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

**Chapter 4**: Commentary Articles No.2 by **Kanji Setsuda**: "Various Arts and Tools for Studying Magic Squares"

# Section 11: Various "Euler Squares" of Order 3, 5 and 7 made by "New Euler's Method" using PNS of Base 3, 5 and 7

## 0. Our purpose

This time I would like to examine our "New Euler's Method" using Positional Number System of Base 3, 5 and 7 by applying it to the cases of order 3, 5 and 7.

I once skipped applying it to the first and smallest case of magic squares simply because we cannot make any pandiagonal magic squares of order 3.

When I invented the composing method of "Knight's Movement" for order 5 and 7, I did not yet get any total idea of "New Euler's Method", though these two methods are essentially similar, I would say, almost the same.

Let's examine our newest method applying to these cases right here, shall we?

## 1. How to apply our New Euler's Method to Magic Square 3x3

We know we cannot make any pan-diagonal magic squares 3x3 but we can only make self-complementary one. This means we cannot make any 'Complete Euler Squares' of order 3. But it bothers us no longer. We now know what we have to do with it.

Please watch the next solution example of S-C MS33. Every complementary pair of 10 is located symmetrically with respect to the geometric center. The n5 always takes 5 just because it is placed on the center and never moves to anywhere else.

If you have the decomposed patterns of solution calculated under the Positional Number System of Base 3, you see n5 is always occupied by '1' on both layers high and low, as you see below. It is logically determined by the basic definitions.

```
/Classic                          /N3i          /D3i
.--------.    .--------.    .--------.
| 2| 9| 4|    | 1| 8| 3|    |01|22|10|    0 2 1   1 2 0
|--+--+--|    |--+--+--|    |--+--+--|
| 7| 5| 3|    | 6| 4| 2|    |20|11|02|    2 1 0   0 1 2
|--+--+--|    |--+--+--|    |--+--+--|
| 6| 1| 8|    | 5| 0| 7|    |12|00|21|    1 0 2   2 0 1
'--------'    '--------'    '--------'    High/    Low/
          [Mathematical Notations]  [Decomposed Patterns]
```

Therefore, one of the primary diagonals must be made of {1,1,1} instead of {0,1,2}. Let me skip my explanation about the logical proof here. Since we accept every row and every column must be made of {0,1,2}, and '1' must be used three times anywhere in each layer, we cannot make any "Complete Euler Squares" of order 3 consequently.

Let's compose the Self-Complementary Euler Square of order 3 that has every row and every column made of only {0,1,2}.

Between those figures above, you see the following equations are active.

1=0x3+0+1; 2=0x3+1+1; 3=0x3+2+1; 4=1x3+0+1; 5=1x3+1+1; 6=1x3+2+1;
7=2x3+0+1; 8=2x3+1+1; 9=2x3+2+1;

Vn=Anx3+Bn+1 (n=1,2,3, ..., 8,9)

Let me show you the following basic diagram and basic conditions I prepared for.

Let's try to compose its layer units with only '0', '1' and '2' at first.

```
** Basic Positions and Basic Conditions **
 .--------.
 |n1|n2|n3|   n1+n2+n3=C ...rw1;   n1+n4+n7=C ...cl1;
 |--+--+--|
 |n4|n5|n6|   n4+n5+n6=C ...rw2;   n2+n5+n8=C ...cl2;
 |--+--+--|
 |n7|n8|n9|   n7+n8+n9=C ...rw3;   n3+n6+n0=C ...cl3;
 '--------'

** Self-Complementary Conditions **
 n1+n9=CC;   n2+n8=CC;   n3+n7=CC;   n4+n6=CC;   n5+n5=CC;
 n6+n4=CC;   n7+n3=CC;   n8+n2=CC;   n9+n1=CC;
```

The magic constant C and CC above must take the values: C=3; CC=2;
I do not define anything explicit about the two primary diagonals:

```
n1+n5+n9 ...pd1;   and   n3+n5+n7 ...pb3;
```

According to the Self-Complementary Conditions above,

```
n5=CC/2; n1+n9=CC; and n3+n7=CC; ...
therefore n1+n5+n9=n3+n5+n7=CC+CC/2=2+1=C;
```

Both of them add up to the same sum, the magic constant. We cannot deny it at all.

I do not define any number pattern for them any longer. It may be {1,1,1}, or may be {0,1,2}, but I do surely define every row and every column must always have the same number pattern {0,1,2} taking each number strictly once, and set each flag for every row and every column so that we can precisely watch how often each number is used there.

The next program is dictated for our new experiment.
If you want to have its whole list, please click at the file end to get it.

```
/**/
/** Core Part of 'EulerS3SC.c' */
/**/
#include <stdio.h>
/**/
short int cnt, cnt3;
short CC, LSM;
short u1,u2;
short nm[10], flg[10];
short anm[5][12];
short tlu[5][10];
short mtc[5][5], cmtc[5][5], scmtc[5][5];
/**/
short rw1[3], cl1[3];
short rw2[3], cl2[3];
short rw3[3], cl3[3];
/**/
/* Main Program */
main(){
 short n;
  printf("\n** Self-Complementary Magic Squares of Order 3 **\n");
  printf("** by 'New Euler's Method' using PNS of Base 3 **\n");
  for(n=0;n<10;n++){nm[n]=0;}
  for(n=0;n<3;n++){
    rw1[n]=0; cl1[n]=0;
```

```
    rw2[n]=0; cl2[n]=0;
    rw3[n]=0; cl3[n]=0;
  }
  CC=2; LSM=3; cnt=0; cnt3=0;
  stp01();    /* Make The Layer Units */
  printf("\n [Layer Units]\n");
  prlunit();  /* Print the Layer Units */
  printf("\n [Composition of Primitive MS33]\n");
  /* printf("\n [Composition of Standard MS33]\n"); :for Substitution */
  cnt=0; cnt3=0;
  cmbcmp();   /* Combine, Compose and Print */
  printf(" [Count = %d]\n",cnt);
  printf("  OK!\n");
 return 0;
}
/* Make The Layer Units */
/* Set n1 & n9 */
void stp01(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
   if((rw1[a]==0)&&(cl1[a]==0)){
    if((rw3[b]==0)&&(cl3[b]==0)){
      nm[1]=a; nm[9]=b;
      rw1[a]=1; cl1[a]=1;
      rw3[b]=1; cl3[b]=1;
      stp02();
      rw1[a]=0; cl1[a]=0;
      rw3[b]=0; cl3[b]=0;
  }}}
}
/* Set n2 & n8 */
void stp02(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
   if((rw1[a]==0)&&(cl2[a]==0)){
    if((rw3[b]==0)&&(cl2[b]==0)){
      nm[2]=a; nm[8]=b;
      rw1[a]=1; cl2[a]=1;
      rw3[b]=1; cl2[b]=1;
      stp03();
      rw1[a]=0; cl2[a]=0;
      rw3[b]=0; cl2[b]=0;
  }}}
}
/* Set n3 & n7 */
void stp03(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
   if((rw1[a]==0)&&(cl3[a]==0)){
    if((rw3[b]==0)&&(cl1[b]==0)){
      nm[3]=a; nm[7]=b;
      rw1[a]=1; cl3[a]=1;
      rw3[b]=1; cl1[b]=1;
      stp04();
      rw1[a]=0; cl3[a]=0;
      rw3[b]=0; cl1[b]=0;
  }}}
}
/* Set n4 & n6 */
```

```
void stp04(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
   if((rw2[a]==0)&&(cl1[a]==0)){
    if((rw2[b]==0)&&(cl3[b]==0)){
      nm[4]=a; nm[6]=b;
      rw2[a]=1; cl1[a]=1;
      rw2[b]=1; cl3[b]=1;
      stp05();
      rw2[a]=0; cl1[a]=0;
      rw2[b]=0; cl3[b]=0;
  }}}
}
/* Set n5 */
void stp05(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
   if(a==b){
    if((rw2[a]==0)&&(cl2[a]==0)){
      nm[5]=a;
      rw2[a]=1; cl2[a]=1;
      lurecord();
      rw2[a]=0; cl2[a]=0;
  }}}
}
/**/
/* Record the Layer Units */
void lurecord(){
 short n;
  tlu[cnt][0]=cnt+1;
  for(n=1;n<10;n++){tlu[cnt][n]=nm[n];}
  cnt++;
}
/**/
```

By this program we have got 4 layer units as follows:

```
** Self-Complementary Magic Squares of Order 3 **
** by 'New Euler's Method' using PNS of Base 3 **

 [Layer Units]
      1/       2/       3/       4/
   0 2 1    1 0 2    1 2 0    2 0 1
   2 1 0    2 1 0    0 1 2    0 1 2
   1 0 2    0 2 1    2 0 1    1 2 0
 [Count of Layer Units = 4]

 [Composition of Primitive MS33]
      1/      1/          1#        1/      2/          2#
   0 2 1   0 2 1   1  9  5     0 2 1   1 0 2   2  7  6
   2 1 0   2 1 0   9  5  1     2 1 0   2 1 0   9  5  1
   1 0 2   1 0 2   5  1  9     1 0 2   0 2 1   4  3  8
      1/      3/          3#        1/      4/          4#
   0 2 1   1 2 0   2  9  4     0 2 1   2 0 1   3  7  5
   2 1 0   0 1 2   7  5  3     2 1 0   0 1 2   7  5  3
   1 0 2   2 0 1   6  1  8     1 0 2   1 2 0   5  3  7
```

```
     2/     1/        5#         2/     2/        6#
  1 0 2  0 2 1   4  3  8      1 0 2  1 0 2   5  1  9
  2 1 0  2 1 0   9  5  1      2 1 0  2 1 0   9  5  1
  0 2 1  1 0 2   2  7  6      0 2 1  0 2 1   1  9  5
     2/     3/        7#         2/     4/        8#
  1 0 2  1 2 0   5  3  7      1 0 2  2 0 1   6  1  8
  2 1 0  0 1 2   7  5  3      2 1 0  0 1 2   7  5  3
  0 2 1  2 0 1   3  7  5      0 2 1  1 2 0   2  9  4
     3/     1/        9#         3/     2/       10#
  1 2 0  0 2 1   4  9  2      1 2 0  1 0 2   5  7  3
  0 1 2  2 1 0   3  5  7      0 1 2  2 1 0   3  5  7
  2 0 1  1 0 2   8  1  6      2 0 1  0 2 1   7  3  5
     3/     3/       11#         3/     4/       12#
  1 2 0  1 2 0   5  9  1      1 2 0  2 0 1   6  7  2
  0 1 2  0 1 2   1  5  9      0 1 2  0 1 2   1  5  9
  2 0 1  2 0 1   9  1  5      2 0 1  1 2 0   8  3  4
     4/     1/       13#         4/     2/       14#
  2 0 1  0 2 1   7  3  5      2 0 1  1 0 2   8  1  6
  0 1 2  2 1 0   3  5  7      0 1 2  2 1 0   3  5  7
  1 2 0  1 0 2   5  7  3      1 2 0  0 2 1   4  9  2
     4/     3/       15#         4/     4/       16#
  2 0 1  1 2 0   8  3  4      2 0 1  2 0 1   9  1  5
  0 1 2  0 1 2   1  5  9      0 1 2  0 1 2   1  5  9
  1 2 0  2 0 1   6  7  2      1 2 0  1 2 0   5  9  1
[Count = 16]
```

Simple combinations of any two units make 4x4 compositions as shown above.

But they are not yet any final solutions at all. Among 16 there are 8 wrong answers against the definition (3). For instance, composition No.1 has three ‘1’s, three ‘5’s, three ‘9’s and nothing else. No.4 has ‘3’s, ‘5’s and ‘7’s three times for each and nothing else.

No.1 is made up of unit 1/ and the same 1/, but this kind of repeating usage of any one unit should make a wrong composition inevitably.

No.4 is made of unit 1/ and 4/, but this pair(1/, 4/) is a ‘complementary unit’ that should always make your composition wrong.

Between those units every value of corresponding positions always adds up to 2.

If (Hn+Ln==2) then we call (Hn, Ln) “Complementary Pair of 2,” and if (all Hn+Ln==2) then we call (H/, L/) “Complementary Units.”

How can we stop these kinds of wrong answers?

I propose you making such a reference table for the best combinations as follows:

We need the ‘Collective Table of S & C’ for our references like the one on the right most below, where we can only select the appropriate pair units whose count are 3.

```
[Reference Table for the Best Pairs]
 S|  1  2  3  4    C|  1  2  3  4   SC|  1  2  3  4
--+-------------  --+-------------  --+-------------
 1|  9  3  3  3    1|  3  3  3  9    1|  9  3  3  9
 2|  3  9  3  3    2|  3  3  9  3    2|  3  9  9  3
 3|  3  3  9  3    3|  3  9  3  3    3|  3  9  9  3
 4|  3  3  3  9    4|  9  3  3  3    4|  9  3  3  9
[Similarity Table]  [Complementary]  [Collective]
```

```
[Compositions of 8]

    1/     2/         1#         1/     3/         2#
 0 2 1  1 0 2   2  7  6      0 2 1  1 2 0   2  9  4
 2 1 0  2 1 0   9  5  1      2 1 0  0 1 2   7  5  3
 1 0 2  0 2 1   4  3  8      1 0 2  2 0 1   6  1  8

    2/     1/         3#         2/     4/         4#
 1 0 2  0 2 1   4  3  8      1 0 2  2 0 1   6  1  8
 2 1 0  2 1 0   9  5  1      2 1 0  0 1 2   7  5  3
 0 2 1  1 0 2   2  7  6      0 2 1  1 2 0   2  9  4

    3/     1/         5#         3/     4/         6#
 1 2 0  0 2 1   4  9  2      1 2 0  2 0 1   6  7  2
 0 1 2  2 1 0   3  5  7      0 1 2  0 1 2   1  5  9
 2 0 1  1 0 2   8  1  6      2 0 1  1 2 0   8  3  4

    4/     2/         7#         4/     3/         8#
 2 0 1  1 0 2   8  1  6      2 0 1  1 2 0   8  3  4
 0 1 2  2 1 0   3  5  7      0 1 2  0 1 2   1  5  9
 1 2 0  0 2 1   4  9  2      1 2 0  2 0 1   6  7  2

[Count = 8]
```

These 8 compositions are no longer wrong ones against the definition (3) and they are considered to be 'primitive solutions'.

Each of them is such an imitation of any other solution as made by simple reflection or simple rotation. We cannot recognize each as an independent solution.

The only one correct solution must be listed out as a result, what can pass under the next list-forming inequality conditions complex.

```
        if(fc==9){/* prans(); */
          if((nm[1]<nm[9])&&(nm[1]<nm[3])&&(nm[1]<nm[7])){
            if(nm[2]>nm[4]){prans();}}
        }
/**/
  if(cnt3==1){pr2ans(); cnt3=0;}
```

```
[Standard Solution of SC MS33]

    1/     3/         1#         0/     0/         0#
 0 2 1  1 2 0   2  9  4      0 0 0  0 0 0   0  0  0
 2 1 0  0 1 2   7  5  3      0 0 0  0 0 0   0  0  0
 1 0 2  2 0 1   6  1  8      0 0 0  0 0 0   0  0  0

[Count = 1]  OK!
```

We have got it! But I am afraid you might feel it is too hard to follow this big experiment just for the smallest magic square 3x3. Of course, you don't have to do the same thing again by yourself, I suppose. You may well only read this and understand that our New Euler's Method using PNS of Base 3 is really effective here.

Every step demonstrates quite reasonable, especially the result 2x1x2x2/8=1 solution is just the same with the one we got before in our former study.

We now know the Self-Complementary Magic Square 3x3 also has the beautiful structure, what we call 'Euler Square' of order 3.

## 2. How about Magic Cube of Order 3?

Let's build Magic Cubes of order 3 by this New Euler's Method using the Positional Number System of Base 3.

Let me show you an example solution of our object below with the decomposed layer figures of Base 3.

```
** Example Solution of S-C magic Cube 3x3x3 **
[#]Solution              *9/            *3/            *1/
  2-----15-----25         0   1   2      0   1   2      1   2   0
  |24      7    |11        2   0   1      1   2   0      2   0   1
  |  16-----20----- 6       1   2   0      2   0   1      0   1   2
 18    | 19      5    |   1   2   0      2   0   1      2   0   1
  | 1 |    14     |27 |    0   1   2      0   1   2      0   1   2
  |  23        9  |  10     2   0   1      1   2   0      1   2   0
 22---|- 8-----12     |   2   0   1      1   2   0      0   1   2
   17 |    21       4 |    1   2   0      2   0   1      1   2   0
      3-----13-----26       0   1   2      0   1   2      2   0   1
   [In Classical Style]    [Layers of Decomposition by Base 3]
```

Between those figures above the following equations are active:

```
   2=0x9+0x3+1x1+1;    15=1x9+1x3+2x1+1;        25=2x9+2x3+0x1+1;
  24=2x9+1x3+2x1+1;     7=0x9+2x3+0x1+1;        11=1x9+0x3+1x1+1;
   . . . . . . .
  Vn=Anx9+Bnx3+Cnx1+1=(Anx3+Bn)x3+Cn+1 (n=1,2,3,4, ... , 26, 27)
```

First of all let's design and compose each layer unit for our object.

I prepared the following basic form and basic conditions:

**** Basic Positions and Basic Conditions ****

```
 1------10------19         n1+n2+n3=C      ...df01
 |\       :       |\       n4+n5+n6=C      ...df02
 | 2      :11     |20      n7+n8+n9=C      ...df03
 4  \    13      22  \     n10+n11+n12=C   ...df04
 |   3---+--12---+--21     n13+n14+n15=C   ...df05
 | 5 |    :14 :   |23 |    n16+n17+n18=C   ...df06
 7---|--16---+--25    |    n19+n20+n21=C   ...df07
  \  6      15     \ 24    n22+n23+n24=C   ...df08
   8 |      17 :     26 |  n25+n26+n27=C   ...df09
    \|         :       \|  n1+n4+n7=C      ...df11
     9------18------27     n2+n5+n8=C      ...df12
                           n3+n6+n9=C      ...df13
 n10+n13+n16=C ...df14     n11+n14+n17=C   ...df15
 n12+n15+n18=C ...df16     n19+n22+n25=C   ...df17
 n20+n23+n26=C ...df18     n21+n24+n27=C   ...df19
 n1+n10+n19=C  ...df21     n2+n11+b20=C    ...df22
 n3+n12+n21=C  ...df23     n4+n13+n22=C    ...df24
 n5+n14+n23=C  ...df25     n6+n15+n24=C    ...df26
 n7+n16+n25=C  ...df27     n8+n17+n26=C    ...df28
 n9+n18+n27=C  ...df29
```

```
** Self-Complementary Conditions **
 n1+n27=CC;  n2+n26=CC;   n3+n25=CC;    n4+n24=CC;
 n5+n23=CC;  n6+n22=CC;   n7+n21=CC;    n8+n20=CC;
```

```
n9+n19=CC;  n10+n18=CC;  n11+n17==CC;  n12+n16=CC;
n13+n15=CC; n14+n14=CC;  n15+n13=CC;   .....
```

In each layer the value of magic constants must be C=3 and CC=2.
I do not define anything here about the 4 primary triagonals:

```
n1+n14+n27 ...pt1;     n3+n14+n25 ...pt2;
n7+n14+n21 ...pt3;     n9+n14+n19 ...pt4;
```

But every sum of these 4 triagonals must be equal to C, because `n14=CC/2=1;` and `(n1+n27)+n14 = CC+CC/2 = 2+1=3 = C; (n3+n25)+n14 = CC+CC/2 = C; ...` according to the Self-Complementary Conditions above.

But we do not define any number patterns about the 4 triagonals.
It may be {1,1,1}, or may be {0,1,2}.

In each layer we define every line in all three dimensions must be made of {0,1,2}, and set each flag to watch precisely how often '0', '1' or '2' is used there.

The next program is dictated for our experiment as follows.
If you want to have the whole list of it, please click at the file end to get it.

```
/**/
/** Core Part of 'EulerMC3.c' **/
/**/
#include <stdio.h>
/**/
/* Variables */
short int cnt;
short CC;
short u1, u2, u3, u4;
short tlu[9][28];
short mtc[9][9];
short nm[31], flg[28];
/* Flags */
short d0[10][3], d1[10][3], d2[10][3];
/**/
/* Main Program */
/**/
main(){
 short m,n;
  printf("\n** Self-Complementary Magic Cubes of Order 3 made by **\n");
  printf("*** 'New Euler's Method' with Posional NS of Base 3 ***\n");
  for(n=0;n<31;n++){nm[n]=0;}
  for(m=0;m<10;m++){
    for(n=0;n<3;n++){
      d0[m][n]=0; d1[m][n]=0; d2[m][n]=0;
  }}
  CC=2; cnt=0;
  nm[14]=1;
  d0[5][1]=1; d1[5][1]=1; d2[5][1]=1;
  printf("\n [Layer Units]\n");
  deep01();   /* Make the Layer Units */
  prlunit();  /* Print the Layer Units */
  cnt=0;
  printf("\n [Composition of Standard MC333]\n");
  cmbcmp();   /* Combibe, Compose and Print */
  printf("\n [Count of Solutions = %d]\n",cnt);
  printf("  OK! \n");
 return 0;
}
```

```
/**/
/* Make the Layer Units */
/* Set n1 & n27 */
void deep01(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[1][a]==0)&&(d1[1][a]==0)&&(d2[1][a]==0)){
      if((d0[9][b]==0)&&(d1[9][b]==0)&&(d2[9][b]==0)){
        nm[1]=a; nm[27]=b;
        d0[1][a]=1; d1[1][a]=1; d2[1][a]=1;
        d0[9][b]=1; d1[9][b]=1; d2[9][b]=1;
        deep02();
        d0[1][a]=0; d1[1][a]=0; d2[1][a]=0;
        d0[9][b]=0; d1[9][b]=0; d2[9][b]=0;
    }}
  }
}
/* Set n2 & n26 */
void deep02(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[1][a]==0)&&(d1[2][a]==0)&&(d2[2][a]==0)){
      if((d0[9][b]==0)&&(d1[8][b]==0)&&(d2[8][b]==0)){
        nm[2]=a; nm[26]=b;
        d0[1][a]=1; d1[2][a]=1; d2[2][a]=1;
        d0[9][b]=1; d1[8][b]=1; d2[8][b]=1;
        deep03();
        d0[1][a]=0; d1[2][a]=0; d2[2][a]=0;
        d0[9][b]=0; d1[8][b]=0; d2[8][b]=0;
    }}
  }
}
/* Set n3 & n25 */
void deep03(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[1][a]==0)&&(d1[3][a]==0)&&(d2[3][a]==0)){
      if((d0[9][b]==0)&&(d1[7][b]==0)&&(d2[7][b]==0)){
        nm[3]=a; nm[25]=b;
        d0[1][a]=1; d1[3][a]=1; d2[3][a]=1;
        d0[9][b]=1; d1[7][b]=1; d2[7][b]=1;
        deep04();
        d0[1][a]=0; d1[3][a]=0; d2[3][a]=0;
        d0[9][b]=0; d1[7][b]=0; d2[7][b]=0;
    }}
  }
}
/* Set n4 & n24 */
void deep04(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[2][a]==0)&&(d1[1][a]==0)&&(d2[4][a]==0)){
      if((d0[8][b]==0)&&(d1[9][b]==0)&&(d2[6][b]==0)){
        nm[4]=a; nm[24]=b;
        d0[2][a]=1; d1[1][a]=1; d2[4][a]=1;
        d0[8][b]=1; d1[9][b]=1; d2[6][b]=1;
        deep05();
        d0[2][a]=0; d1[1][a]=0; d2[4][a]=0;
        d0[8][b]=0; d1[9][b]=0; d2[6][b]=0;
```

```
    }}
  }
}
/* Set n5 & n23 */
void deep05(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[2][a]==0)&&(d1[2][a]==0)&&(d2[5][a]==0)){
      if((d0[8][b]==0)&&(d1[8][b]==0)&&(d2[5][b]==0)){
        nm[5]=a; nm[23]=b;
        d0[2][a]=1; d1[2][a]=1; d2[5][a]=1;
        d0[8][b]=1; d1[8][b]=1; d2[5][b]=1;
        deep06();
        d0[2][a]=0; d1[2][a]=0; d2[5][a]=0;
        d0[8][b]=0; d1[8][b]=0; d2[5][b]=0;
    }}
  }
}
/* Set n6 & n22 */
void deep06(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[2][a]==0)&&(d1[3][a]==0)&&(d2[6][a]==0)){
      if((d0[8][b]==0)&&(d1[7][b]==0)&&(d2[4][b]==0)){
        nm[6]=a; nm[22]=b;
        d0[2][a]=1; d1[3][a]=1; d2[6][a]=1;
        d0[8][b]=1; d1[7][b]=1; d2[4][b]=1;
        deep07();
        d0[2][a]=0; d1[3][a]=0; d2[6][a]=0;
        d0[8][b]=0; d1[7][b]=0; d2[4][b]=0;
    }}
  }
}
/**/
 . . . . . . .
/**/
/* Set n13 & n15 */
void deep13(){
 short a,b;
  for(a=0;a<3;a++){b=CC-a;
    if((d0[5][a]==0)&&(d1[4][a]==0)&&(d2[4][a]==0)){
      if((d0[5][b]==0)&&(d1[6][b]==0)&&(d2[6][b]==0)){
        nm[13]=a; nm[15]=b;
        d0[5][a]=1; d1[4][a]=1; d2[4][a]=1;
        d0[5][b]=1; d1[6][b]=1; d2[6][b]=1;
        recordans();
        d0[5][a]=0; d1[4][a]=0; d2[4][a]=0;
        d0[5][b]=0; d1[6][b]=0; d2[6][b]=0;
    }}
  }
}
/**/
/* Record the Layer Units */
void recordans(){
 short n;
  tlu[cnt][0]=cnt+1;
  for(n=1;n<28;n++){tlu[cnt][n]=nm[n];}
  cnt++;
}
```

```
/**/
 . . . . . . .
```

The next list shows the result of my recent calculation:

```
** Self-Complementary Magic Cubes of Order 3 made by **
** 'New Euler's Method' with Positional NS of Base 3 **
```

```
 [Layer Units]

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

           5/            6/            7/            8/
  1   2   0     2   1   0     2   1   0     2   0   1
   2   0   1     0   2   1     1   0   2     1   2   0
    0   1   2     1   0   2     0   2   1     0   1   2
  2   0   1     1   0   2     0   2   1     1   2   0
   0   1   2     2   1   0     2   1   0     0   1   2
    1   2   0     0   2   1     1   0   2     2   0   1
  0   1   2     0   2   1     1   0   2     0   1   2
   1   2   0     1   0   2     0   2   1     2   0   1
    2   0   1     2   1   0     2   1   0     1   2   0

 [Count of Layer Units = 8]

 [Reference Table for the Best Combinations]
```

| SC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | 27 | 9 | 9 | 9 | 9 | 9 | 9 | 27 |
| 2 | 9 | 27 | 9 | 9 | 9 | 9 | 27 | 9 |
| 3 | 9 | 9 | 27 | 9 | 9 | 27 | 9 | 9 |
| 4 | 9 | 9 | 9 | 27 | 27 | 9 | 9 | 9 |
| 5 | 9 | 9 | 9 | 27 | 27 | 9 | 9 | 9 |
| 6 | 9 | 9 | 27 | 9 | 9 | 27 | 9 | 9 |
| 7 | 9 | 27 | 9 | 9 | 9 | 9 | 27 | 9 |
| 8 | 27 | 9 | 9 | 9 | 9 | 9 | 9 | 27 |

```
 [Composition of Standard MC333]

         1/            2/            3/                     1#
 0   2   1     0   1   2     0   1   2       1-----23-----18
  1   0   2     1   2   0     2   0   1      |15      7    |20
   2   1   0     2   0   1     1   2   0     |  26-----12--+-- 4
 1   0   2     2   0   1     1   2   0      17   |  3     22   |
  2   1   0     0   1   2     0   1   2      |19 |    14   | 9 |
   0   2   1     1   2   0     2   0   1     |   6      25 |  11
 2   1   0     1   2   0     2   0   1      24---+-16----- 2   |
  0   2   1     2   0   1     1   2   0        8 |    21     13 |
   1   0   2     0   1   2     0   1   2         10----- 5-----27
```

```
       1/            2/            5/                   2#
0   2   1     0   1   2     1   2   0       2-----24-----16
 1   0   2     1   2   0     2   0   1      |15      7    |20
  2   1   0     2   0   1     0   1   2     |  25-----11--+-- 6
1   0   2     2   0   1     2   0   1      18   |  1     23   |
 2   1   0     0   1   2     0   1   2      |19 |   14    | 9 |
  0   2   1     1   2   0     1   2   0     |   5     27  |   10
2   1   0     1   2   0     0   1   2      22---+-17----- 3   |
 0   2   1     2   0   1     1   2   0        8 |   21     13 |
  1   0   2     0   1   2     2   0   1         12----- 4-----26

       1/            5/            2/                   3#
0   2   1     1   2   0     0   1   2       4-----26-----12
 1   0   2     2   0   1     1   2   0      |17      3    |22
  2   1   0     0   1   2     2   0   1     |  21-----13--+-- 8
1   0   2     2   0   1     2   0   1      18   |  1     23   |
 2   1   0     0   1   2     0   1   2      |19 |   14    | 9 |
  0   2   1     1   2   0     1   2   0     |   5     27  |   10
2   1   0     0   1   2     1   2   0      20---+-15----- 7   |
 0   2   1     1   2   0     2   0   1        6 |   25     11 |
  1   0   2     2   0   1     0   1   2         16----- 2-----24

       1/            5/            6/                   4#
0   2   1     1   2   0     2   1   0       6-----26-----10
 1   0   2     2   0   1     0   2   1      |16      3    |23
  2   1   0     0   1   2     1   0   2     |  20-----13--+-- 9
1   0   2     2   0   1     1   0   2      17   |  1     24   |
 2   1   0     0   1   2     2   1   0      |21 |   14    | 7 |
  0   2   1     1   2   0     0   2   1     |   4     27  |   11
2   1   0     0   1   2     0   2   1      19---+-15----- 8   |
 0   2   1     1   2   0     1   0   2        5 |   25     12 |
  1   0   2     2   0   1     2   1   0         18----- 2-----22

[Count of Solutions = 4]  OK!
```

All the result solutions are just the same with the ones we got in our former study. Our New Euler's Method could certainly demonstrate here how powerful it is.

### 3. How to Compose Pan-Diagonal MS55 by this Method of PNS Base 5

Let's examine our New Euler's Method of PNS Base 5 applying to the case of Pan-Diagonal Magic Squares 5x5 and also Simultaneous type.

We once made them by our 'Knight's Compositions', but we have not yet applied our New Euler's Method to those objects.

Let's compose each layer unit by our new method at first, and then combine, compose and test our answers.

I would like to modify a little about the way how to compose layer units.

Since we have to make only two layers high and low, we may modify each layer into more compact and effective one, especially about high layer.

Why not apply the list-forming inequality conditions to the earlier stage of making each layer? We can get the smaller set of high layers, can't we?

I prepared the following basic form and basic conditions for our layer units:

*****  Basic Diagram for Magic Square 5x5  *****
**** with Basic Conditions and Pandiagonals ****

```
23 24 25 21 22 23 24 25 21 22 23 24
         .--------------.
 3  4  5| 1| 2| 3| 4| 5| 1  2  3  4
        |--+--+--+--+--|
 8  9 10| 6| 7| 8| 9|10| 6  7  8  9
        |--+--+--+--+--|
13 14 15|11|12|13|14|15|11 12 13 14
        |--+--+--+--+--|
18 19 20|16|17|18|19|20|16 17 18 19
        |--+--+--+--+--|
23 24 25|21|22|23|24|25|21 22 23 24
        '--------------'
 3  4  5  1  2  3  4  5  1  2  3  4
```

```
n1+n2+n3+n4+n5=C       ...rw1;   n1+n6+n11+n16+n21=C   ...cl1;
n6+n7+n8+n9+n10=C      ...rw2;   n2+n7+n12+n17+n22=C   ...cl2;
n11+n12+n13+n14+n15=C ...rw3;   n3+n8+n13+n18+n23=C   ...cl3;
n16+n17+n18+n19+n20=C ...rw4;   n4+n9+n14+n19+n24=C   ...cl4;
n21+n22+n23+n24+n25=C ...rw5;   n5+n10+n15+n20+n25=C  ...cl5;

* Pandiagonals *
n1+n7+n13+n19+n25=C    ...pd1;   n1+n10+n14+n18+n22=C  ...pb1;
n2+n8+n14+n20+n21=C    ...pd2;   n2+n6+n15+n19+n23=C   ...pb2;
n3+n9+n15+n16+n22=C    ...pd3;   n3+n7+n11+n20+n24=C   ...pb3;
n4+n10+n11+n17+n23=C   ...pd4;   n4+n8+n12+n16+n25=C   ...pb4;
n5+n6+n12+n18+n24=C    ...pb5;   n5+n9+n13+n17+n21=C   ...pb5;
```

Let me show you the new program I dictated for our object recently.
If you want to have the whole list of it, please click at the file end to get that.

```
/**/
/** Core Part of 'CES55PD.c' **/
/**/
#include <stdio.h>
/**/
short int cnt, cnt2;
short u1,u2;
short nm[26], uflg[26];
short st[3601][28];
char thlu[31][26], tllu[241][26];
char mtc[31][241];
/**/
short rw1[5], cl1[5], pd1[5], pb1[5];
short rw2[5], cl2[5], pd2[5], pb2[5];
short rw3[5], cl3[5], pd3[5], pb3[5];
short rw4[5], cl4[5], pd4[5], pb4[5];
short rw5[5], cl5[5], pd5[5], pb5[5];
/**/
/* Main Program */
main(){
 short n;
  printf("\n** Pan-diagonal Magic Squares of Order 5: **\n");
  printf("** Made by 'New Euler's Method' with /D5i **\n");
  for(n=0;n<26;n++){nm[n]=0;}
  for(n=0;n<5;n++){
    rw1[n]=0; cl1[n]=0; pd1[n]=0; pb1[n]=0;
```

```
    rw2[n]=0; cl2[n]=0; pd2[n]=0; pb2[n]=0;
    rw3[n]=0; cl3[n]=0; pd3[n]=0; pb3[n]=0;
    rw4[n]=0; cl4[n]=0; pd4[n]=0; pb4[n]=0;
    rw5[n]=0; cl5[n]=0; pd5[n]=0; pb5[n]=0;
  }
  cnt=0; cnt2=0;
  stp01();      /* Make the Layer Units */
  printf("\n [Layer Units]\n");
  prlunit();    /* Print the Layer Units */
  cnt=0;
  printf("\n [Compositions: Used Units// List Number#]\n");
  cmbcmp();     /* Combine and Compose */
  srtsol(cnt);  /* Sort the Solutions */
  prsol(1,cnt); /* Print the Solution List */
  printf(" [Count = %d]\n",cnt);
  printf("  OK!\n");
 return 0;
}
/* Make the Layer Units */
/* Set n1 */
void stp01(){
 short a;
  for(a=0;a<5;a++){
    if((rw1[a]==0)&&(cl1[a]==0)&&(pd1[a]==0)&&(pb1[a]==0)){
      nm[1]=a;
      rw1[a]=1; cl1[a]=1; pd1[a]=1; pb1[a]=1;
      stp02();
      rw1[a]=0; cl1[a]=0; pd1[a]=0; pb1[a]=0;
  }}
}
/* Set n2 */
void stp02(){
 short a;
  for(a=0;a<5;a++){
    if((rw1[a]==0)&&(cl2[a]==0)&&(pd2[a]==0)&&(pb2[a]==0)){
        nm[2]=a;
        rw1[a]=1; cl2[a]=1; pd2[a]=1; pb2[a]=1;
        stp03();
        rw1[a]=0; cl2[a]=0; pd2[a]=0; pb2[a]=0;
  }}
}
/* Set n3 */
void stp03(){
 short a;
  for(a=0;a<5;a++){
    if((rw1[a]==0)&&(cl3[a]==0)&&(pd3[a]==0)&&(pb3[a]==0)){
        nm[3]=a;
        rw1[a]=1; cl3[a]=1; pd3[a]=1; pb3[a]=1;
        stp04();
        rw1[a]=0; cl3[a]=0; pd3[a]=0; pb3[a]=0;
  }}
}
/* Set n4 */
void stp04(){
 short a;
  for(a=0;a<5;a++){
    if((rw1[a]==0)&&(cl4[a]==0)&&(pd4[a]==0)&&(pb4[a]==0)){
        nm[4]=a;
        rw1[a]=1; cl4[a]=1; pd4[a]=1; pb4[a]=1;
```

```
        stp05();
        rw1[a]=0; cl4[a]=0; pd4[a]=0; pb4[a]=0;
  }}
}
/* Set n5 */
void stp05(){
 short a;
  for(a=0;a<5;a++){
    if((rw1[a]==0)&&(cl5[a]==0)&&(pd5[a]==0)&&(pb5[a]==0)){
        nm[5]=a;
        rw1[a]=1; cl5[a]=1; pd5[a]=1; pb5[a]=1;
        stp06();
        rw1[a]=0; cl5[a]=0; pd5[a]=0; pb5[a]=0;
  }}
}
/* Level 2: */
/* Set n6 */
void stp06(){
 short a;
  for(a=0;a<5;a++){
    if((rw2[a]==0)&&(cl1[a]==0)&&(pd5[a]==0)&&(pb2[a]==0)){
        nm[6]=a;
        rw2[a]=1; cl1[a]=1; pd5[a]=1; pb2[a]=1;
        stp07();
        rw2[a]=0; cl1[a]=0; pd5[a]=0; pb2[a]=0;
  }}
}
/* Set n7 */
void stp07(){
 short a;
  for(a=0;a<5;a++){
    if((rw2[a]==0)&&(cl2[a]==0)&&(pd1[a]==0)&&(pb3[a]==0)){
        nm[7]=a;
        rw2[a]=1; cl2[a]=1; pd1[a]=1; pb3[a]=1;
        stp08();
        rw2[a]=0; cl2[a]=0; pd1[a]=0; pb3[a]=0;
  }}
}
/**/
 . . . . . . . .
/**/
/* Set n25 */
void stp25(){
 short a;
  for(a=0;a<5;a++){
    if((rw5[a]==0)&&(cl5[a]==0)&&(pd1[a]==0)&&(pb4[a]==0)){
      nm[25]=a;
      rw5[a]=1; cl5[a]=1; pd1[a]=1; pb4[a]=1;
      ansrecord();
      rw5[a]=0; cl5[a]=0; pd1[a]=0; pb4[a]=0;
  }}
}
/**/
/* Record the Answers */
void ansrecord(){
 short n;
  tllu[cnt][0]=cnt+1;
  for(n=1;n<26;n++){tllu[cnt][n]=nm[n];}
  if((nm[1]<nm[25])&&(nm[1]<=nm[5])&&(nm[1]<=nm[21])&&(nm[2]>=nm[6])){
```

```
    thlu[cnt2][0]=cnt2+1;
    for(n=1;n<26;n++){thlu[cnt2][n]=nm[n];}
    cnt2++;}
  cnt++;
}
/**/
 . . . . . . . .
```

I could get the set of high layer units smaller into 1/8 of original size.
The next list shows the total result of my recent calculation:

```
** Pan-diagonal Magic Squares of Order 5: **
** Made by 'New Euler's Method' with /D5i **

 [Layer Units]
  [for High]
          1/H          2/H          3/H          4/H          5/H          6/H
   0 2 1 3 4    0 2 1 4 3    0 2 3 1 4    0 2 4 1 3    0 3 1 2 4    0 3 1 2 4
   1 3 4 0 2    1 4 3 0 2    1 4 0 2 3    1 3 0 2 4    1 2 4 0 3    2 4 0 3 1
   4 0 2 1 3    3 0 2 1 4    2 3 1 4 0    2 4 1 3 0    4 0 3 1 2    3 1 2 4 0
   2 1 3 4 0    2 1 4 3 0    4 0 2 3 1    3 0 2 4 1    3 1 2 4 0    4 0 3 1 2
   3 4 0 2 1    4 3 0 2 1    3 1 4 0 2    4 1 3 0 2    2 4 0 3 1    1 2 4 0 3
          7/H          8/H          9/H         10/H         11/H         12/H
   0 3 1 4 2    0 3 2 1 4    0 3 2 1 4    0 3 2 4 1    0 3 4 1 2    0 3 4 2 1
   1 4 2 0 3    1 4 0 3 2    2 1 4 0 3    2 4 1 0 3    1 2 0 3 4    2 1 0 3 4
   2 0 3 1 4    3 2 1 4 0    4 0 3 2 1    1 0 3 2 4    3 4 1 2 0    3 4 2 1 0
   3 1 4 2 0    4 0 3 2 1    3 2 1 4 0    3 2 4 1 0    2 0 3 4 1    1 0 3 4 2
   4 2 0 3 1    2 1 4 0 3    1 4 0 3 2    4 1 0 3 2    4 1 2 0 3    4 2 1 0 3
         13/H         14/H         15/H         16/H         17/H         18/H
   0 4 1 2 3    0 4 1 2 3    0 4 1 3 2    0 4 1 3 2    0 4 2 1 3    0 4 2 1 3
   1 2 3 0 4    2 3 0 4 1    1 3 2 0 4    3 2 0 4 1    1 3 0 4 2    2 1 3 0 4
   3 0 4 1 2    4 1 2 3 0    2 0 4 1 3    4 1 3 2 0    4 2 1 3 0    3 0 4 2 1
   4 1 2 3 0    3 0 4 1 2    4 1 3 2 0    2 0 4 1 3    3 0 4 2 1    4 2 1 3 0
   2 3 0 4 1    1 2 3 0 4    3 2 0 4 1    1 3 2 0 4    2 1 3 0 4    1 3 0 4 2
         19/H         20/H         21/H         22/H         23/H         24/H
   0 4 2 3 1    0 4 2 3 1    0 4 3 1 2    0 4 3 1 2    0 4 3 2 1    0 4 3 2 1
   2 3 1 0 4    3 1 0 4 2    1 2 0 4 3    3 1 2 0 4    2 1 0 4 3    3 2 1 0 4
   1 0 4 2 3    4 2 3 1 0    4 3 1 2 0    2 0 4 3 1    4 3 2 1 0    1 0 4 3 2
   4 2 3 1 0    1 0 4 2 3    2 0 4 3 1    4 3 1 2 0    1 0 4 3 2    4 3 2 1 0
   3 1 0 4 2    2 3 1 0 4    3 1 2 0 4    1 2 0 4 3    3 2 1 0 4    2 1 0 4 3
         25/H         26/H         27/H         28/H         29/H         30/H
   1 2 3 0 4    1 2 4 0 3    1 3 2 0 4    1 3 4 0 2    1 4 2 0 3    1 4 3 0 2
   0 4 1 2 3    0 3 1 2 4    0 4 1 3 2    0 2 1 3 4    0 3 1 4 2    0 2 1 4 3
   2 3 0 4 1    2 4 0 3 1    3 2 0 4 1    3 4 0 2 1    4 2 0 3 1    4 3 0 2 1
   4 1 2 3 0    3 1 2 4 0    4 1 3 2 0    2 1 3 4 0    3 1 4 2 0    2 1 4 3 0
   3 0 4 1 2    4 0 3 1 2    2 0 4 1 3    4 0 2 1 3    2 0 3 1 4    3 0 2 1 4

  [for Low]
          1/L          2/L          3/L          4/L          5/L          6/L
   0 1 2 3 4    0 1 2 3 4    0 1 2 4 3    0 1 2 4 3    0 1 3 2 4    0 1 3 2 4
   2 3 4 0 1    3 4 0 1 2    2 4 3 0 1    4 3 0 1 2    2 4 0 1 3    3 2 4 0 1
   4 0 1 2 3    1 2 3 4 0    3 0 1 2 4    1 2 4 3 0    1 3 2 4 0    4 0 1 3 2
   1 2 3 4 0    4 0 1 2 3    1 2 4 3 0    3 0 1 2 4    4 0 1 3 2    1 3 2 4 0
   3 4 0 1 2    2 3 4 0 1    4 3 0 1 2    2 4 3 0 1    3 2 4 0 1    2 4 0 1 3
         41/L         42/L         43/L         44/L         45/L         46/L
   0 4 2 1 3    0 4 2 1 3    0 4 2 3 1    0 4 2 3 1    0 4 3 1 2    0 4 3 1 2
   1 3 0 4 2    2 1 3 0 4    2 3 1 0 4    3 1 0 4 2    1 2 0 4 3    3 1 2 0 4
   4 2 1 3 0    3 0 4 2 1    1 0 4 2 3    4 2 3 1 0    4 3 1 2 0    2 0 4 3 1
   3 0 4 2 1    4 2 1 3 0    4 2 3 1 0    1 0 4 2 3    2 0 4 3 1    4 3 1 2 0
   2 1 3 0 4    1 3 0 4 2    3 1 0 4 2    2 3 1 0 4    3 1 2 0 4    1 2 0 4 3
```

```
       81/L        82/L        83/L        84/L        85/L        86/L
   1 3 4 0 2   1 3 4 0 2   1 3 4 2 0   1 3 4 2 0   1 4 0 2 3   1 4 0 2 3
   0 2 1 3 4   4 0 2 1 3   2 0 1 3 4   4 2 0 1 3   0 2 3 1 4   2 3 1 4 0
   3 4 0 2 1   2 1 3 4 0   3 4 2 0 1   0 1 3 4 2   3 1 4 0 2   4 0 2 3 1
   2 1 3 4 0   3 4 0 2 1   0 1 3 4 2   3 4 2 0 1   4 0 2 3 1   3 1 4 0 2
   4 0 2 1 3   0 2 1 3 4   4 2 0 1 3   2 0 1 3 4   2 3 1 4 0   0 2 3 1 4
      121/L       122/L       123/L       124/L       125/L       126/L
   2 3 0 1 4   2 3 0 1 4   2 3 0 4 1   2 3 0 4 1   2 3 1 0 4   2 3 1 0 4
   0 1 4 2 3   1 4 2 3 0   0 4 1 2 3   4 1 2 3 0   0 4 2 3 1   1 0 4 2 3
   4 2 3 0 1   3 0 1 4 2   1 2 3 0 4   3 0 4 1 2   3 1 0 4 2   4 2 3 1 0
   3 0 1 4 2   4 2 3 0 1   3 0 4 1 2   1 2 3 0 4   4 2 3 1 0   3 1 0 4 2
   1 4 2 3 0   0 1 4 2 3   4 1 2 3 0   0 4 1 2 3   1 0 4 2 3   0 4 2 3 1
      161/L       162/L       163/L       164/L       165/L       166/L
   3 1 2 0 4   3 1 2 0 4   3 1 2 4 0   3 1 2 4 0   3 1 4 0 2   3 1 4 0 2
   0 4 3 1 2   2 0 4 3 1   2 4 0 3 1   4 0 3 1 2   0 2 3 1 4   4 0 2 3 1
   1 2 0 4 3   4 3 1 2 0   0 3 1 2 4   1 2 4 0 3   1 4 0 2 3   2 3 1 4 0
   4 3 1 2 0   1 2 0 4 3   1 2 4 0 3   0 3 1 2 4   2 3 1 4 0   1 4 0 2 3
   2 0 4 3 1   0 4 3 1 2   4 0 3 1 2   2 4 0 3 1   4 0 2 3 1   0 2 3 1 4
      201/L       202/L       203/L       204/L       205/L       206/L
   4 0 3 1 2   4 0 3 1 2   4 0 3 2 1   4 0 3 2 1   4 1 0 2 3   4 1 0 2 3
   1 2 4 0 3   3 1 2 4 0   2 1 4 0 3   3 2 1 4 0   0 2 3 4 1   2 3 4 1 0
   0 3 1 2 4   2 4 0 3 1   0 3 2 1 4   1 4 0 3 2   3 4 1 0 2   1 0 2 3 4
   2 4 0 3 1   0 3 1 2 4   1 4 0 3 2   0 3 2 1 4   1 0 2 3 4   3 4 1 0 2
   3 1 2 4 0   1 2 4 0 3   3 2 1 4 0   2 1 4 0 3   2 3 4 1 0   0 2 3 4 1
```

[Count of Layer Units = 30H/240L]

## [Reference Table for the Best Combination]

| SC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 25 | 5 | 15 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 15 |
| 2 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 25 | 5 | 5 | 10 | 15 | 5 | 5 | 15 | 5 | 10 |
| 3 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 15 | 5 | 10 | 25 | 5 | 5 | 15 | 15 | 5 | 10 | 5 |
| 4 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 15 | 15 | 5 | 5 | 10 | 25 | 5 | 15 | 5 |
| 5 | 10 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 7 | 5 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 |
| 8 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 |
| 9 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 |
| 10 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 5 | 10 |
| 11 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 |
| 12 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 |
| 13 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 |
| 14 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 |
| 15 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 15 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 |
| 16 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 17 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 |
| 18 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 |
| 19 | 15 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 15 |
| 20 | 5 | 15 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 |
| 21 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 10 | 5 | 5 | 5 |
| 22 | 5 | 5 | 5 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 5 |
| 23 | 5 | 5 | 5 | 5 | 15 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 |
| 24 | 5 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 10 |
| 25 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 10 | 5 | 15 | 15 | 5 | 5 | 10 | 5 | 5 | 5 | 5 |
| 26 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 15 | 5 | 10 | 5 |
| 27 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 5 | 0 | 5 |
| 28 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 29 | 5 | 5 | 5 | 10 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 10 | 5 | 5 | 5 | 5 |
| 30 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 10 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 0 | 5 | 0 | 5 |

| #2 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 15 | 5 | 25 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 15 |
| 2 | 10 | 5 | 15 | 5 | 5 | 15 | 10 | 5 | 5 | 25 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 |
| 3 | 5 | 10 | 5 | 15 | 15 | 5 | 5 | 25 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 |
| 4 | 5 | 15 | 5 | 25 | 10 | 5 | 5 | 15 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 10 |
| 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 |
| 7 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 5 |
| 8 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 |
| 9 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 15 |
| 10 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 |
| 11 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 12 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 |
| 13 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 |
| 14 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 |
| 15 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 15 | 15 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 |
| 16 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 15 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 17 | 5 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 15 | 5 | 10 | 5 |
| 18 | 10 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 5 | 10 |
| 19 | 15 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 15 |
| 20 | 5 | 15 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 15 | 5 |
| 21 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 5 | 5 | 5 | 5 |
| 22 | 5 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 5 | 5 | 5 |
| 23 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 10 | 5 | 5 | 15 | 5 | 5 | 5 | 5 |
| 24 | 10 | 5 | 5 | 5 | 5 | 15 | 10 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 10 | 15 | 5 | 5 | 5 | 5 | 5 |
| 25 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 15 | 15 | 5 | 10 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 |
| 26 | 5 | 10 | 5 | 15 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 0 | 5 | 5 | 0 | 5 |
| 27 | 5 | 0 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 15 | 5 | 10 | 5 |
| 28 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 10 | 5 | 5 | 15 | 5 | 5 | 5 | 10 | 5 | 5 | 5 |
| 29 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 10 | 5 | 5 | 5 |
| 30 | 5 | 0 | 5 | 0 | 5 | 5 | 5 | 5 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 10 | 5 | 5 | 5 | 5 | 5 | 0 | 5 |

## [Compositions: Used Units// List Number#(Sorted)]

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

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

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

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

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

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

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

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

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

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

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

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

| | | | | 1/H | | | | | 16/L | | | | | 26# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 3 | 4 | 0 | 2 | 1 | 4 | 3 | 1 | 13 | 7 | 20 | 24 |
| 1 | 3 | 4 | 0 | 2 | 4 | 3 | 0 | 2 | 1 | 10 | 19 | 21 | 3 | 12 |
| 4 | 0 | 2 | 1 | 3 | 2 | 1 | 4 | 3 | 0 | 23 | 2 | 15 | 9 | 16 |
| 2 | 1 | 3 | 4 | 0 | 3 | 0 | 2 | 1 | 4 | 14 | 6 | 18 | 22 | 5 |
| 3 | 4 | 0 | 2 | 1 | 1 | 4 | 3 | 0 | 2 | 17 | 25 | 4 | 11 | 8 |

| | | | | 1/H | | | | | 26/L | | | | | 49# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 3 | 4 | 0 | 3 | 1 | 2 | 4 | 1 | 14 | 7 | 18 | 25 |
| 1 | 3 | 4 | 0 | 2 | 2 | 4 | 0 | 3 | 1 | 8 | 20 | 21 | 4 | 12 |
| 4 | 0 | 2 | 1 | 3 | 3 | 1 | 2 | 4 | 0 | 24 | 2 | 13 | 10 | 16 |
| 2 | 1 | 3 | 4 | 0 | 4 | 0 | 3 | 1 | 2 | 15 | 6 | 19 | 22 | 3 |
| 3 | 4 | 0 | 2 | 1 | 1 | 2 | 4 | 0 | 3 | 17 | 23 | 5 | 11 | 9 |

| | | | | 1/H | | | | | 28/L | | | | | 50# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 3 | 4 | 0 | 3 | 1 | 4 | 2 | 1 | 14 | 7 | 20 | 23 |
| 1 | 3 | 4 | 0 | 2 | 4 | 2 | 0 | 3 | 1 | 10 | 18 | 21 | 4 | 12 |
| 4 | 0 | 2 | 1 | 3 | 3 | 1 | 4 | 2 | 0 | 24 | 2 | 15 | 8 | 16 |
| 2 | 1 | 3 | 4 | 0 | 2 | 0 | 3 | 1 | 4 | 13 | 6 | 19 | 22 | 5 |
| 3 | 4 | 0 | 2 | 1 | 1 | 4 | 2 | 0 | 3 | 17 | 25 | 3 | 11 | 9 |

| | | | | 1/H | | | | | 38/L | | | | | 73# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 3 | 4 | 0 | 4 | 1 | 2 | 3 | 1 | 15 | 7 | 18 | 24 |
| 1 | 3 | 4 | 0 | 2 | 2 | 3 | 0 | 4 | 1 | 8 | 19 | 21 | 5 | 12 |
| 4 | 0 | 2 | 1 | 3 | 4 | 1 | 2 | 3 | 0 | 25 | 2 | 13 | 9 | 16 |
| 2 | 1 | 3 | 4 | 0 | 3 | 0 | 4 | 1 | 2 | 14 | 6 | 20 | 22 | 3 |
| 3 | 4 | 0 | 2 | 1 | 1 | 2 | 3 | 0 | 4 | 17 | 23 | 4 | 11 | 10 |

| | | | | 1/H | | | | | 40/L | | | | | 74# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 3 | 4 | 0 | 4 | 1 | 3 | 2 | 1 | 15 | 7 | 19 | 23 |
| 1 | 3 | 4 | 0 | 2 | 3 | 2 | 0 | 4 | 1 | 9 | 18 | 21 | 5 | 12 |
| 4 | 0 | 2 | 1 | 3 | 4 | 1 | 3 | 2 | 0 | 25 | 2 | 14 | 8 | 16 |
| 2 | 1 | 3 | 4 | 0 | 2 | 0 | 4 | 1 | 3 | 13 | 6 | 20 | 22 | 4 |
| 3 | 4 | 0 | 2 | 1 | 1 | 3 | 2 | 0 | 4 | 17 | 24 | 3 | 11 | 10 |

| | | | | 5/H | | | | | 2/L | | | | | 97# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 3 | 1 | 2 | 4 | 0 | 1 | 2 | 3 | 4 | 1 | 17 | 8 | 14 | 25 |
| 1 | 2 | 4 | 0 | 3 | 3 | 4 | 0 | 1 | 2 | 9 | 15 | 21 | 2 | 18 |
| 4 | 0 | 3 | 1 | 2 | 1 | 2 | 3 | 4 | 0 | 22 | 3 | 19 | 10 | 11 |
| 3 | 1 | 2 | 4 | 0 | 4 | 0 | 1 | 2 | 3 | 20 | 6 | 12 | 23 | 4 |
| 2 | 4 | 0 | 3 | 1 | 2 | 3 | 4 | 0 | 1 | 13 | 24 | 5 | 16 | 7 |

| | | | | 6/H | | | | | 1/L | | | | | 98# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 3 | 1 | 2 | 4 | 0 | 1 | 2 | 3 | 4 | 1 | 17 | 8 | 14 | 25 |
| 2 | 4 | 0 | 3 | 1 | 2 | 3 | 4 | 0 | 1 | 13 | 24 | 5 | 16 | 7 |
| 3 | 1 | 2 | 4 | 0 | 4 | 0 | 1 | 2 | 3 | 20 | 6 | 12 | 23 | 4 |
| 4 | 0 | 3 | 1 | 2 | 1 | 2 | 3 | 4 | 0 | 22 | 3 | 19 | 10 | 11 |
| 1 | 2 | 4 | 0 | 3 | 3 | 4 | 0 | 1 | 2 | 9 | 15 | 21 | 2 | 18 |

| 5/H | 14/L | 145# | 6/H | 13/L | 146# |
|---|---|---|---|---|---|
| 0 3 1 2 4 | 0 2 1 3 4 | 1 18 7 14 25 | 0 3 1 2 4 | 0 2 1 3 4 | 1 18 7 14 25 |
| 1 2 4 0 3 | 3 4 0 2 1 | 9 15 21 3 17 | 2 4 0 3 1 | 1 3 4 0 2 | 12 24 5 16 8 |
| 4 0 3 1 2 | 2 1 3 4 0 | 23 2 19 10 11 | 3 1 2 4 0 | 4 0 2 1 3 | 20 6 13 22 4 |
| 3 1 2 4 0 | 4 0 2 1 3 | 20 6 13 22 4 | 4 0 3 1 2 | 2 1 3 4 0 | 23 2 19 10 11 |
| 2 4 0 3 1 | 1 3 4 0 2 | 12 24 5 16 8 | 1 2 4 0 3 | 3 4 0 2 1 | 9 15 21 3 17 |

| 5/H | 26/L | 193# | 6/H | 25/L | 194# |
|---|---|---|---|---|---|
| 0 3 1 2 4 | 0 3 1 2 4 | 1 19 7 13 25 | 0 3 1 2 4 | 0 3 1 2 4 | 1 19 7 13 25 |
| 1 2 4 0 3 | 2 4 0 3 1 | 8 15 21 4 17 | 2 4 0 3 1 | 1 2 4 0 3 | 12 23 5 16 9 |
| 4 0 3 1 2 | 3 1 2 4 0 | 24 2 18 10 11 | 3 1 2 4 0 | 4 0 3 1 2 | 20 6 14 22 3 |
| 3 1 2 4 0 | 4 0 3 1 2 | 20 6 14 22 3 | 4 0 3 1 2 | 3 1 2 4 0 | 24 2 18 10 11 |
| 2 4 0 3 1 | 1 2 4 0 3 | 12 23 5 16 9 | 1 2 4 0 3 | 2 4 0 3 1 | 8 15 21 4 17 |

| 5/H | 38/L | 241# | 6/H | 37/L | 242# |
|---|---|---|---|---|---|
| 0 3 1 2 4 | 0 4 1 2 3 | 1 20 7 13 24 | 0 3 1 2 4 | 0 4 1 2 3 | 1 20 7 13 24 |
| 1 2 4 0 3 | 2 3 0 4 1 | 8 14 21 5 17 | 2 4 0 3 1 | 1 2 3 0 4 | 12 23 4 16 10 |
| 4 0 3 1 2 | 4 1 2 3 0 | 25 2 18 9 11 | 3 1 2 4 0 | 3 0 4 1 2 | 19 6 15 22 3 |
| 3 1 2 4 0 | 3 0 4 1 2 | 19 6 15 22 3 | 4 0 3 1 2 | 4 1 2 3 0 | 25 2 18 9 11 |
| 2 4 0 3 1 | 1 2 3 0 4 | 12 23 4 16 10 | 1 2 4 0 3 | 2 3 0 4 1 | 8 14 21 5 17 |

| 13/H | 2/L | 289# | 14/H | 1/L | 290# |
|---|---|---|---|---|---|
| 0 4 1 2 3 | 0 1 2 3 4 | 1 22 8 14 20 | 0 4 1 2 3 | 0 1 2 3 4 | 1 22 8 14 20 |
| 1 2 3 0 4 | 3 4 0 1 2 | 9 15 16 2 23 | 2 3 0 4 1 | 2 3 4 0 1 | 13 19 5 21 7 |
| 3 0 4 1 2 | 1 2 3 4 0 | 17 3 24 10 11 | 4 1 2 3 0 | 4 0 1 2 3 | 25 6 12 18 4 |
| 4 1 2 3 0 | 4 0 1 2 3 | 25 6 12 18 4 | 3 0 4 1 2 | 1 2 3 4 0 | 17 3 24 10 11 |
| 2 3 0 4 1 | 2 3 4 0 1 | 13 19 5 21 7 | 1 2 3 0 4 | 3 4 0 1 2 | 9 15 16 2 23 |

| 13/H | 14/L | 361# | 14/H | 13/L | 362# |
|---|---|---|---|---|---|
| 0 4 1 2 3 | 0 2 1 3 4 | 1 23 7 14 20 | 0 4 1 2 3 | 0 2 1 3 4 | 1 23 7 14 20 |
| 1 2 3 0 4 | 3 4 0 2 1 | 9 15 16 3 22 | 2 3 0 4 1 | 1 3 4 0 2 | 12 19 5 21 8 |
| 3 0 4 1 2 | 2 1 3 4 0 | 18 2 24 10 11 | 4 1 2 3 0 | 4 0 2 1 3 | 25 6 13 17 4 |
| 4 1 2 3 0 | 4 0 2 1 3 | 25 6 13 17 4 | 3 0 4 1 2 | 2 1 3 4 0 | 18 2 24 10 11 |
| 2 3 0 4 1 | 1 3 4 0 2 | 12 19 5 21 8 | 1 2 3 0 4 | 3 4 0 2 1 | 9 15 16 3 22 |

| 13/H | 26/L | 433# | 14/H | 25/L | 434# |
|---|---|---|---|---|---|
| 0 4 1 2 3 | 0 3 1 2 4 | 1 24 7 13 20 | 0 4 1 2 3 | 0 3 1 2 4 | 1 24 7 13 20 |
| 1 2 3 0 4 | 2 4 0 3 1 | 8 15 16 4 22 | 2 3 0 4 1 | 1 2 4 0 3 | 12 18 5 21 9 |
| 3 0 4 1 2 | 3 1 2 4 0 | 19 2 23 10 11 | 4 1 2 3 0 | 4 0 3 1 2 | 25 6 14 17 3 |
| 4 1 2 3 0 | 4 0 3 1 2 | 25 6 14 17 3 | 3 0 4 1 2 | 3 1 2 4 0 | 19 2 23 10 11 |
| 2 3 0 4 1 | 1 2 4 0 3 | 12 18 5 21 9 | 1 2 3 0 4 | 2 4 0 3 1 | 8 15 16 4 22 |

| 13/H | 38/L | 505# | 14/H | 37/L | 506# |
|---|---|---|---|---|---|
| 0 4 1 2 3 | 0 4 1 2 3 | 1 25 7 13 19 | 0 4 1 2 3 | 0 4 1 2 3 | 1 25 7 13 19 |
| 1 2 3 0 4 | 2 3 0 4 1 | 8 14 16 5 22 | 2 3 0 4 1 | 1 2 3 0 4 | 12 18 4 21 10 |
| 3 0 4 1 2 | 4 1 2 3 0 | 20 2 23 9 11 | 4 1 2 3 0 | 3 0 4 1 2 | 24 6 15 17 3 |
| 4 1 2 3 0 | 3 0 4 1 2 | 24 6 15 17 3 | 3 0 4 1 2 | 4 1 2 3 0 | 20 2 23 9 11 |
| 2 3 0 4 1 | 1 2 3 0 4 | 12 18 4 21 10 | 1 2 3 0 4 | 2 3 0 4 1 | 8 14 16 5 22 |

| 1/H | 50/L | 577# | 1/H | 52/L | 578# |
|---|---|---|---|---|---|
| 0 2 1 3 4 | 1 0 2 3 4 | 2 11 8 19 25 | 0 2 1 3 4 | 1 0 2 4 3 | 2 11 8 20 24 |
| 1 3 4 0 2 | 3 4 1 0 2 | 9 20 22 1 13 | 1 3 4 0 2 | 4 3 1 0 2 | 10 19 22 1 13 |
| 4 0 2 1 3 | 0 2 3 4 1 | 21 3 14 10 17 | 4 0 2 1 3 | 0 2 4 3 1 | 21 3 15 9 17 |
| 2 1 3 4 0 | 4 1 0 2 3 | 15 7 16 23 4 | 2 1 3 4 0 | 3 1 0 2 4 | 14 7 16 23 5 |
| 3 4 0 2 1 | 2 3 4 1 0 | 18 24 5 12 6 | 3 4 0 2 1 | 2 4 3 1 0 | 18 25 4 12 6 |

| 1/H | 98/L | 1153# | 1/H | 100/L | 1154# |
|---|---|---|---|---|---|
| 0 2 1 3 4 | 2 0 1 3 4 | 3 11 7 19 25 | 0 2 1 3 4 | 2 0 1 4 3 | 3 11 7 20 24 |
| 1 3 4 0 2 | 3 4 2 0 1 | 9 20 23 1 12 | 1 3 4 0 2 | 4 3 2 0 1 | 10 19 23 1 12 |
| 4 0 2 1 3 | 0 1 3 4 2 | 21 2 14 10 18 | 4 0 2 1 3 | 0 1 4 3 2 | 21 2 15 9 18 |
| 2 1 3 4 0 | 4 2 0 1 3 | 15 8 16 22 4 | 2 1 3 4 0 | 3 2 0 1 4 | 14 8 16 22 5 |
| 3 4 0 2 1 | 1 3 4 2 0 | 17 24 5 13 6 | 3 4 0 2 1 | 1 4 3 2 0 | 17 25 4 13 6 |

```
       1/H      146/L          1729#        1/H      148/L          1730#
0 2 1 3 4  3 0 1 2 4   4 11  7 18 25   0 2 1 3 4  3 0 1 4 2   4 11  7 20 23
1 3 4 0 2  2 4 3 0 1   8 20 24  1 12   1 3 4 0 2  4 2 3 0 1  10 18 24  1 12
4 0 2 1 3  0 1 2 4 3  21  2 13 10 19   4 0 2 1 3  0 1 4 2 3  21  2 15  8 19
2 1 3 4 0  4 3 0 1 2  15  9 16 22  3   2 1 3 4 0  2 3 0 1 4  13  9 16 22  5
3 4 0 2 1  1 2 4 3 0  17 23  5 14  6   3 4 0 2 1  1 4 2 3 0  17 25  3 14  6
       1/H      194/L          2305#        1/H      196/L          2306#
0 2 1 3 4  4 0 1 2 3   5 11  7 18 24   0 2 1 3 4  4 0 1 3 2   5 11  7 19 23
1 3 4 0 2  2 3 4 0 1   8 19 25  1 12   1 3 4 0 2  3 2 4 0 1   9 18 25  1 12
4 0 2 1 3  0 1 2 3 4  21  2 13  9 20   4 0 2 1 3  0 1 3 2 4  21  2 14  8 20
2 1 3 4 0  3 4 0 1 2  14 10 16 22  3   2 1 3 4 0  2 4 0 1 3  13 10 16 22  4
3 4 0 2 1  1 2 3 4 0  17 23  4 15  6   3 4 0 2 1  1 3 2 4 0  17 24  3 15  6
      25/H        1/L          2881#       25/H        3/L          2882#
1 2 3 0 4  0 1 2 3 4   6 12 18  4 25   1 2 3 0 4  0 1 2 4 3   6 12 18  5 24
0 4 1 2 3  2 3 4 0 1   3 24 10 11 17   0 4 1 2 3  2 4 3 0 1   3 25  9 11 17
2 3 0 4 1  4 0 1 2 3  15 16  2 23  9   2 3 0 4 1  3 0 1 2 4  14 16  2 23 10
4 1 2 3 0  1 2 3 4 0  22  8 14 20  1   4 1 2 3 0  1 2 4 3 0  22  8 15 19  1
3 0 4 1 2  3 4 0 1 2  19  5 21  7 13   3 0 4 1 2  4 3 0 1 2  20  4 21  7 13
      25/H       49/L          3025#       25/H       51/L          3026#
1 2 3 0 4  1 0 2 3 4   7 11 18  4 25   1 2 3 0 4  1 0 2 4 3   7 11 18  5 24
0 4 1 2 3  2 3 4 1 0   3 24 10 12 16   0 4 1 2 3  2 4 3 1 0   3 25  9 12 16
2 3 0 4 1  4 1 0 2 3  15 17  1 23  9   2 3 0 4 1  3 1 0 2 4  14 17  1 23 10
4 1 2 3 0  0 2 3 4 1  21  8 14 20  2   4 1 2 3 0  0 2 4 3 1  21  8 15 19  2
3 0 4 1 2  3 4 1 0 2  19  5 22  6 13   3 0 4 1 2  4 3 1 0 2  20  4 22  6 13
      25/H       97/L          3169#       25/H       99/L          3170#
1 2 3 0 4  2 0 1 3 4   8 11 17  4 25   1 2 3 0 4  2 0 1 4 3   8 11 17  5 24
0 4 1 2 3  1 3 4 2 0   2 24 10 13 16   0 4 1 2 3  1 4 3 2 0   2 25  9 13 16
2 3 0 4 1  4 2 0 1 3  15 18  1 22  9   2 3 0 4 1  3 2 0 1 4  14 18  1 22 10
4 1 2 3 0  0 1 3 4 2  21  7 14 20  3   4 1 2 3 0  0 1 4 3 2  21  7 15 19  3
3 0 4 1 2  3 4 2 0 1  19  5 23  6 12   3 0 4 1 2  4 3 2 0 1  20  4 23  6 12
      25/H      145/L          3313#       25/H      147/L          3314#
1 2 3 0 4  3 0 1 2 4   9 11 17  3 25   1 2 3 0 4  3 0 1 4 2   9 11 17  5 23
0 4 1 2 3  1 2 4 3 0   2 23 10 14 16   0 4 1 2 3  1 4 2 3 0   2 25  8 14 16
2 3 0 4 1  4 3 0 1 2  15 19  1 22  8   2 3 0 4 1  2 3 0 1 4  13 19  1 22 10
4 1 2 3 0  0 1 2 4 3  21  7 13 20  4   4 1 2 3 0  0 1 4 2 3  21  7 15 18  4
3 0 4 1 2  2 4 3 0 1  18  5 24  6 12   3 0 4 1 2  4 2 3 0 1  20  3 24  6 12
      25/H      193/L          3457#       25/H      195/L          3458#
1 2 3 0 4  4 0 1 2 3  10 11 17  3 24   1 2 3 0 4  4 0 1 3 2  10 11 17  4 23
0 4 1 2 3  1 2 3 4 0   2 23  9 15 16   0 4 1 2 3  1 3 2 4 0   2 24  8 15 16
2 3 0 4 1  3 4 0 1 2  14 20  1 22  8   2 3 0 4 1  2 4 0 1 3  13 20  1 22  9
4 1 2 3 0  0 1 2 3 4  21  7 13 19  5   4 1 2 3 0  0 1 3 2 4  21  7 14 18  5
3 0 4 1 2  2 3 4 0 1  18  4 25  6 12   3 0 4 1 2  3 2 4 0 1  19  3 25  6 12
[Count = 3600]  OK!
```

I must mention now that I used the sort program before listing out the solutions to rearrange them, and made the list smarter so that you could read it easier.

3600 solutions composed here are just the same with the ones we have got before.
It makes me happy, because it means the verification of our “Knight’s Movement”.
How fast this program could run! Down-sizing of high layer unit set really makes our program run faster, because it surely saves a lot of memories in our computer.

I must report here about those 16 Simultaneous MS55 made by the same method.

*** Simultaneous Magic Squares of Order 5: ***
** Both Self-Complementary and Pan-diagonal **
*** Made by 'New Euler's Method' with /D5i ***

[Layer Units]

| 1/ | 2/ | 3/ | 4/ | 5/ | 6/ | 7/ | 8/ |
|---|---|---|---|---|---|---|---|
| 02413 | 02431 | 04123 | 04321 | 12304 | 12340 | 13024 | 13420 |
| 41302 | 43102 | 23041 | 21043 | 30412 | 34012 | 24130 | 20134 |
| 30241 | 10243 | 41230 | 43210 | 41230 | 01234 | 30241 | 34201 |
| 24130 | 24310 | 30412 | 10432 | 23041 | 23401 | 41302 | 01342 |
| 13024 | 31024 | 12304 | 32104 | 04123 | 40123 | 02413 | 42013 |

| 9/ | 10/ | 11/ | 12/ | 13/ | 14/ | 15/ | 16/ |
|---|---|---|---|---|---|---|---|
| 31024 | 31420 | 32104 | 32140 | 40123 | 40321 | 42013 | 42031 |
| 24310 | 20314 | 10432 | 14032 | 23401 | 21403 | 01342 | 03142 |
| 10243 | 14203 | 43210 | 03214 | 01234 | 03214 | 34201 | 14203 |
| 43102 | 03142 | 21043 | 21403 | 34012 | 14032 | 20134 | 20314 |
| 02431 | 42031 | 04321 | 40321 | 12340 | 32140 | 13420 | 31420 |

[Count of Layer Units = 16]

** Reference Tables for the Best Combination **

| SC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 |
| 2 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 |
| 3 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 |
| 4 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 |
| 5 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 |
| 6 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 |
| 7 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 |
| 8 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 |
| 9 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 |
| 10 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 |
| 11 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 |
| 12 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 |
| 13 | 5 | 5 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 | 5 | 5 |
| 14 | 5 | 5 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 | 5 | 5 |
| 15 | 15 | 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 15 |
| 16 | 25 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 25 |

[Compositions: Used Units// List Number#(Sorted)]

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

```
         4/H        5/L              7#         4/H        6/L              8#
 0 4 3 2 1  1 2 3 0 4   2 23 19 11 10   0 4 3 2 1  1 2 3 4 0   2 23 19 15  6
 2 1 0 4 3  3 0 4 1 2  14  6  5 22 18   2 1 0 4 3  3 4 0 1 2  14 10  1 22 18
 4 3 2 1 0  4 1 2 3 0  25 17 13  9  1   4 3 2 1 0  0 1 2 3 4  21 17 13  9  5
 1 0 4 3 2  2 3 0 4 1   8  4 21 20 12   1 0 4 3 2  2 3 4 0 1   8  4 25 16 12
 3 2 1 0 4  0 4 1 2 3  16 15  7  3 24   3 2 1 0 4  4 0 1 2 3  20 11  7  3 24
         2/H        9/L              9#         2/H       10/L             10#
 0 2 4 3 1  3 1 0 2 4   4 12 21 18 10   0 2 4 3 1  3 1 4 2 0   4 12 25 18  6
 4 3 1 0 2  2 4 3 1 0  23 20  9  2 11   4 3 1 0 2  2 0 3 1 4  23 16  9  2 15
 1 0 2 4 3  1 0 2 4 3   7  1 13 25 19   1 0 2 4 3  1 4 2 0 3   7  5 13 21 19
 2 4 3 1 0  4 3 1 0 2  15 24 17  6  3   2 4 3 1 0  0 3 1 4 2  11 24 17 10  3
 3 1 0 2 4  0 2 4 3 1  16  8  5 14 22   3 1 0 2 4  4 2 0 3 1  20  8  1 14 22
         4/H       11/L             11#         4/H       12/L             12#
 0 4 3 2 1  3 2 1 0 4   4 23 17 11 10   0 4 3 2 1  3 2 1 4 0   4 23 17 15  6
 2 1 0 4 3  1 0 4 3 2  12  6  5 24 18   2 1 0 4 3  1 4 0 3 2  12 10  1 24 18
 4 3 2 1 0  4 3 2 1 0  25 19 13  7  1   4 3 2 1 0  0 3 2 1 4  21 19 13  7  5
 1 0 4 3 2  2 1 0 4 3   8  2 21 20 14   1 0 4 3 2  2 1 4 0 3   8  2 25 16 14
 3 2 1 0 4  0 4 3 2 1  16 15  9  3 22   3 2 1 0 4  4 0 3 2 1  20 11  9  3 22
         2/H       13/L             13#         2/H       14/L             14#
 0 2 4 3 1  4 0 1 2 3   5 11 22 18  9   0 2 4 3 1  4 0 3 2 1   5 11 24 18  7
 4 3 1 0 2  2 3 4 0 1  23 19 10  1 12   4 3 1 0 2  2 1 4 0 3  23 17 10  1 14
 1 0 2 4 3  0 1 2 3 4   6  2 13 24 20   1 0 2 4 3  0 3 2 1 4   6  4 13 22 20
 2 4 3 1 0  3 4 0 1 2  14 25 16  7  3   2 4 3 1 0  1 4 0 3 2  12 25 16  9  3
 3 1 0 2 4  1 2 3 4 0  17  8  4 15 21   3 1 0 2 4  3 2 1 4 0  19  8  2 15 21
         4/H       15/L             15#         4/H       16/L             16#
 0 4 3 2 1  4 2 0 1 3   5 23 16 12  9   0 4 3 2 1  4 2 0 3 1   5 23 16 14  7
 2 1 0 4 3  0 1 3 4 2  11  7  4 25 18   2 1 0 4 3  0 3 1 4 2  11  9  2 25 18
 4 3 2 1 0  3 4 2 0 1  24 20 13  6  2   4 3 2 1 0  1 4 2 0 3  22 20 13  6  4
 1 0 4 3 2  2 0 1 3 4   8  1 22 19 15   1 0 4 3 2  2 0 3 1 4   8  1 24 17 15
 3 2 1 0 4  1 3 4 2 0  17 14 10  3 21   3 2 1 0 4  3 1 4 2 0  19 12 10  3 21
[Count = 16]  OK!
```

### 4. How about Simultaneous Magic Squares 7x7: Both S-C & P-D Type?

Can we make Simultaneous MS77 both Self-Complementary and Pan-Diagonal by this new method of Base 7? I prepared the following basic form and basic conditions for our object. First of all let's compose two sets of layer units high and low decomposed by PNS of Base 7.

```
 ***  Basic Diagram for Simultaneous MS77  ***
 ** with Basic Conditions and Pan-Diagonals **
                  .--------------------.
  3  4  5  6  7|  1|  2|  3|  4|  5|  6|  7|  1  2  3  4  5
               |--+--+--+--+--+--+--|
 10 11 12 13 14|  8|  9|10|11|12|13|14|  8  9 10 11 12
               |--+--+--+--+--+--+--|
 17 18 19 20 21|15|16|17|18|19|20|21|15 16 17 18 19
               |--+--+--+--+--+--+--|
 24 25 26 27 28|22|23|24|25|26|27|28|22 23 24 25 26
               |--+--+--+--+--+--+--|
 31 32 33 34 35|29|30|31|32|33|34|35|29 30 31 32 33
               |--+--+--+--+--+--+--|
 38 39 40 41 42|36|37|38|39|40|41|42|36 37 38 39 40
               |--+--+--+--+--+--+--|
 45 46 47 48 49|43|44|45|46|47|48|49|43 44 45 46 47
               '--------------------'
```

```
** Basic Conditions: **
n1+n2+n3+n4+n5+n6+n7=C          ... rw1;  n1+n8+n15+n22+n29+n36+n43=C  ... cl1;
n8+n9+n10+n11+n12+n13+n14=C     ... rw2;  n2+n9+n16+n23+n30+n37+n44=C  ... cl2;
n15+n16+n17+n18+n19+n20+n21=C ... rw3;  n3+n10+n17+n24+n31+n38+n45=C ... cl3;
n22+n23+n24+n25+n26+n27+n28=C ... rw4;  n4+n11+n18+n25+n32+n39+n46=C ... cl4;
n29+n30+n31+n32+n33+n34+n35=C ... rw5;  n5+n12+n19+n26+n33+n40+n47=C ... cl5;
n36+n37+n38+n39+n40+n41+n42=C ... rw6;  n6+n13+n20+n27+n34+n41+n48=C ... cl6;
n43+n44+n45+n46+n47+n48+n49=C ... rw7;  n7+n14+n21+n28+n35+n42+n49=C ... cl7;

** Pan-diagonal Conditions: **
n1+n9+n17+n25+n33+n41+n49=C   ... pd1;  n1+n14+n20+n26+n32+n38+n44=C ... pb1;
n2+n10+n18+n26+n34+n42+n43=C  ... pd2;  n2+n8+n21+n27+n33+n39+n45=C  ... pb2;
n3+n11+n19+n27+n35+n36+n44=C  ... pd3;  n3+n9+n15+n28+n34+n40+n46=C  ... pb3;
n4+n12+n20+n28+n29+n37+n45=C  ... pd4;  n4+n10+n16+n22+n35+n41+n47=C ... pb4;
n5+n13+n21+n22+n30+n38+n46=C  ... pd5;  n5+n11+n17+n23+n29+n42+n48=C ... pb5;
n6+n14+n15+n23+n31+n39+n47=C  ... pd6;  n6+n12+n18+n24+n30+n36+n49=C ... pb6;
n7+n8+n16+n24+n32+n40+n48=C   ... pd7;  n7+n13+n19+n25+n31+n37+n43=C ... pb7;

** Self-complementary Conditions: **
  n1+n49=n2+n48=n3+n47=n4+n46=n5+n45=n6+n44=n7+n43=n8+n42=n9+n41
 =n10+n40=n11+n39=n12+n38=n13+n37=n14+n36=n15+n35=n16+n34=n17+n33
 =n18+n32=n19+n31=n20+n30=n21+n29=n22+n28=n23+n27=n24+n26=C=50
```

The next list shows part of my computer program dictated recently for our object. If you want to have the whole list of it, please click at the file end to get that.

```
/**/
/** Core Part of 'CES7Sml.c' **/
/**/
#include <stdio.h>
/**/
short int cnt, bcnt, cnt2, cnt3;
short CC;
short u1, u2;
short nm[50], flg[50];
short anm[4][53];
short tn[3457][53];
char thlu[25][50], tllu[193][50];
char mtc[25][193];
/**/
short rw1[7], cl1[7], pd1[7], pb1[7];
short rw2[7], cl2[7], pd2[7], pb2[7];
short rw3[7], cl3[7], pd3[7], pb3[7];
short rw4[7], cl4[7], pd4[7], pb4[7];
short rw5[7], cl5[7], pd5[7], pb5[7];
short rw6[7], cl6[7], pd6[7], pb6[7];
short rw7[7], cl7[7], pd7[7], pb7[7];
/**/
/* Main Program */
int main(){
 short n;
  printf("\n*** 'Complete Euler Squares' of Order 7 for Simultaneous Magic Squares:  ***\n");
  printf("** Both Self-Complementary and Pan-diagonal built by 'New Euler's Method' **\n");
  for(n=0;n<50;n++){nm[n]=0;}
  for(n=0;n<7;n++){
     rw1[n]=0; cl1[n]=0; pd1[n]=0; pb1[n]=0;
     rw2[n]=0; cl2[n]=0; pd2[n]=0; pb2[n]=0;
     rw3[n]=0; cl3[n]=0; pd3[n]=0; pb3[n]=0;
     rw4[n]=0; cl4[n]=0; pd4[n]=0; pb4[n]=0;
     rw5[n]=0; cl5[n]=0; pd5[n]=0; pb5[n]=0;
     rw6[n]=0; cl6[n]=0; pd6[n]=0; pb6[n]=0;
     rw7[n]=0; cl7[n]=0; pd7[n]=0; pb7[n]=0;
```

```
  }
  CC=6; cnt=0; bcnt=0; cnt3=0;
  nm[25]=3; rw4[3]=1; cl4[3]=1; pd1[3]=1; pb7[3]=1;
  stp01();           /* Make the Layer Units */
  rw4[3]=0; cl4[3]=0; pd1[3]=0; pb7[3]=0;
  printf("\n [Layer Units]\n");
  prlunit();         /* Print the Layer Units */
  cnt=0;
  printf("\n [Compositions of Simultaneous MS77]\n");
  cmbcmp();          /* Combine and Compose */
  solsort(cnt);      /* Sort the Solutions */
  solprint(1,cnt);   /* Print the Solution List */
  if(cnt3==1){pr1sol();} /* Print The Rest One */
  printf(" [Count = %d]\n",cnt);
  printf("  OK!\n");
 return 0;
}
/* Make the Layer Units */
/* Set n1 & n49 */
void stp01(){
 short a,b;
  for(a=0;a<7;a++){b=CC-a;
    if((rw1[a]==0)&&(cl1[a]==0)&&(pd1[a]==0)&&(pb1[a]==0)){
     if((rw7[b]==0)&&(cl7[b]==0)&&(pd1[b]==0)&&(pb6[b]==0)){
      nm[1]=a; nm[49]=b;
      rw1[a]=1; cl1[a]=1; pd1[a]=1; pb1[a]=1;
      rw7[b]=1; cl7[b]=1; pd1[b]=1; pb6[b]=1;
      stp02();
      rw1[a]=0; cl1[a]=0; pd1[a]=0; pb1[a]=0;
      rw7[b]=0; cl7[b]=0; pd1[b]=0; pb6[b]=0;
  }}}
}
/* Set n2 & n48 */
void stp02(){
 short a,b;
  for(a=0;a<7;a++){b=CC-a;
    if((rw1[a]==0)&&(cl2[a]==0)&&(pd2[a]==0)&&(pb2[a]==0)){
     if((rw7[b]==0)&&(cl6[b]==0)&&(pd7[b]==0)&&(pb5[b]==0)){
      nm[2]=a; nm[48]=b;
      rw1[a]=1; cl2[a]=1; pd2[a]=1; pb2[a]=1;
      rw7[b]=1; cl6[b]=1; pd7[b]=1; pb5[b]=1;
      stp03();
      rw1[a]=0; cl2[a]=0; pd2[a]=0; pb2[a]=0;
      rw7[b]=0; cl6[b]=0; pd7[b]=0; pb5[b]=0;
  }}}
}
/* Set n3 & n47 */
void stp03(){
 short a,b;
  for(a=0;a<7;a++){b=CC-a;
    if((rw1[a]==0)&&(cl3[a]==0)&&(pd3[a]==0)&&(pb3[a]==0)){
     if((rw7[b]==0)&&(cl5[b]==0)&&(pd6[b]==0)&&(pb4[b]==0)){
      nm[3]=a; nm[47]=b;
      rw1[a]=1; cl3[a]=1; pd3[a]=1; pb3[a]=1;
      rw7[b]=1; cl5[b]=1; pd6[b]=1; pb4[b]=1;
      stp04();
      rw1[a]=0; cl3[a]=0; pd3[a]=0; pb3[a]=0;
      rw7[b]=0; cl5[b]=0; pd6[b]=0; pb4[b]=0;
  }}}
}
/* Set n4 & n46 */
void stp04(){
 short a,b;
  for(a=0;a<7;a++){b=CC-a;
```

```
      if((rw1[a]==0)&&(cl4[a]==0)&&(pd4[a]==0)&&(pb4[a]==0)){
       if((rw7[b]==0)&&(cl4[b]==0)&&(pd5[b]==0)&&(pb3[b]==0)){
         nm[4]=a; nm[46]=b;
         rw1[a]=1; cl4[a]=1; pd4[a]=1; pb4[a]=1;
         rw7[b]=1; cl4[b]=1; pd5[b]=1; pb3[b]=1;
         stp05();
         rw1[a]=0; cl4[a]=0; pd4[a]=0; pb4[a]=0;
         rw7[b]=0; cl4[b]=0; pd5[b]=0; pb3[b]=0;
   }}}
}
/* Set n5 & n45 */
void stp05(){
 short a,b;
   for(a=0;a<7;a++){b=CC-a;
      if((rw1[a]==0)&&(cl5[a]==0)&&(pd5[a]==0)&&(pb5[a]==0)){
       if((rw7[b]==0)&&(cl3[b]==0)&&(pd4[b]==0)&&(pb2[b]==0)){
         nm[5]=a; nm[45]=b;
         rw1[a]=1; cl5[a]=1; pd5[a]=1; pb5[a]=1;
         rw7[b]=1; cl3[b]=1; pd4[b]=1; pb2[b]=1;
         stp06();
         rw1[a]=0; cl5[a]=0; pd5[a]=0; pb5[a]=0;
         rw7[b]=0; cl3[b]=0; pd4[b]=0; pb2[b]=0;
   }}}
}
/* Set n6 & n44 */
void stp06(){
 short a,b;
   for(a=0;a<7;a++){b=CC-a;
      if((rw1[a]==0)&&(cl6[a]==0)&&(pd6[a]==0)&&(pb6[a]==0)){
       if((rw7[b]==0)&&(cl2[b]==0)&&(pd3[b]==0)&&(pb1[b]==0)){
         nm[6]=a; nm[44]=b;
         rw1[a]=1; cl6[a]=1; pd6[a]=1; pb6[a]=1;
         rw7[b]=1; cl2[b]=1; pd3[b]=1; pb1[b]=1;
         stp07();
         rw1[a]=0; cl6[a]=0; pd6[a]=0; pb6[a]=0;
         rw7[b]=0; cl2[b]=0; pd3[b]=0; pb1[b]=0;
   }}}
}
/* Set n7 & n43 */
void stp07(){
 short a,b;
   for(a=0;a<7;a++){b=CC-a;
      if((rw1[a]==0)&&(cl7[a]==0)&&(pd7[a]==0)&&(pb7[a]==0)){
       if((rw7[b]==0)&&(cl1[b]==0)&&(pd2[b]==0)&&(pb7[b]==0)){
         nm[7]=a; nm[43]=b;
         rw1[a]=1; cl7[a]=1; pd7[a]=1; pb7[a]=1;
         rw7[b]=1; cl1[b]=1; pd2[b]=1; pb7[b]=1;
         stp08();
         rw1[a]=0; cl7[a]=0; pd7[a]=0; pb7[a]=0;
         rw7[b]=0; cl1[b]=0; pd2[b]=0; pb7[b]=0;
   }}}
}
/* Set n8 & n42 */
void stp08(){
 short a,b;
   for(a=0;a<7;a++){b=CC-a;
      if((rw2[a]==0)&&(cl1[a]==0)&&(pd7[a]==0)&&(pb2[a]==0)){
       if((rw6[b]==0)&&(cl7[b]==0)&&(pd2[b]==0)&&(pb5[b]==0)){
         nm[8]=a; nm[42]=b;
         rw2[a]=1; cl1[a]=1; pd7[a]=1; pb2[a]=1;
         rw6[b]=1; cl7[b]=1; pd2[b]=1; pb5[b]=1;
         stp09();
         rw2[a]=0; cl1[a]=0; pd7[a]=0; pb2[a]=0;
         rw6[b]=0; cl7[b]=0; pd2[b]=0; pb5[b]=0;
```

```
  }}}
}
/**/
  .......
/**/
/* Set n24 & n26 */
void stp24(){
 short a,b;
  for(a=0;a<7;a++){b=CC-a;
    if((rw4[a]==0)&&(cl3[a]==0)&&(pd7[a]==0)&&(pb6[a]==0)){
     if((rw4[b]==0)&&(cl5[b]==0)&&(pd2[b]==0)&&(pb1[b]==0)){
      nm[24]=a; nm[26]=b;
      rw4[a]=1; cl3[a]=1; pd7[a]=1; pb6[a]=1;
      rw4[b]=1; cl5[b]=1; pd2[b]=1; pb1[b]=1;
      lurecord();
      rw4[a]=0; cl3[a]=0; pd7[a]=0; pb6[a]=0;
      rw4[b]=0; cl5[b]=0; pd2[b]=0; pb1[b]=0;
  }}}
}
/**/
/* Record the Layer Units */
void lurecord(){
 short n;
  cnt++;
  tllu[cnt-1][0]=cnt;
  for(n=1;n<50;n++){tllu[cnt-1][n]=nm[n];}
  if((nm[1]<nm[49])&&(nm[1]<=nm[7])&&(nm[7]<=nm[43])){
    cnt2++;
    thlu[cnt2-1][0]=cnt2;
    for(n=1;n<50;n++){thlu[cnt2-1][n]=nm[n];}
  }
}
/**/
  .......
```

We have got 30 layer units for high, and 240 ones for low. Let's combine them, compose solutions and test them.

```
*** 'Complete Euler Squares' of Order 7 for Simultaneous Magic Squares:  ***
** Both Self-Complementary and Pan-diagonal built by 'New Euler's Method' **
 [Layer Units]  [for High]
      1/      2/      3/      4/      5/      6/      7/      8/
  013564  015643  023465  024653  036415  036451  036524  036542
  356420  643201  346510  653102  152036  512036  241036  421036
  642013  201564  651023  102465  364152  364512  365241  365421
  201356  564320  102346  465310  520364  120364  410365  210365
  135642  320156  234651  310246  641520  645120  652410  654210
  564201  156432  465102  246531  203641  203645  103652  103654
  420135  432015  510234  531024  415203  451203  524103  542103
      9/     10/     11/     12/     13/     14/     15/     16/
  042653  043265  051643  053164  064135  064531  065234  065432
  653104  326510  643205  316420  520641  120645  410652  210654
  104265  651043  205164  642053  135206  531206  234106  432106
  265310  104326  164320  205316  641352  645312  652341  654321
  310426  432651  320516  531642  206413  206453  106523  106543
  426531  265104  516432  164205  352064  312064  341065  321065
  531042  510432  432051  420531  413520  453120  523410  543210
     17/     18/     19/     20/     21/     22/     23/     24/
  103654  106543  135406  135460  154036  154630  160543  163054
  365421  543210  062135  602135  621540  021546  543216  305421
  542103  210654  354062  354602  036215  630215  216054  542163
  210365  654321  621354  021354  540362  546302  054321  216305
  036542  321065  540621  546021  215403  215463  321605  630542
  654210  065432  213540  213546  362154  302154  605432  054216
  421036  432106  406213  460213  403621  463021  432160  421630
```

[for Low]

| 1/ | 2/ | 3/ | 4/ | 5/ | 6/ | 7/ | 8/ |
|---|---|---|---|---|---|---|---|
| 013562 | 013564 | 015623 | 015643 | 023461 | 023465 | 024613 | 024653 |
| 356240 | 356420 | 623401 | 643201 | 346150 | 346510 | 613502 | 653102 |
| 624013 | 642013 | 401562 | 201564 | 615023 | 651023 | 502461 | 102465 |
| 401356 | 201356 | 562340 | 564320 | 502346 | 102346 | 461350 | 465310 |
| 135624 | 135642 | 340156 | 320156 | 234615 | 234651 | 350246 | 310246 |
| 562401 | 564201 | 156234 | 156432 | 461502 | 465102 | 246135 | 246531 |
| 240135 | 420135 | 234015 | 432015 | 150234 | 510234 | 135024 | 531024 |

| 49/ | 50/ | 51/ | 52/ | 53/ | 54/ | 55/ | 56/ |
|---|---|---|---|---|---|---|---|
| 142503 | 142563 | 143250 | 143256 | 150234 | 150432 | 152036 | 152630 |
| 503614 | 563014 | 325061 | 325601 | 461502 | 261504 | 641520 | 041526 |
| 614250 | 014256 | 506143 | 560143 | 234615 | 432615 | 036415 | 630415 |
| 250361 | 256301 | 614325 | 014325 | 502346 | 504326 | 520364 | 526304 |
| 361425 | 301425 | 432506 | 432560 | 615023 | 615043 | 415203 | 415263 |
| 425036 | 425630 | 250614 | 256014 | 346150 | 326150 | 364152 | 304152 |
| 036142 | 630142 | 061432 | 601432 | 023461 | 043261 | 203641 | 263041 |

| 97/ | 98/ | 99/ | 100/ | 101/ | 102/ | 103/ | 104/ |
|---|---|---|---|---|---|---|---|
| 403621 | 403625 | 406213 | 406253 | 413520 | 413526 | 415203 | 415263 |
| 362154 | 362514 | 213540 | 253140 | 352064 | 352604 | 203641 | 263041 |
| 215403 | 251403 | 540621 | 140625 | 206413 | 260413 | 641520 | 041526 |
| 540362 | 140362 | 621354 | 625314 | 641352 | 041352 | 520364 | 526304 |
| 036215 | 036251 | 354062 | 314062 | 135206 | 135260 | 364152 | 304152 |
| 621540 | 625140 | 062135 | 062531 | 520641 | 526041 | 152036 | 152630 |
| 154036 | 514036 | 135406 | 531406 | 064135 | 604135 | 036415 | 630415 |

| 145/ | 146/ | 147/ | 148/ | 149/ | 150/ | 151/ | 152/ |
|---|---|---|---|---|---|---|---|
| 531024 | 531042 | 531206 | 531260 | 531406 | 531460 | 531624 | 531642 |
| 246531 | 426531 | 064531 | 604531 | 062531 | 602531 | 240531 | 420531 |
| 310246 | 310426 | 312064 | 312604 | 314062 | 314602 | 316240 | 316420 |
| 465310 | 265310 | 645312 | 045312 | 625314 | 025314 | 405316 | 205316 |
| 102465 | 104265 | 120645 | 126045 | 140625 | 146025 | 162405 | 164205 |
| 653102 | 653104 | 453120 | 453126 | 253140 | 253146 | 053162 | 053164 |
| 024653 | 042653 | 206453 | 260453 | 406253 | 460253 | 624053 | 642053 |

[Count of Layer Units = 24H/192L]

[Reference Table for the Best Combination = 3840]

| #1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1H | 35 | 49 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 35 |
| 2H | 7 | 7 | 35 | 49 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 35 | 7 | 7 |
| 3H | 21 | 21 | 7 | 7 | 35 | 49 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 35 | 7 | 7 | 21 | 21 |
| 4H | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 49 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 35 | 7 | 7 | 21 | 21 | 7 | 7 |
| 5H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 35 | 35 | 49 | 35 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 6H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 35 | 35 | 35 | 49 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 7H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 35 | 21 | 21 | 21 | 21 | 49 | 35 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 8H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 35 | 21 | 21 | 21 | 21 | 35 | 49 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 9H | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 35 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 49 | 7 | 7 | 21 | 21 | 7 | 7 |
| 10H | 21 | 21 | 7 | 7 | 35 | 35 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 35 | 49 | 7 | 7 | 21 | 21 |
| 11H | 7 | 7 | 35 | 35 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 49 | 7 | 7 |
| 12H | 35 | 35 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 35 | 49 |
| 13H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 14H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 15H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 16H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 17H | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 |
| 18H | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 |
| 19H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 21H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 22H | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 23H | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 |
| 24H | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 |

| #2 | 97 | 98 | 99 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1H | 35 | 35 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 49 | 35 |
| 2H | 7 | 7 | 35 | 35 | 7 | 7 | 21 | 21 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 21 | 21 | 7 | 7 | 49 | 35 | 7 | 7 |
| 3H | 21 | 21 | 7 | 7 | 35 | 35 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 49 | 35 | 7 | 7 | 21 | 21 |

```
 4H|  7  7 21 21  7  7 35 35  7  7  7  7  7  7  7  7 49 35  7  7 21 21  7  7
 5H|  7  7  7  7  7  7  7  7 21 21 35 49 35 35 21 21  7  7  7  7  7  7  7  7
 6H|  7  7  7  7  7  7  7  7 21 21 49 35 35 35 21 21  7  7  7  7  7  7  7  7
 7H|  7  7  7  7  7  7  7  7 35 49 21 21 21 21 35 35  7  7  7  7  7  7  7  7
 8H|  7  7  7  7  7  7  7  7 49 35 21 21 21 21 35 35  7  7  7  7  7  7  7  7
 9H|  7  7 21 21  7  7 49 35  7  7  7  7  7  7  7  7 35 35  7  7 21 21  7  7
10H| 21 21  7  7 49 35  7  7  7  7  7  7  7  7  7  7  7  7 35 35  7  7 21 21
11H|  7  7 49 35  7  7 21 21  7  7  7  7  7  7  7  7 21 21  7  7 35 35  7  7
12H| 49 35  7  7 21 21  7  7  7  7  7  7  7  7  7  7  7  7 21 21  7  7 35 35
13H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
14H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
15H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
16H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
17H| 21 21  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7 21 21
18H|  7  7 21 21  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7 21 21  7  7
19H|  7  7  7  7  7  7  7  7  7  7 21 21 21 21  7  7  7  7  7  7  7  7  7  7
20H|  7  7  7  7  7  7  7  7  7  7 21 21 21 21  7  7  7  7  7  7  7  7  7  7
21H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
22H|  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
23H|  7  7 21 21  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7 21 21  7  7
24H| 21 21  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7 21 21
  . . . . . .
```

[Compositions of Simultaneous MS77]

```
   1/H     3/L                     1#
0135642 0156234   1  9 27 42 45 32 19
3564201 6234015  28 38 46 33 15  2 13
6420135 4015623  47 29 16  6 14 24 39
2013564 5623401  20  7 10 25 40 43 30
1356420 3401562  11 26 36 44 34 21  3
5642013 1562340  37 48 35 17  4 12 22
4201356 2340156  31 18  5  8 23 41 49
```

```
   1/H     4/L                     2#
0135642 0156432   1  9 27 42 47 32 17
3564201 6432015  28 40 46 31 15  2 13
6420135 2015643  45 29 16  6 14 26 39
2013564 5643201  20  7 12 25 38 43 30
1356420 3201564  11 24 36 44 34 21  5
5642013 1564320  37 48 35 19  4 10 22
4201356 4320156  33 18  3  8 23 41 49
```

```
   2/H     1/L                     3#
0156432 0135624   1  9 39 48 35 24 19
6432015 3562401  46 34 28 17  5  8 37
2015643 6240135  21  3 12 36 44 32 27
5643201 4013562  40 43 30 25 20  7 10
3201564 1356240  23 18  6 14 38 47 29
1564320 5624013  13 42 45 33 22 16  4
4320156 2401356  31 26 15  2 11 41 49
```

```
   1/H     7/L                     5#
0135642 0246135   1 10 26 42 44 32 20
3564201 6135024  28 37 46 34 15  3 12
6420135 5024613  48 29 17  5 14 23 39
2013564 4613502  19  7  9 25 41 43 31
1356420 3502461  11 27 36 45 33 21  2
5642013 2461350  38 47 35 16  4 13 22
4201356 1350246  30 18  6  8 24 40 49
```

```
   1/H     8/L                     6#
0135642 0246531   1 10 26 42 48 32 16
3564201 6531024  28 41 46 30 15  3 12
6420135 1024653  44 29 17  5 14 27 39
2013564 4653102  19  7 13 25 37 43 31
1356420 3102465  11 23 36 45 33 21  6
5642013 2465310  38 47 35 20  4  9 22
4201356 5310246  34 18  2  8 24 40 49
```

```
   2/H     5/L                     7#
0156432 0234615   1 10 39 47 35 23 20
6432015 3461502  46 33 28 16  6  8 38
2015643 6150234  21  2 13 36 45 32 26
5643201 5023461  41 43 31 25 19  7  9
3201564 2346150  24 18  5 14 37 48 29
1564320 4615023  12 42 44 34 22 17  4
4320156 1502346  30 27 15  3 11 40 49
```

```
   1/H     9/L                     9#
0135642 0361245   1 11 28 37 45 33 20
3564201 2450361  24 40 48 29 18  7  9
6420135 3612450  46 35 16  3 12 27 36
2013564 4503612  19  6  8 25 42 44 31
1356420 6124503  14 23 38 47 34 15  4
5642013 5036124  41 43 32 21  2 10 26
4201356 1245036  30 17  5 13 22 39 49
```

```
   2/H     9/L                    17#
0156432 0361245   1 11 42 44 31 26 20
6432015 2450361  45 33 27 15  4 14 37
2015643 3612450  18  7  9 38 47 34 22
5643201 4503612  40 48 29 25 21  2 10
3201564 6124503  28 16  3 12 41 43 32
1564320 5036124  13 36 46 35 23 17  5
4320156 1245036  30 24 19  6  8 39 49
```

| 1/H | 17/L | | | | | | | 25# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 0426135 | 1 | 12 | 24 | 42 | 44 | 32 | 20 |
| 3564201 | 6135042 | 28 | 37 | 46 | 34 | 15 | 5 | 10 |
| 6420135 | 5042613 | 48 | 29 | 19 | 3 | 14 | 23 | 39 |
| 2013564 | 2613504 | 17 | 7 | 9 | 25 | 41 | 43 | 33 |
| 1356420 | 3504261 | 11 | 27 | 36 | 47 | 31 | 21 | 2 |
| 5642013 | 4261350 | 40 | 45 | 35 | 16 | 4 | 13 | 22 |
| 4201356 | 1350426 | 30 | 18 | 6 | 8 | 26 | 38 | 49 |

| 2/H | 19/L | | | | | | | 27# |
|---|---|---|---|---|---|---|---|---|
| 0156432 | 0432615 | 1 | 12 | 39 | 45 | 35 | 23 | 20 |
| 6432015 | 3261504 | 46 | 31 | 28 | 16 | 6 | 8 | 40 |
| 2015643 | 6150432 | 21 | 2 | 13 | 36 | 47 | 32 | 24 |
| 5643201 | 5043261 | 41 | 43 | 33 | 25 | 17 | 7 | 9 |
| 3201564 | 4326150 | 26 | 18 | 3 | 14 | 37 | 48 | 29 |
| 1564320 | 2615043 | 10 | 42 | 44 | 34 | 22 | 19 | 4 |
| 4320156 | 1504326 | 30 | 27 | 15 | 5 | 11 | 38 | 49 |

| 1/H | 21/L | | | | | | | 29# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 0516234 | 1 | 13 | 23 | 42 | 45 | 32 | 19 |
| 3564201 | 6234051 | 28 | 38 | 46 | 33 | 15 | 6 | 9 |
| 6420135 | 4051623 | 47 | 29 | 20 | 2 | 14 | 24 | 39 |
| 2013564 | 1623405 | 16 | 7 | 10 | 25 | 40 | 43 | 34 |
| 1356420 | 3405162 | 11 | 26 | 36 | 48 | 30 | 21 | 3 |
| 5642013 | 5162340 | 41 | 44 | 35 | 17 | 4 | 12 | 22 |
| 4201356 | 2340516 | 31 | 18 | 5 | 8 | 27 | 37 | 49 |

| 1/H | 25/L | | | | | | | 33# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 0612345 | 1 | 14 | 23 | 38 | 46 | 33 | 20 |
| 3564201 | 4506123 | 26 | 41 | 43 | 35 | 16 | 3 | 11 |
| 6420135 | 2345061 | 45 | 32 | 19 | 6 | 8 | 28 | 37 |
| 2013564 | 6123450 | 21 | 2 | 10 | 25 | 40 | 48 | 29 |
| 1356420 | 5061234 | 13 | 22 | 42 | 44 | 31 | 18 | 5 |
| 5642013 | 3450612 | 39 | 47 | 34 | 15 | 7 | 9 | 24 |
| 4201356 | 1234506 | 30 | 17 | 4 | 12 | 27 | 36 | 49 |

| 3/H | 3/L | | | | | | | 49# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0156234 | 1 | 16 | 27 | 35 | 45 | 39 | 12 |
| 3465102 | 6234015 | 28 | 31 | 46 | 40 | 8 | 2 | 20 |
| 6510234 | 4015623 | 47 | 36 | 9 | 6 | 21 | 24 | 32 |
| 1023465 | 5623401 | 13 | 7 | 17 | 25 | 33 | 43 | 37 |
| 2346510 | 3401562 | 18 | 26 | 29 | 44 | 41 | 14 | 3 |
| 4651023 | 1562340 | 30 | 48 | 42 | 10 | 4 | 19 | 22 |
| 5102346 | 2340156 | 38 | 11 | 5 | 15 | 23 | 34 | 49 |

| 3/H | 7/L | | | | | | | 53# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0246135 | 1 | 17 | 26 | 35 | 44 | 39 | 13 |
| 3465102 | 6135024 | 28 | 30 | 46 | 41 | 8 | 3 | 19 |
| 6510234 | 5024613 | 48 | 36 | 10 | 5 | 21 | 23 | 32 |
| 1023465 | 4613502 | 12 | 7 | 16 | 25 | 34 | 43 | 38 |
| 2346510 | 3502461 | 18 | 27 | 29 | 45 | 40 | 14 | 2 |
| 4651023 | 2461350 | 31 | 47 | 42 | 9 | 4 | 20 | 22 |
| 5102346 | 1350246 | 37 | 11 | 6 | 15 | 24 | 33 | 49 |

| 3/H | 9/L | | | | | | | 57# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0361245 | 1 | 18 | 28 | 30 | 45 | 40 | 13 |
| 3465102 | 2450361 | 24 | 33 | 48 | 36 | 11 | 7 | 16 |
| 6510234 | 3612450 | 46 | 42 | 9 | 3 | 19 | 27 | 29 |
| 1023465 | 4503612 | 12 | 6 | 15 | 25 | 35 | 44 | 38 |
| 2346510 | 6124503 | 21 | 23 | 31 | 47 | 41 | 8 | 4 |
| 4651023 | 5036124 | 34 | 43 | 39 | 14 | 2 | 17 | 26 |
| 5102346 | 1245036 | 37 | 10 | 5 | 20 | 22 | 32 | 49 |

| 3/H | 17/L | | | | | | | 73# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0426135 | 1 | 19 | 24 | 35 | 44 | 39 | 13 |
| 3465102 | 6135042 | 28 | 30 | 46 | 41 | 8 | 5 | 17 |
| 6510234 | 5042613 | 48 | 36 | 12 | 3 | 21 | 23 | 32 |
| 1023465 | 2613504 | 10 | 7 | 16 | 25 | 34 | 43 | 40 |
| 2346510 | 3504261 | 18 | 27 | 29 | 47 | 38 | 14 | 2 |
| 4651023 | 4261350 | 33 | 45 | 42 | 9 | 4 | 20 | 22 |
| 5102346 | 1350426 | 37 | 11 | 6 | 15 | 26 | 31 | 49 |

| 3/H | 21/L | | | | | | | 77# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0516234 | 1 | 20 | 23 | 35 | 45 | 39 | 12 |
| 3465102 | 6234051 | 28 | 31 | 46 | 40 | 8 | 6 | 16 |
| 6510234 | 4051623 | 47 | 36 | 13 | 2 | 21 | 24 | 32 |
| 1023465 | 1623405 | 9 | 7 | 17 | 25 | 33 | 43 | 41 |
| 2346510 | 3405162 | 18 | 26 | 29 | 48 | 37 | 14 | 3 |
| 4651023 | 5162340 | 34 | 44 | 42 | 10 | 4 | 19 | 22 |
| 5102346 | 2340516 | 38 | 11 | 5 | 15 | 27 | 30 | 49 |

| 3/H | 25/L | | | | | | | 81# |
|---|---|---|---|---|---|---|---|---|
| 0234651 | 0612345 | 1 | 21 | 23 | 31 | 46 | 40 | 13 |
| 3465102 | 4506123 | 26 | 34 | 43 | 42 | 9 | 3 | 18 |
| 6510234 | 2345061 | 45 | 39 | 12 | 6 | 15 | 28 | 30 |
| 1023465 | 6123450 | 14 | 2 | 17 | 25 | 33 | 48 | 36 |
| 2346510 | 5061234 | 20 | 22 | 35 | 44 | 38 | 11 | 5 |
| 4651023 | 3450612 | 32 | 47 | 41 | 8 | 7 | 16 | 24 |
| 5102346 | 1234506 | 37 | 10 | 4 | 19 | 27 | 29 | 49 |

| 5/H | 1/L | | | | | | | 97# |
|---|---|---|---|---|---|---|---|---|
| 0364152 | 0135624 | 1 | 23 | 46 | 34 | 14 | 38 | 19 |
| 1520364 | 3562401 | 11 | 41 | 21 | 3 | 26 | 43 | 30 |
| 3641520 | 6240135 | 28 | 45 | 33 | 8 | 37 | 18 | 6 |
| 5203641 | 4013562 | 40 | 15 | 2 | 25 | 48 | 35 | 10 |
| 6415203 | 1356240 | 44 | 32 | 13 | 42 | 17 | 5 | 22 |
| 2036415 | 5624013 | 20 | 7 | 24 | 47 | 29 | 9 | 39 |
| 4152036 | 2401356 | 31 | 12 | 36 | 16 | 4 | 27 | 49 |

| 5/H | 5/L | | | | | | | 113# |
|---|---|---|---|---|---|---|---|---|
| 0364152 | 0234615 | 1 | 24 | 46 | 33 | 14 | 37 | 20 |
| 1520364 | 3461502 | 11 | 40 | 21 | 2 | 27 | 43 | 31 |
| 3641520 | 6150234 | 28 | 44 | 34 | 8 | 38 | 18 | 5 |
| 5203641 | 5023461 | 41 | 15 | 3 | 25 | 47 | 35 | 9 |
| 6415203 | 2346150 | 45 | 32 | 12 | 42 | 16 | 6 | 22 |
| 2036415 | 4615023 | 19 | 7 | 23 | 48 | 29 | 10 | 39 |
| 4152036 | 1502346 | 30 | 13 | 36 | 17 | 4 | 26 | 49 |

| 5/H | 17/L | | | | | | | 129# |
|---|---|---|---|---|---|---|---|---|
| 0364152 | 0426135 | 1 | 26 | 45 | 35 | 9 | 39 | 20 |
| 1520364 | 6135042 | 14 | 37 | 18 | 6 | 22 | 47 | 31 |
| 3641520 | 5042613 | 27 | 43 | 33 | 10 | 42 | 16 | 4 |
| 5203641 | 2613504 | 38 | 21 | 2 | 25 | 48 | 29 | 12 |
| 6415203 | 3504261 | 46 | 34 | 8 | 40 | 17 | 7 | 23 |
| 2036415 | 4261350 | 19 | 3 | 28 | 44 | 32 | 13 | 36 |
| 4152036 | 1350426 | 30 | 11 | 41 | 15 | 5 | 24 | 49 |

| 5/H | 21/L | | | | | | | 145# |
|---|---|---|---|---|---|---|---|---|
| 0364152 | 0516234 | 1 | 27 | 44 | 35 | 10 | 39 | 19 |
| 1520364 | 6234051 | 14 | 38 | 18 | 5 | 22 | 48 | 30 |
| 3641520 | 4051623 | 26 | 43 | 34 | 9 | 42 | 17 | 4 |
| 5203641 | 1623405 | 37 | 21 | 3 | 25 | 47 | 29 | 13 |
| 6415203 | 3405162 | 46 | 33 | 8 | 41 | 16 | 7 | 24 |
| 2036415 | 5162340 | 20 | 2 | 28 | 45 | 32 | 12 | 36 |
| 4152036 | 2340516 | 31 | 11 | 40 | 15 | 6 | 23 | 49 |

| 5/H | 25/L | | | | | | | 161# |
|---|---|---|---|---|---|---|---|---|
| 0364152 | 0612345 | 1 | 28 | 44 | 31 | 11 | 40 | 20 |
| 1520364 | 4506123 | 12 | 41 | 15 | 7 | 23 | 45 | 32 |
| 3641520 | 2345061 | 24 | 46 | 33 | 13 | 36 | 21 | 2 |
| 5203641 | 6123450 | 42 | 16 | 3 | 25 | 47 | 34 | 8 |
| 6415203 | 5061234 | 48 | 29 | 14 | 37 | 17 | 4 | 26 |
| 2036415 | 3450612 | 18 | 5 | 27 | 43 | 35 | 9 | 38 |
| 4152036 | 1234506 | 30 | 10 | 39 | 19 | 6 | 22 | 49 |

| 9/H | 1/L | | | | | | | 193# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0135624 | 1 | 30 | 18 | 48 | 42 | 24 | 12 |
| 6531042 | 3562401 | 46 | 41 | 28 | 10 | 5 | 29 | 16 |
| 1042653 | 6240135 | 14 | 3 | 33 | 15 | 44 | 39 | 27 |
| 2653104 | 4013562 | 19 | 43 | 37 | 25 | 13 | 7 | 31 |
| 3104265 | 1356240 | 23 | 11 | 6 | 35 | 17 | 47 | 36 |
| 4265310 | 5624013 | 34 | 21 | 45 | 40 | 22 | 9 | 4 |
| 5310426 | 2401356 | 38 | 26 | 8 | 2 | 32 | 20 | 49 |

| 9/H | 5/L | | | | | | | 197# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0234615 | 1 | 31 | 18 | 47 | 42 | 23 | 13 |
| 6531042 | 3461502 | 46 | 40 | 28 | 9 | 6 | 29 | 17 |
| 1042653 | 6150234 | 14 | 2 | 34 | 15 | 45 | 39 | 26 |
| 2653104 | 5023461 | 20 | 43 | 38 | 25 | 12 | 7 | 30 |
| 3104265 | 2346150 | 24 | 11 | 5 | 35 | 16 | 48 | 36 |
| 4265310 | 4615023 | 33 | 21 | 44 | 41 | 22 | 10 | 4 |
| 5310426 | 1502346 | 37 | 27 | 8 | 3 | 32 | 19 | 49 |

| 9/H | 9/L | | | | | | | 201# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0361245 | 1 | 32 | 21 | 44 | 38 | 26 | 13 |
| 6531042 | 2450361 | 45 | 40 | 27 | 8 | 4 | 35 | 16 |
| 1042653 | 3612450 | 11 | 7 | 30 | 17 | 47 | 41 | 22 |
| 2653104 | 4503612 | 19 | 48 | 36 | 25 | 14 | 2 | 31 |
| 3104265 | 6124503 | 28 | 9 | 3 | 33 | 20 | 43 | 39 |
| 4265310 | 5036124 | 34 | 15 | 46 | 42 | 23 | 10 | 5 |
| 5310426 | 1245036 | 37 | 24 | 12 | 6 | 29 | 18 | 49 |

| 9/H | 19/L | | | | | | | 217# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0432615 | 1 | 33 | 18 | 45 | 42 | 23 | 13 |
| 6531042 | 3261504 | 46 | 38 | 28 | 9 | 6 | 29 | 19 |
| 1042653 | 6150432 | 14 | 2 | 34 | 15 | 47 | 39 | 24 |
| 2653104 | 5043261 | 20 | 43 | 40 | 25 | 10 | 7 | 30 |
| 3104265 | 4326150 | 26 | 11 | 3 | 35 | 16 | 48 | 36 |
| 4265310 | 2615043 | 31 | 21 | 44 | 41 | 22 | 12 | 4 |
| 5310426 | 1504326 | 37 | 27 | 8 | 5 | 32 | 17 | 49 |

| 9/H | 23/L | | | | | | | 221# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0531624 | 1 | 34 | 18 | 44 | 42 | 24 | 12 |
| 6531042 | 3162405 | 46 | 37 | 28 | 10 | 5 | 29 | 20 |
| 1042653 | 6240531 | 14 | 3 | 33 | 15 | 48 | 39 | 23 |
| 2653104 | 4053162 | 19 | 43 | 41 | 25 | 9 | 7 | 31 |
| 3104265 | 5316240 | 27 | 11 | 2 | 35 | 17 | 47 | 36 |
| 4265310 | 1624053 | 30 | 21 | 45 | 40 | 22 | 13 | 4 |
| 5310426 | 2405316 | 38 | 26 | 8 | 6 | 32 | 16 | 49 |

| 9/H | 25/L | | | | | | | 225# |
|---|---|---|---|---|---|---|---|---|
| 0426531 | 0612345 | 1 | 35 | 16 | 45 | 39 | 26 | 13 |
| 6531042 | 4506123 | 47 | 41 | 22 | 14 | 2 | 31 | 18 |
| 1042653 | 2345061 | 10 | 4 | 33 | 20 | 43 | 42 | 23 |
| 2653104 | 6123450 | 21 | 44 | 38 | 25 | 12 | 6 | 29 |
| 3104265 | 5061234 | 27 | 8 | 7 | 30 | 17 | 46 | 40 |
| 4265310 | 3450612 | 32 | 19 | 48 | 36 | 28 | 9 | 3 |
| 5310426 | 1234506 | 37 | 24 | 11 | 5 | 34 | 15 | 49 |

| 11/H | 1/L | | | | | | | 241# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0135624 | 1 | 37 | 11 | 48 | 35 | 24 | 19 |
| 6432051 | 3562401 | 46 | 34 | 28 | 17 | 5 | 36 | 9 |
| 2051643 | 6240135 | 21 | 3 | 40 | 8 | 44 | 32 | 27 |
| 1643205 | 4013562 | 12 | 43 | 30 | 25 | 20 | 7 | 38 |
| 3205164 | 1356240 | 23 | 18 | 6 | 42 | 10 | 47 | 29 |
| 5164320 | 5624013 | 41 | 14 | 45 | 33 | 22 | 16 | 4 |
| 4320516 | 2401356 | 31 | 26 | 15 | 2 | 39 | 13 | 49 |

| 11/H | 5/L | | | | | | | 245# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0234615 | 1 | 38 | 11 | 47 | 35 | 23 | 20 |
| 6432051 | 3461502 | 46 | 33 | 28 | 16 | 6 | 36 | 10 |
| 2051643 | 6150234 | 21 | 2 | 41 | 8 | 45 | 32 | 26 |
| 1643205 | 5023461 | 13 | 43 | 31 | 25 | 19 | 7 | 37 |
| 3205164 | 2346150 | 24 | 18 | 5 | 42 | 9 | 48 | 29 |
| 5164320 | 4615023 | 40 | 14 | 44 | 34 | 22 | 17 | 4 |
| 4320516 | 1502346 | 30 | 27 | 15 | 3 | 39 | 12 | 49 |

| 11/H | 9/L | | | | | | | 249# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0361245 | 1 | 39 | 14 | 44 | 31 | 26 | 20 |
| 6432051 | 2450361 | 45 | 33 | 27 | 15 | 4 | 42 | 9 |
| 2051643 | 3612450 | 18 | 7 | 37 | 10 | 47 | 34 | 22 |
| 1643205 | 4503612 | 12 | 48 | 29 | 25 | 21 | 2 | 38 |
| 3205164 | 6124503 | 28 | 16 | 3 | 40 | 13 | 43 | 32 |
| 5164320 | 5036124 | 41 | 8 | 46 | 35 | 23 | 17 | 5 |
| 4320516 | 1245036 | 30 | 24 | 19 | 6 | 36 | 11 | 49 |

| 11/H | 19/L | | | | | | | 265# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0432615 | 1 | 40 | 11 | 45 | 35 | 23 | 20 |
| 6432051 | 3261504 | 46 | 31 | 28 | 16 | 6 | 36 | 12 |
| 2051643 | 6150432 | 21 | 2 | 41 | 8 | 47 | 32 | 24 |
| 1643205 | 5043261 | 13 | 43 | 33 | 25 | 17 | 7 | 37 |
| 3205164 | 4326150 | 26 | 18 | 3 | 42 | 9 | 48 | 29 |
| 5164320 | 2615043 | 38 | 14 | 44 | 34 | 22 | 19 | 4 |
| 4320516 | 1504326 | 30 | 27 | 15 | 5 | 39 | 10 | 49 |

| 11/H | 23/L | | | | | | | 269# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0531624 | 1 | 41 | 11 | 44 | 35 | 24 | 19 |
| 6432051 | 3162405 | 46 | 30 | 28 | 17 | 5 | 36 | 13 |
| 2051643 | 6240531 | 21 | 3 | 40 | 8 | 48 | 32 | 23 |
| 1643205 | 4053162 | 12 | 43 | 34 | 25 | 16 | 7 | 38 |
| 3205164 | 5316240 | 27 | 18 | 2 | 42 | 10 | 47 | 29 |
| 5164320 | 1624053 | 37 | 14 | 45 | 33 | 22 | 20 | 4 |
| 4320516 | 2405316 | 31 | 26 | 15 | 6 | 39 | 9 | 49 |

| 11/H | 25/L | | | | | | | 273# |
|---|---|---|---|---|---|---|---|---|
| 0516432 | 0612345 | 1 | 42 | 9 | 45 | 32 | 26 | 20 |
| 6432051 | 4506123 | 47 | 34 | 22 | 21 | 2 | 38 | 11 |
| 2051643 | 2345061 | 17 | 4 | 40 | 13 | 43 | 35 | 23 |
| 1643205 | 6123450 | 14 | 44 | 31 | 25 | 19 | 6 | 36 |
| 3205164 | 5061234 | 27 | 15 | 7 | 37 | 10 | 46 | 33 |
| 5164320 | 3450612 | 39 | 12 | 48 | 29 | 28 | 16 | 3 |
| 4320516 | 1234506 | 30 | 24 | 18 | 5 | 41 | 8 | 49 |

| 13/H | 1/L | | | | | | | 289# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 0135624 | 1 | 44 | 32 | 13 | 28 | 38 | 19 |
| 5206413 | 3562401 | 39 | 20 | 7 | 45 | 33 | 8 | 23 |
| 1352064 | 6240135 | 14 | 24 | 40 | 15 | 2 | 46 | 34 |
| 6413520 | 4013562 | 47 | 29 | 9 | 25 | 41 | 21 | 3 |
| 2064135 | 1356240 | 16 | 4 | 48 | 35 | 10 | 26 | 36 |
| 3520641 | 5624013 | 27 | 42 | 17 | 5 | 43 | 30 | 11 |
| 4135206 | 2401356 | 31 | 12 | 22 | 37 | 18 | 6 | 49 |

| 13/H | 5/L | | | | | | | 305# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 0234615 | 1 | 45 | 32 | 12 | 28 | 37 | 20 |
| 5206413 | 3461502 | 39 | 19 | 7 | 44 | 34 | 8 | 24 |
| 1352064 | 6150234 | 14 | 23 | 41 | 15 | 3 | 46 | 33 |
| 6413520 | 5023461 | 48 | 29 | 10 | 25 | 40 | 21 | 2 |
| 2064135 | 2346150 | 17 | 4 | 47 | 35 | 9 | 27 | 36 |
| 3520641 | 4615023 | 26 | 42 | 16 | 6 | 43 | 31 | 11 |
| 4135206 | 1502346 | 30 | 13 | 22 | 38 | 18 | 5 | 49 |

| 13/H | 9/L | | | | | | | 321# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 0361245 | 1 | 46 | 35 | 9 | 24 | 40 | 20 |
| 5206413 | 2450361 | 38 | 19 | 6 | 43 | 32 | 14 | 23 |
| 1352064 | 3612450 | 11 | 28 | 37 | 17 | 5 | 48 | 29 |
| 6413520 | 4503612 | 47 | 34 | 8 | 25 | 42 | 16 | 3 |
| 2064135 | 6124503 | 21 | 2 | 45 | 33 | 13 | 22 | 39 |
| 3520641 | 5036124 | 27 | 36 | 18 | 7 | 44 | 31 | 12 |
| 4135206 | 1245036 | 30 | 10 | 26 | 41 | 15 | 4 | 49 |

| 13/H | 17/L | | | | | | | 353# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 0426135 | 1 | 47 | 31 | 14 | 23 | 39 | 20 |
| 5206413 | 6135042 | 42 | 16 | 4 | 48 | 29 | 12 | 24 |
| 1352064 | 5042613 | 13 | 22 | 40 | 17 | 7 | 44 | 32 |
| 6413520 | 2613504 | 45 | 35 | 9 | 25 | 41 | 15 | 5 |
| 2064135 | 3504261 | 18 | 6 | 43 | 33 | 10 | 28 | 37 |
| 3520641 | 4261350 | 26 | 38 | 21 | 2 | 46 | 34 | 8 |
| 4135206 | 1350426 | 30 | 11 | 27 | 36 | 19 | 3 | 49 |

| 13/H | 21/L | | | | | | | 369# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 0516234 | 1 | 48 | 30 | 14 | 24 | 39 | 19 |
| 5206413 | 6234051 | 42 | 17 | 4 | 47 | 29 | 13 | 23 |
| 1352064 | 4051623 | 12 | 22 | 41 | 16 | 7 | 45 | 32 |
| 6413520 | 1623405 | 44 | 35 | 10 | 25 | 40 | 15 | 6 |
| 2064135 | 3405162 | 18 | 5 | 43 | 34 | 9 | 28 | 38 |
| 3520641 | 5162340 | 27 | 37 | 21 | 3 | 46 | 33 | 8 |
| 4135206 | 2340516 | 31 | 11 | 26 | 36 | 20 | 2 | 49 |

| 1/H | 35/L | | | | | | | 385# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1065234 | 2 | 8 | 28 | 41 | 45 | 32 | 19 |
| 3564201 | 5234106 | 27 | 38 | 46 | 33 | 16 | 1 | 14 |
| 6420135 | 4106523 | 47 | 30 | 15 | 7 | 13 | 24 | 39 |
| 2013564 | 6523410 | 21 | 6 | 10 | 25 | 40 | 44 | 29 |
| 1356420 | 3410652 | 11 | 26 | 37 | 43 | 35 | 20 | 3 |
| 5642013 | 0652341 | 36 | 49 | 34 | 17 | 4 | 12 | 23 |
| 4201356 | 2341065 | 31 | 18 | 5 | 9 | 22 | 42 | 48 |

| 1/H | 39/L | | | | | | | 389# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1245036 | 2 | 10 | 26 | 41 | 43 | 32 | 21 |
| 3564201 | 5036124 | 27 | 36 | 46 | 35 | 16 | 3 | 12 |
| 6420135 | 6124503 | 49 | 30 | 17 | 5 | 13 | 22 | 39 |
| 2013564 | 4503612 | 19 | 6 | 8 | 25 | 42 | 44 | 31 |
| 1356420 | 3612450 | 11 | 28 | 37 | 45 | 33 | 20 | 1 |
| 5642013 | 2450361 | 38 | 47 | 34 | 15 | 4 | 14 | 23 |
| 4201356 | 0361245 | 29 | 18 | 7 | 9 | 24 | 40 | 48 |

| 1/H | 41/L | | | | | | | 393# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1350246 | 2 | 11 | 27 | 36 | 45 | 33 | 21 |
| 3564201 | 2461350 | 24 | 40 | 49 | 30 | 18 | 6 | 8 |
| 6420135 | 3502461 | 46 | 34 | 15 | 3 | 12 | 28 | 37 |
| 2013564 | 4613502 | 19 | 7 | 9 | 25 | 41 | 43 | 31 |
| 1356420 | 5024613 | 13 | 22 | 38 | 47 | 35 | 16 | 4 |
| 5642013 | 6135024 | 42 | 44 | 32 | 20 | 1 | 10 | 26 |
| 4201356 | 0246135 | 29 | 17 | 5 | 14 | 23 | 39 | 48 |

| 1/H | 49/L | | | | | | | 409# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1425036 | 2 | 12 | 24 | 41 | 43 | 32 | 21 |
| 3564201 | 5036142 | 27 | 36 | 46 | 35 | 16 | 5 | 10 |
| 6420135 | 6142503 | 49 | 30 | 19 | 3 | 13 | 22 | 39 |
| 2013564 | 2503614 | 17 | 6 | 8 | 25 | 42 | 44 | 33 |
| 1356420 | 3614250 | 11 | 28 | 37 | 47 | 31 | 20 | 1 |
| 5642013 | 4250361 | 40 | 45 | 34 | 15 | 4 | 14 | 23 |
| 4201356 | 0361425 | 29 | 18 | 7 | 9 | 26 | 38 | 48 |

| 1/H | 53/L | | | | | | | 413# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1502346 | 2 | 13 | 22 | 38 | 46 | 33 | 21 |
| 3564201 | 4615023 | 26 | 42 | 44 | 34 | 15 | 3 | 11 |
| 6420135 | 2346150 | 45 | 32 | 19 | 7 | 9 | 27 | 36 |
| 2013564 | 5023461 | 20 | 1 | 10 | 25 | 40 | 49 | 30 |
| 1356420 | 6150234 | 14 | 23 | 41 | 43 | 31 | 18 | 5 |
| 5642013 | 3461502 | 39 | 47 | 35 | 16 | 6 | 8 | 24 |
| 4201356 | 0234615 | 29 | 17 | 4 | 12 | 28 | 37 | 48 |

| 1/H | 61/L | | | | | | | 429# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 1605234 | 2 | 14 | 22 | 41 | 45 | 32 | 19 |
| 3564201 | 5234160 | 27 | 38 | 46 | 33 | 16 | 7 | 8 |
| 6420135 | 4160523 | 47 | 30 | 21 | 1 | 13 | 24 | 39 |
| 2013564 | 0523416 | 15 | 6 | 10 | 25 | 40 | 44 | 35 |
| 1356420 | 3416052 | 11 | 26 | 37 | 49 | 29 | 20 | 3 |
| 5642013 | 6052341 | 42 | 43 | 34 | 17 | 4 | 12 | 23 |
| 4201356 | 2341605 | 31 | 18 | 5 | 9 | 28 | 36 | 48 |

| 13/H | 49/L | | | | | | | 737# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 1425036 | 2 | 47 | 31 | 13 | 22 | 39 | 21 |
| 5206413 | 5036142 | 41 | 15 | 4 | 49 | 30 | 12 | 24 |
| 1352064 | 6142503 | 14 | 23 | 40 | 17 | 6 | 43 | 32 |
| 6413520 | 2503614 | 45 | 34 | 8 | 25 | 42 | 16 | 5 |
| 2064135 | 3614250 | 18 | 7 | 44 | 33 | 10 | 27 | 36 |
| 3520641 | 4250361 | 26 | 38 | 20 | 1 | 46 | 35 | 9 |
| 4135206 | 0361425 | 29 | 11 | 28 | 37 | 19 | 3 | 48 |

| 13/H | 61/L | | | | | | | 753# |
|---|---|---|---|---|---|---|---|---|
| 0641352 | 1605234 | 2 | 49 | 29 | 13 | 24 | 39 | 19 |
| 5206413 | 5234160 | 41 | 17 | 4 | 47 | 30 | 14 | 22 |
| 1352064 | 4160523 | 12 | 23 | 42 | 15 | 6 | 45 | 32 |
| 6413520 | 0523416 | 43 | 34 | 10 | 25 | 40 | 16 | 7 |
| 2064135 | 3416052 | 18 | 5 | 44 | 35 | 8 | 27 | 38 |
| 3520641 | 6052341 | 28 | 36 | 20 | 3 | 46 | 33 | 9 |
| 4135206 | 2341605 | 31 | 11 | 26 | 37 | 21 | 1 | 48 |

| 1/H | 67/L | | | | | | | 769# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 2064135 | 3 | 8 | 28 | 40 | 44 | 32 | 20 |
| 3564201 | 4135206 | 26 | 37 | 46 | 34 | 17 | 1 | 14 |
| 6420135 | 5206413 | 48 | 31 | 15 | 7 | 12 | 23 | 39 |
| 2013564 | 6413520 | 21 | 5 | 9 | 25 | 41 | 45 | 29 |
| 1356420 | 3520641 | 11 | 27 | 38 | 43 | 35 | 19 | 2 |
| 5642013 | 0641352 | 36 | 49 | 33 | 16 | 4 | 13 | 24 |
| 4201356 | 1352064 | 30 | 18 | 6 | 10 | 22 | 42 | 47 |

| 1/H | 99/L | | | | | | | 1153# |
|---|---|---|---|---|---|---|---|---|
| 0135642 | 4062135 | 5 | 8 | 28 | 38 | 44 | 32 | 20 |
| 3564201 | 2135406 | 24 | 37 | 46 | 34 | 19 | 1 | 14 |
| 6420135 | 5406213 | 48 | 33 | 15 | 7 | 10 | 23 | 39 |
| 2013564 | 6213540 | 21 | 3 | 9 | 25 | 41 | 47 | 29 |
| 1356420 | 3540621 | 11 | 27 | 40 | 43 | 35 | 17 | 2 |
| 5642013 | 0621354 | 36 | 49 | 31 | 16 | 4 | 13 | 26 |
| 4201356 | 1354062 | 30 | 18 | 6 | 12 | 22 | 42 | 45 |

```
   1/H   131/L                1537#     1/H   161/L                1921#
0135642 5061234   6  8 28 37 45 32 19  0135642 6012345   7  8 23 38 46 33 20
3564201 1234506  23 38 46 33 20  1 14  3564201 4560123  26 41 49 29 16  3 11
6420135 4506123  47 34 15  7  9 24 39  6420135 2345601  45 32 19  6 14 22 37
2013564 6123450  21  2 10 25 40 48 29  2013564 0123456  15  2 10 25 40 48 35
1356420 3450612  11 26 41 43 35 16  3  1356420 5601234  13 28 36 44 31 18  5
5642013 0612345  36 49 30 17  4 12 27  5642013 3456012  39 47 34 21  1  9 24
4201356 2345061  31 18  5 13 22 42 44  4201356 1234560  30 17  4 12 27 42 43
  17/H     3/L                2305#    17/H    35/L                2497#
1036542 0156234   8  2 27 49 38 32 19  1036542 1065234   9  1 28 48 38 32 19
3654210 6234015  28 45 39 33 15  9  6  3654210 5234106  27 45 39 33 16  8  7
5421036 4015623  40 29 16 13  7 24 46  5421036 4106523  40 30 15 14  6 24 46
2103654 5623401  20 14  3 25 47 36 30  2103654 6523410  21 13  3 25 47 37 29
0365421 3401562   4 26 43 37 34 21 10  0365421 3410652   4 26 44 36 35 20 10
6542103 1562340  44 41 35 17 11  5 22  6542103 0652341  43 42 34 17 11  5 23
4210365 2340156  31 18 12  1 23 48 42  4210365 2341065  31 18 12  2 22 49 41
  17/H    67/L                2689#    17/H    99/L                2881#
1036542 2064135  10  1 28 47 37 32 20  1036542 4062135  12  1 28 45 37 32 20
3654210 4135206  26 44 39 34 17  8  7  3654210 2135406  24 44 39 34 19  8  7
5421036 5206413  41 31 15 14  5 23 46  5421036 5406213  41 33 15 14  3 23 46
2103654 6413520  21 12  2 25 48 38 29  2103654 6213540  21 10  2 25 48 40 29
0365421 3520641   4 27 45 36 35 19  9  0365421 3540621   4 27 47 36 35 17  9
6542103 0641352  43 42 33 16 11  6 24  6542103 0621354  43 42 31 16 11  6 26
4210365 1352064  30 18 13  3 22 49 40  4210365 1354062  30 18 13  5 22 49 38
  17/H   131/L                3073#    17/H   161/L                3265#
1036542 5061234  13  1 28 44 38 32 19  1036542 6012345  14  1 23 45 39 33 20
3654210 1234506  23 45 39 33 20  8  7  3654210 4560123  26 48 42 29 16 10  4
5421036 4506123  40 34 15 14  2 24 46  5421036 2345601  38 32 19 13  7 22 44
2103654 6123450  21  9  3 25 47 41 29  2103654 0123456  15  9  3 25 47 41 35
0365421 3450612   4 26 48 36 35 16 10  0365421 5601234   6 28 43 37 31 18 12
6542103 0612345  43 42 30 17 11  5 27  6542103 3456012  46 40 34 21  8  2 24
4210365 2345061  31 18 12  6 22 49 37  4210365 1234560  30 17 11  5 27 49 36
[Count = 3456]  OK!
```

These 3456 solutions are just the same ones we have got before. We have made it! This means we could verify our “Knight’s Compositions” was correct for order 7.

I must report that I could reconstruct 38102400 solutions of Pandiagonal MS77 by this method of Base 7, though I would like to skip my exact report here. If you want to have my report, please click at the file end to get the outline of that.

## 5. Why are ‘Complete Euler Squares’ 7x7 rare?

In the end I would like you to think about the reason why ‘Complete Euler Squares’ are found rare in the case of any odd order. There are many “Non-Euler” type of MS77, say, far more than ‘Complete Euler Squares’. Why?

Please think about the next questions:

(1) If n1+n2+n3+n4+n5+n6+n7=21, then how many correct number patterns are possible to it? Every variable must take any one of {0,1,2,3,4,5,6}. But it can take any one number twice or more often and can neglect any other to take.

(2) If n1+n2+n3+n4+n5+n6+n7+n8=4, then how many correct number patterns are possible to it? Every variable must take either one of {0,1}.

You see these questions are often asked when you compose any layer unit by the Positional Number System of Base 7 or 2.

**** Possible Number Patterns to the Equation of Layer Units of Order N ****

[Order 3: Base 3]

```
If [n1+n2+n3==3] then [{n1,n2,n3}={0,1,2}, {1,1,1}]
```

[Order 4: Base 2]

```
If [n1+n2+n3+n4==2] then [{n1,n2,n3,n4}={0,0,1,1}]
```

[Order 5: Base 5]

```
If [n1+n2+n3+n4+n5==10] then [{n1,n2,n3,n4,n5}=
 {0,0,2,4,4}, {0,0,3,3,4}, {0,1,1,4,4}, {0,1,2,3,4}, {0,1,3,3,3},
 {0,2,2,2,4}, {0,2,2,3,3}, {1,1,1,3,4}, {1,1,2,2,4}, {1,1,2,3,3},
 {1,2,2,2,3}, {2,2,2,2,2}]
```

[Order 7: Base 7]

```
If [n1+n2+n3+n4+n5+n6+n7==21] then [{n1,n2,n3,n4,n5,n6,n7}=
 {0,0,0,3,6,6,6}, {0,0,0,4,5,6,6}, {0,0,0,5,5,5,6}, {0,0,1,2,6,6,6},
 {0,0,1,3,5,6,6}, {0,0,1,4,4,6,6}, {0,0,1,4,5,5,6}, {0,0,1,5,5,5,5},
 {0,0,2,2,5,6,6}, {0,0,2,3,4,6,6}, {0,0,2,3,5,5,6}, {0,0,2,4,4,5,6},
 {0,0,2,4,5,5,5}, {0,0,3,3,3,6,6}, {0,0,3,3,4,5,6}, {0,0,3,3,5,5,5},
 {0,0,3,4,4,4,6}, {0,0,3,4,4,5,5}, {0,0,4,4,4,4,5}, {0,1,1,1,6,6,6},
 {0,1,1,2,5,6,6}, {0,1,1,3,4,6,6}, {0,1,1,3,5,5,6}, {0,1,1,4,4,5,6},
 {0,1,1,4,5,5,5}, {0,1,2,2,4,6,6}, {0,1,2,2,5,5,6}, {0,1,2,3,3,6,6},
 {0,1,2,3,4,5,6}, {0,1,2,3,5,5,5}, {0,1,2,4,4,4,6}, {0,1,2,4,4,5,5},
 {0,1,3,3,3,5,6}, {0,1,3,3,4,4,6}, {0,1,3,3,4,5,5}, {0,1,3,4,4,4,5},
 {0,1,4,4,4,4,4}, {0,2,2,2,3,6,6}, {0,2,2,2,4,5,6}, {0,2,2,2,5,5,5},
 {0,2,2,3,3,5,6}, {0,2,2,3,4,4,6}, {0,2,2,3,4,5,5}, {0,2,2,4,4,4,5},
 {0,2,3,3,3,4,6}, {0,2,3,3,3,5,5}, {0,2,3,3,4,4,5}, {0,2,3,4,4,4,4},
 {0,3,3,3,3,3,6}, {0,3,3,3,3,4,5}, {0,3,3,3,4,4,4}, {1,1,1,1,5,6,6},
 {1,1,1,2,4,6,6}, {1,1,1,2,5,5,6}, {1,1,1,3,3,6,6}, {1,1,1,3,4,5,6},
 {1,1,1,3,5,5,5}, {1,1,1,4,4,4,6}, {1,1,1,4,4,5,5}, {1,1,2,2,3,6,6},
 {1,1,2,2,4,5,6}, {1,1,2,2,5,5,5}, {1,1,2,3,3,5,6}, {1,1,2,3,4,4,6},
 {1,1,2,3,4,5,5}, {1,1,2,4,4,4,5}, {1,1,3,3,3,4,6}, {1,1,3,3,3,5,5},
 {1,1,3,3,4,4,5}, {1,1,3,4,4,4,4}, {1,2,2,2,2,6,6}, {1,2,2,2,3,5,6},
 {1,2,2,2,4,4,6}, {1,2,2,2,4,5,5}, {1,2,2,3,3,4,6}, {1,2,2,3,3,5,5},
 {1,2,2,3,4,4,5}, {1,2,2,4,4,4,4}, {1,2,3,3,3,3,6}, {1,2,3,3,3,4,5},
 {1,2,3,3,4,4,4}, {1,3,3,3,3,3,5}, {1,3,3,3,3,4,4}, {2,2,2,2,2,5,6},
 {2,2,2,2,3,4,6}, {2,2,2,2,3,5,5}, {2,2,2,2,4,4,5}, {2,2,2,3,3,3,6},
 {2,2,2,3,3,4,5}, {2,2,2,3,4,4,4}, {2,2,3,3,3,3,5}, {2,2,3,3,3,4,4},
 {2,3,3,3,3,3,4}, {3,3,3,3,3,3,3}]
```

[Order 8: Base 2]

```
If [n1+n2+n3+n4+n5+n6+n7+n8==4] then [{n1,n2,n3,n4,n5,n6,n7,n8}=
 {0,0,0,0,1,1,1,1}]
```

[Order 9: Base 3]

```
If [n1+n2+n3+n4+n5+n6+n7+n8+n9==9] then [{n1,n2,n3,n4,n5,n6,n7,n8,n9}=
 {0,0,0,0,1,2,2,2,2}, {0,0,0,1,1,1,2,2,2}, {0,0,1,1,1,1,1,2,2},
 {0,1,1,1,1,1,1,1,2}, {1,1,1,1,1,1,1,1,1}]
```

The only one number pattern can make the ‘Euler Square’ in each case.
I hope you could see how rare it is, especially in the case of order 7.

(October 16, 2003; Revised on September 15, 2005;
New Calculation by Kanji Setsuda on MacOSX and Xcode 1.5)

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(Program Sheets are now available. Please click here to get them.)