 2	1 2 0 3 4
1 0 4 3 2		3 1 4 2 0	3 2 4 1 0	3 1 2 4 0	3 4 2 1 0	3 2 1 4 0	3 4 1 2 0
4 3 2 1 0		2 0 3 1 4	1 0 3 2 4	4 0 3 1 2	1 0 3 4 2	4 0 3 2 1	2 0 3 4 1
2 1 0 4 3		1 4 2 0 3	2 4 1 0 3	1 2 4 0 3	4 2 1 0 3	2 1 4 0 3	4 1 2 0 3

97/	73/H	97/L	98/L	101/L	102/L	105/L	106/L
0 4 3 2 1		0 2 1 4 3	0 2 3 4 1	0 2 1 3 4	0 2 4 3 1	0 2 3 1 4	0 2 4 1 3
3 2 1 0 4		4 3 0 2 1	4 1 0 2 3	3 4 0 2 1	3 1 0 2 4	1 4 0 2 3	1 3 0 2 4
1 0 4 3 2		2 1 4 3 0	2 3 4 1 0	2 1 3 4 0	2 4 3 1 0	2 3 1 4 0	2 4 1 3 0
4 3 2 1 0		3 0 2 1 4	1 0 2 3 4	4 0 2 1 3	1 0 2 4 3	4 0 2 3 1	3 0 2 4 1
2 1 0 4 3		1 4 3 0 2	3 4 1 0 2	1 3 4 0 2	4 3 1 0 2	3 1 4 0 2	4 1 3 0 2

109/	73/H	109/L	110/L	113/L	114/L	117/L	118/L
0 4 3 2 1		0 1 2 4 3	0 1 3 4 2	0 1 2 3 4	0 1 4 3 2	0 1 3 2 4	0 1 4 2 3
3 2 1 0 4		4 3 0 1 2	4 2 0 1 3	3 4 0 1 2	3 2 0 1 4	2 4 0 1 3	2 3 0 1 4
1 0 4 3 2		1 2 4 3 0	1 3 4 2 0	1 2 3 4 0	1 4 3 2 0	1 3 2 4 0	1 4 2 3 0
4 3 2 1 0		3 0 1 2 4	2 0 1 3 4	4 0 1 2 3	2 0 1 4 3	4 0 1 3 2	3 0 1 4 2
2 1 0 4 3		2 4 3 0 1	3 4 2 0 1	2 3 4 0 1	4 3 2 0 1	3 2 4 0 1	4 2 3 0 1

[Group 5] D5i

75/	75/H	73/L	74/L	77/L	78/L	81/L	82/L
0 4 3 1 2		0 4 1 3 2	0 4 2 3 1	0 4 1 2 3	0 4 3 2 1	0 4 2 1 3	0 4 3 1 2
3 1 2 0 4		3 2 0 4 1	3 1 0 4 2	2 3 0 4 1	2 1 0 4 3	1 3 0 4 2	1 2 0 4 3
2 0 4 3 1		4 1 3 2 0	4 2 3 1 0	4 1 2 3 0	4 3 2 1 0	4 2 1 3 0	4 3 1 2 0
4 3 1 2 0		2 0 4 1 3	1 0 4 2 3	3 0 4 1 2	1 0 4 3 2	3 0 4 2 1	2 0 4 3 1
1 2 0 4 3		1 3 2 0 4	2 3 1 0 4	1 2 3 0 4	3 2 1 0 4	2 1 3 0 4	3 1 2 0 4

[Group 6] D5i

121/	121/H	73/L	74/L	77/L	78/L	81/L	82/L
0 4 2 1 3		0 4 1 3 2	0 4 2 3 1	0 4 1 2 3	0 4 3 2 1	0 4 2 1 3	0 4 3 1 2
2 1 3 0 4		3 2 0 4 1	3 1 0 4 2	2 3 0 4 1	2 1 0 4 3	1 3 0 4 2	1 2 0 4 3
3 0 4 2 1		4 1 3 2 0	4 2 3 1 0	4 1 2 3 0	4 3 2 1 0	4 2 1 3 0	4 3 1 2 0
4 2 1 3 0		2 0 4 1 3	1 0 4 2 3	3 0 4 1 2	1 0 4 3 2	3 0 4 2 1	2 0 4 3 1
1 3 0 4 2		1 3 2 0 4	2 3 1 0 4	1 2 3 0 4	3 2 1 0 4	2 1 3 0 4	3 1 2 0 4

From what into what can we transform by any simple exchanges of data?

7. Transformation System for Pandiagonal Mafic Squares 5x5

Let me come to my conclusion. I invented such a transformation system as follows:

```

/**/
/* Transform: Mirror Reflection */
void reflect() {
    short n;
    d[1]=c[1];  d[2]=c[6];  d[3]=c[11];  d[4]=c[16];  d[5]=c[21];
    d[6]=c[2];  d[7]=c[7];  d[8]=c[12];  d[9]=c[17];  d[10]=c[22];
    d[11]=c[3]; d[12]=c[8];  d[13]=c[13]; d[14]=c[18];  d[15]=c[23];
    d[16]=c[4]; d[17]=c[9];  d[18]=c[14]; d[19]=c[19];  d[20]=c[24];
    d[21]=c[5]; d[22]=c[10]; d[23]=c[15]; d[24]=c[20];  d[25]=c[25];
    for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf01() {
    short n;
    for(n=1; n<26; n++) { d[n]=c[n]; }
    for(n=1; n<26; n++) {
        if(c[n]==1) { d[n]=2; }
        if(c[n]==2) { d[n]=1; }
    }
    for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf02() {
    short n;
    for(n=1; n<26; n++) { d[n]=c[n]; }
    for(n=1; n<26; n++) {
        if(c[n]==2) { d[n]=3; }
        if(c[n]==3) { d[n]=2; }
    }
    for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf03() {
    short n;
    for(n=1; n<26; n++) { d[n]=c[n]; }
    for(n=1; n<26; n++) {
        if(c[n]==1) { d[n]=3; }
        if(c[n]==3) { d[n]=1; }
    }
    for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf04() {

```

```

short n;
  for(n=1; n<26; n++) { d[n]=c[n]; }
  for(n=1; n<26; n++) {
    if(c[n]==4) { d[n]=3; }
    if(c[n]==3) { d[n]=4; }
  }
  for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf05() {
  short n;
  for(n=1; n<26; n++) { d[n]=c[n]; }
  for(n=1; n<26; n++) {
    if(c[n]==4) { d[n]=2; }
    if(c[n]==2) { d[n]=4; }
  }
  for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/
/* Transform: Exchange 5 Pairs */
void trnsf06() {
  short n;
  for(n=1; n<26; n++) { d[n]=c[n]; }
  for(n=1; n<26; n++) {
    if(c[n]==4) { d[n]=1; }
    if(c[n]==1) { d[n]=4; }
  }
  for(n=1; n<26; n++) { c[n]=d[n]; }
}
/**/

```

**** Quick View: What Pairs can we transform by that type?**

(Group 1)

(Group 4)

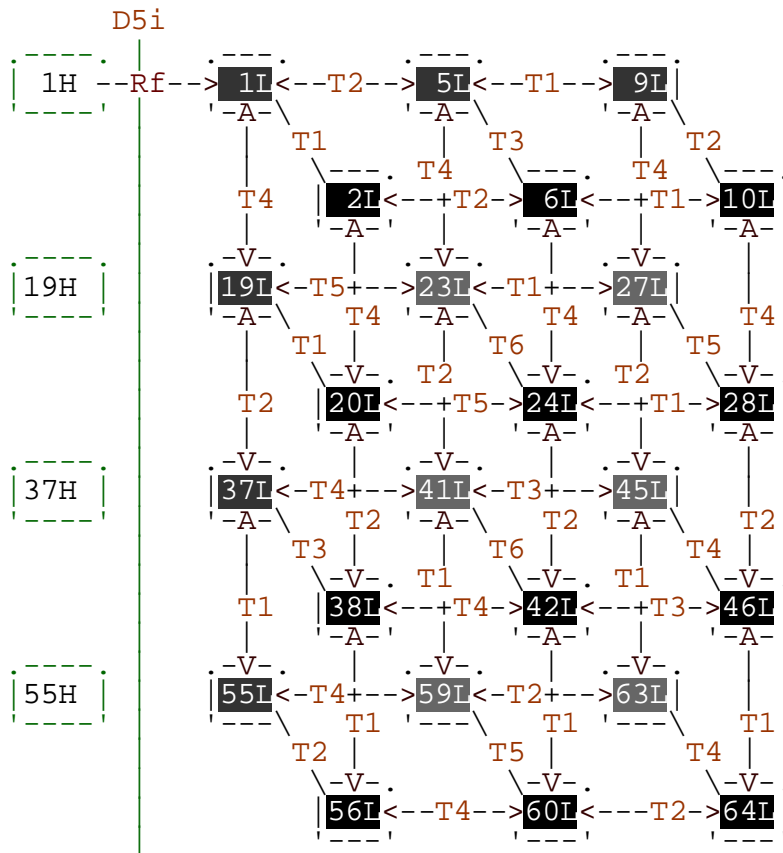
n	nL	Rf	T1	T2	T3	T4	T5	T6	n	nL	Rf	T1	T2	T3	T4	T5	T6
1	1	73	2	5	10	19	41	60	73	73	1	74	77	82	85	101	114
2	2	74	1	6	9	20	42	59	74	74	2	73	78	81	86	102	113
5	5	77	9	1	6	23	37	64	77	77	5	81	73	78	89	97	118
6	6	78	10	2	5	24	38	63	78	78	6	82	74	77	90	98	117
9	9	81	5	10	2	27	46	55	81	81	9	77	82	74	93	106	109
10	10	82	6	9	1	28	45	56	82	82	10	78	81	73	94	105	110
19	19	85	20	37	56	1	23	28	85	85	19	86	97	110	73	89	94
20	20	86	19	38	55	2	24	27	86	86	20	85	98	109	74	90	93
23	23	89	27	41	63	5	19	24	89	89	23	93	101	117	77	85	90
24	24	90	28	42	64	6	20	23	90	90	24	94	102	118	78	86	89
27	27	93	23	45	59	9	28	20	93	93	27	89	105	113	81	94	86

28	28	94	24	46	60	10	27	19	94	94	28	90	106	114	82	93	85	
37	37	97	55	19	38	41	5	46	97	97	37	109	85	98	101	77	106	
38	38	98	56	20	37	42	6	45	98	98	38	110	86	97	102	78	105	
41	41	101	59	23	45	37	1	42	101	101	41	113	89	105	97	73	102	
42	42	102	60	24	46	38	2	41	102	102	42	114	90	106	98	74	101	
45	45	105	63	27	41	46	10	38	105	105	45	117	93	101	106	82	98	
46	46	106	64	28	42	45	9	37	106	106	46	118	94	102	105	81	97	
55	55	109	37	56	20	59	64	9	109	109	55	97	110	86	113	118	81	
56	56	110	38	55	19	60	63	10	110	110	56	98	109	85	114	117	82	
59	59	113	41	63	27	55	60	2	113	113	59	101	117	93	109	114	74	
60	60	114	42	64	28	56	59	1	114	114	60	102	118	94	110	113	73	
63	63	117	45	59	23	64	56	6	117	117	63	105	113	89	118	110	78	
64	64	118	46	60	24	63	55	5	118	118	64	106	114	90	117	109	77	
	n	nL	Rf	T1	T2	T3	T4	T5	T6	n	nL	Rf	T1	T2	T3	T4	T5	T6

(Group 1) (Group 4)

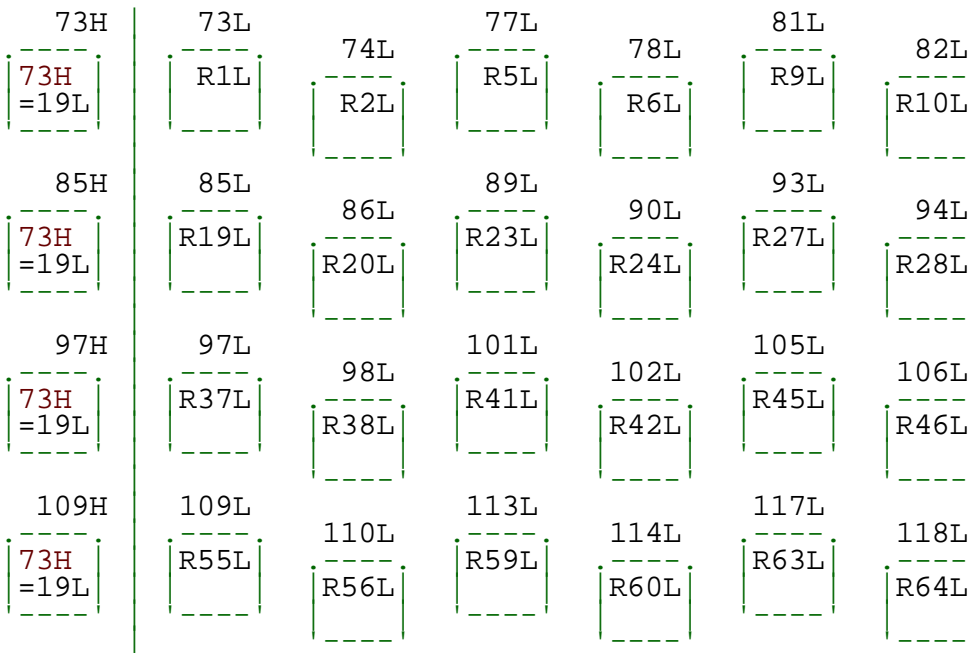
**** Step Diagram for our New Transformation System ****

[Group 1]

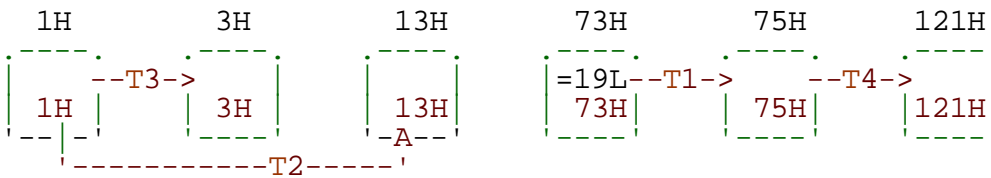


[Group 4]

D5i



**** How to Make High Layers for All Groups ****



If you want to reconstruct all 144 objects, give the initial data to 1H and use our new transformation system. Let me skip here showing my list of reconstruction.

But I want you to see the step diagram of our transformation system again.

Although it simply shows how to use various transformation methods, it also looks like indicating some structural informations about object solution set, doesn't it?

I say we have discovered various types of mutual relationship among solutions.

How impressive they are!

(Written in English on May 31, 2003 by Kanji Setsuda ; Calculated by MWCW)

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