

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

Chapter 7: New Method of Composing High-Dimensional Extra-Cubic Objects and their Developed Forms: Kanji Setsuda

Section 5 : New Method of Composing Two Types of Magic Squares 4^2 Using All View-Forms of Extra-Cubic Object 2^4

I have recently invented a new, unique way of composing special types of magic squares and cubes of order 4, 8, and 9, when I was studying high dimensional Extra-Cubic Objects and their 'basic view-forms' for the developed ones. Whenever I made various tests to this method of composition, I always had good results. I would like to report about this new method precisely in the following two or three sections.

#1. How could I invent this new method of composition?

The idea came up to me when I wondered how many 'Basic View-diagrams' of developed ECO we could draw and how we could make our computer draw them all.

Let me take the case of Extra-Cubic Object of order 2^4 for instance at first.

We now know in the first section: if we use four-time loops of `for(...){...}` sentences and produce Binary Numbers, we can draw the first 'basic view-diagram' for ECO_{2^4} .

If you change the original program a little in the order of variables $\{d_0, d_1, d_2, d_3\}$, you could have any different view-forms of the same ECO. You could draw different pictures with $n_1=1$ as many as 24 in all. Because ${}_4P_4=4 \times 3 \times 2 \times 1=24$.

If you put any count-down type of conditions in the `for(...){...}` sentences, you could have another type of different view-forms of the same ECO.

How many different pictures could you draw for that type, then?

We use 4 loops of `for(...){...}` sentences in all. And we have two cases for each loop: whether we use the count-down condition or not. Therefore we could have different pictures of that type as many as 16 in all, because $2^4=16$.

Take your careful look at the next lists.

** The Basic View-Diagram for Extra-Cubic Object 2^4 **

| BD/d0 | /d1 | SC/ | CC/ |
|-----------|-----------|-------------|-------------|
| 1----- 2 | 3----- 4 | 1 2 3 4 | 1 2 4 3 |
| 9-----10 | 11-----12 | 5 6 7 8 | 5 6 8 7 |
| 5-- - 6 | 7-- - 8 | 9 10 11 12 | 13 14 16 15 |
| 13-----14 | 15-----16 | 13 14 15 16 | 9 10 12 11 |

** Type #1 of View-Forms for Developed MS44 **

| 1/ | 2/ | 3/ | 4/ | 5/ | 6/ |
|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 2 3 4 | 1 3 2 4 | 1 2 5 6 | 1 3 5 7 | 1 5 2 6 | 1 5 3 7 |
| 5 6 7 8 | 5 7 6 8 | 3 4 7 8 | 2 4 6 8 | 3 7 4 8 | 2 6 4 8 |
| 9 10 11 12 | 9 11 10 12 | 9 10 13 14 | 9 11 13 15 | 9 13 10 14 | 9 13 11 15 |
| 13 14 15 16 | 13 15 14 16 | 11 12 15 16 | 10 12 14 16 | 11 15 12 16 | 10 14 12 16 |
| 7/ | 8/ | 9/ | 10/ | 11/ | 12/ |
| 1 2 3 4 | 1 3 2 4 | 1 2 5 6 | 1 3 5 7 | 1 5 2 6 | 1 5 3 7 |
| 9 10 11 12 | 9 11 10 12 | 9 10 13 14 | 9 11 13 15 | 9 13 10 14 | 9 13 11 15 |
| 5 6 7 8 | 5 7 6 8 | 3 4 7 8 | 2 4 6 8 | 3 7 4 8 | 2 6 4 8 |
| 13 14 15 16 | 13 15 14 16 | 11 12 15 16 | 10 12 14 16 | 11 15 12 16 | 10 14 12 16 |
| 13/ | 14/ | 15/ | 16/ | 17/ | 18/ |
| 1 2 9 10 | 1 3 9 11 | 1 2 9 10 | 1 3 9 11 | 1 5 9 13 | 1 5 9 13 |
| 3 4 11 12 | 2 4 10 12 | 5 6 13 14 | 5 7 13 15 | 2 6 10 14 | 3 7 11 15 |
| 5 6 13 14 | 5 7 13 15 | 3 4 11 12 | 2 4 10 12 | 3 7 11 15 | 2 6 10 14 |
| 7 8 15 16 | 6 8 14 16 | 7 8 15 16 | 6 8 14 16 | 4 8 12 16 | 4 8 12 16 |

| | | | | | | | | | | | |
|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|
| | 19/ | | 20/ | | 21/ | | 22/ | | 23/ | | 24/ |
| 1 | 9 | 2 | 10 | 1 | 9 | 3 | 11 | 1 | 9 | 3 | 11 |
| 3 | 11 | 4 | 12 | 2 | 10 | 4 | 12 | 5 | 13 | 6 | 14 |
| 5 | 13 | 6 | 14 | 5 | 13 | 7 | 15 | 3 | 11 | 4 | 12 |
| 7 | 15 | 8 | 16 | 6 | 14 | 8 | 16 | 2 | 10 | 4 | 12 |
| | | | | 6 | 14 | 8 | 16 | 6 | 14 | 8 | 16 |
| | | | | 7 | 15 | 8 | 16 | 4 | 12 | 8 | 16 |

**** Type #2 of View-Forms for Developed MS44 ****

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

I drew these pictures and listed them as above in the style of developed SCMS44 here. All of them are different 'view-forms' of the same ECO2⁴.

How many different pictures can we draw in all for the view-forms of the developed ECO, then? We want to know the total count of 'primitive' pictures.

As you guess you may combine those 2 sets of view-forms above one by one. We can draw them so many as 384 in all, because 24x16=384.

But why do they count 384? It is the same count just as the primitive solutions of 'Self-complementary' MS44 or various types of 'Pan-diagonal' ones, isn't it?

Is it only an accidental coincidence? It doesn't look so. What does it really mean?

When I watched those primitive 384 view forms, I noticed they are quite similar to the 'Prototype Squares' of order 4, which begins with the same form as the regular array 4x4 at the first solution. I remember I once made the list of them long before. The new set of pictures is really just the same with those old solutions.

Then I expected I might be able to compose our object solutions by these Prototype Squares and the 'D(o it) A(fter the) M(odel) Transformation', if I just try to do that.

I believed I would surely be able to make those by myself.

For the next step I had to find any appropriate 'Model' solutions and select the best one for my purpose.

I tried to find it out, designed how to compose the object solutions, dictated the first test programs, and carefully examined them many times.

#2. How do you compose them?

Now let's try to use this method actually and compose two types of 2-dimensional Magic Squares of order 4: 'Self-complementary' and 'Complete Pan-diagonal'.

(1) First of all we are going to draw all possible view-forms of developed ECO2⁴. We use 4-time loops of for(...){...} sentences and produce Binary Numbers.

For the preparation step we calculate two types of modifications and save the

results to the tables beforehand. We use the data afterward by 'indirect addressing mode' for the 4-time loops. It is rather a high-levelled technique of programming, though I am afraid of confusing you a little with it.

- (2) Next we make each view-form into our object 'Self-complementary' type of MS44 solution by DAM Transformation at first.
- (3) Then we change each SCMS44 solution into 'Complete Pan-diagonal' one by the typical method of transformation, which is already familiar to us.

That is all for us to do now. It looks very simple, doesn't it?

The following diagrams illustrate a representative solution selected for our best 'Model' and concept of 'DAM Transformation'. A half of elements must be changed by the 'Self-complementary Transformation' and the rest half be kept unchanged.

```

/**
/** Concept of DAM Transformation *
BD/d0      /d1      PT/
  1---- 2      3---- 4      1 2 3 4
  | 9---10    | 11---12    5 6 7 8
  5--|- 6 | 7--|- 8 | 9 10 11 12
    13----14    15----16    13 14 15 16
MD/d0      /d1      SC/  ↓
  1----15    14---- 4      1 15 14 4
  | 8---10    | 11--- 5    12 6 7 9
  12--|- 6 | 7--|- 9 | 8 10 11 5
    13---- 3      2----16    13 3 2 16
//
/** Self-Complementary Transformation for Half *
CC=17;
y[1]=x[1];   y[2]=CC-x[2];   y[3]=CC-x[3];   y[4]=x[4];
y[5]=CC-x[5]; y[6]=x[6];     y[7]=x[7];     y[8]=CC-x[8];
y[9]=CC-x[9]; y[10]=x[10];    y[11]=x[11];   y[12]=CC-x[12];
y[13]=x[13]; y[14]=CC-x[14]; y[15]=CC-x[15]; y[16]=x[16];
//

```

Let's compose the Self-complementary Magic Squares of order 4 at first by this method and convert the result into the Complete Pan-magic Square of order 4 next.

The next list is a sample program made for our purpose only with a few essential components so that you could understand it easily.

```

/** Compose 2 Types of Magic Squares 4x4 by the Newest Method **
/** Using All Developed View-Diagrams of the Extra-Cubic Objects 2^4 **
/** List of the 384 Prototype Squares and 2 Types of MS44 **
/** File: 'S2NewMS4.c' Dictated by Kanji Setsuda in **
/** 2005 and 2006 with MacOSX & Xcode2.1; Recompiled on **
/** March 16, 2015 with MacOSX 10.10.2 & Xcode 6.2 **
//
#include <stdio.h>
//
short cnt, tcnt;
short vc, pc;
short tv[16][4];
short td[24][4];
short nm[17];
short prnm[385][17], snm[385][17], tnm[385][17];
//
void mkfv16(void), prmt24(void);
void d24(short x, short y);

```

```

void mkso124(void), tconv24(void);
void pr32ans(short x, short y);
void solsort(void), exc(short x);
//
/** Main Program *
int main(){
short m,n;
cnt=0;
printf("\n");
printf("** Compose 2 Types of Magic Squares 4^2 by the Newest Method\n");
printf("    Using All Developed View-Diagrams of the Extra-Cubic Objects 2^4 **\n");
printf("** List of the 384 Prototype Squares and 2 Types of MS44 Composed **\n");
vc=0; mkfv16();
pc=0; prmt24();
tcnt=pc*vc;
for(m=0;m<vc;m++){for(n=0;n<pc;n++){d24(m,n);}}
solsort();
mkso124();      /** 'Do-it-After-the-Model Transformation' for the SCMS44 **
tconv24();      /** Type Conversion from SCMS44 into CPDMS44 **
pr32ans(1,25);  /** Print each Prototype and Object Solutions *
printf(" . . . . .\n");
pr32ans(48,50);
printf(" . . . . .\n");
pr32ans(72,74);
printf(" . . . . .\n");
pr32ans(96,98);
printf(" . . . . .\n");
pr32ans(120,122);
printf(" . . . . .\n");
pr32ans(192,194);
printf(" . . . . .\n");
pr32ans(tcnt-5,tcnt);
printf("\n");
printf(" [Count = %d] OK!\n",tcnt);
printf("\n");
printf("** Recompiled and Listed by Kanji Setsuda on\n");
printf("    March 16, 2015 with MacOSX 10.10.2 & Xcode 6.2 **\n");
printf("\n");
return 0;
}
//
/** Sub-Procedures for EC02^4 *
void mkfv16(void){
short d0,d1,d2,d3;
for(d0=0;d0<2;d0++){
for(d1=0;d1<2;d1++){
for(d2=0;d2<2;d2++){
for(d3=0;d3<2;d3++){
tv[vc][0]=d0; tv[vc][1]=d1; tv[vc][2]=d2; tv[vc][3]=d3;
vc++;
}
}
}
}
}
//
void prmt24(void){
short d0,d1,d2,d3,n;
short uf1g[4];
for(n=0;n<4;n++){uf1g[n]=0;}
for(d0=0;d0<4;d0++){
uf1g[d0]=1;
for(d1=0;d1<4;d1++){
if(uf1g[d1]==0){uf1g[d1]=1;
for(d2=0;d2<4;d2++){

```

```

        if(uflg[d2]==0){uflg[d2]=1;
            for(d3=0;d3<4;d3++){
                if(uflg[d3]==0){uflg[d3]=1;
                    td[pc][0]=d0; td[pc][1]=d1; td[pc][2]=d2; td[pc][3]=d3;
                    pc++;
                    uflg[d3]=0;
                }}
            uflg[d2]=0;
        }}
        uflg[d1]=0;
    }}
    uflg[d0]=0;
}
}
//
void d24(short x, short y){
    short d0,d1,d2,d3;
    short t0,t1,t2,t3;
    short CC,c,n;
    short s[4], t[4][2];
    CC=1;
    for(n=0;n<4;n++){
        t[n][0]=tv[x][n]; t[n][1]=CC-tv[x][n];}
    //
    c=0;
    for(d0=0;d0<2;d0++){
        for(d1=0;d1<2;d1++){
            for(d2=0;d2<2;d2++){
                for(d3=0;d3<2;d3++){c++;
                    s[0]=t[0][d0]; s[1]=t[1][d1]; s[2]=t[2][d2]; s[3]=t[3][d3];
                    t0=td[y][0]; t1=td[y][1]; t2=td[y][2]; t3=td[y][3];
                    pnm[x*pc+y][c]=((s[t0]*2+s[t1])*2+s[t2])*2+s[t3]+1;
                }
            }
        }
    }
}
//
/* Transformation from Prototype into SCMS44 **
void mksol24(void){
    short m,n,CC;
    CC=17;
    for(m=0;m<tcnt;m++){
        nm[1]=pnm[m][1]; nm[2]=CC-pnm[m][2]; nm[3]=CC-pnm[m][3]; nm[4]=pnm[m][4];
        nm[5]=CC-pnm[m][5]; nm[6]=pnm[m][6]; nm[7]=pnm[m][7]; nm[8]=CC-pnm[m][8];
        nm[9]=CC-pnm[m][9]; nm[10]=pnm[m][10]; nm[11]=pnm[m][11]; nm[12]=CC-pnm[m][12];
        nm[13]=pnm[m][13]; nm[14]=CC-pnm[m][14]; nm[15]=CC-pnm[m][15]; nm[16]=pnm[m][16];
        for(n=1;n<17;n++){snm[m][n]=nm[n];}
    }
}
//
/* Type Conversion from SCMS44 into CPDMS44 **
void tconv24(void){
    short m,n;
    for(m=0;m<tcnt;m++){
        nm[1]=snm[m][1]; nm[2]=snm[m][2]; nm[3]=snm[m][4]; nm[4]=snm[m][3];
        nm[5]=snm[m][5]; nm[6]=snm[m][6]; nm[7]=snm[m][8]; nm[8]=snm[m][7];
        nm[9]=snm[m][13]; nm[10]=snm[m][14]; nm[11]=snm[m][16]; nm[12]=snm[m][15];
        nm[13]=snm[m][9]; nm[14]=snm[m][10]; nm[15]=snm[m][12]; nm[16]=snm[m][11];
        for(n=1;n<17;n++){tnm[m][n]=nm[n];}
    }
}
//
/* Print each Prototype and Object Solutions *
void pr32ans(short x, short y){

```

```

short m;
for(m=x-1;m<y;m++){
printf("%4d/d0          /d1          PT/          SC/          CP/\n",m+1);
printf("%5d----%2d%7d----%2d   ",pnm[m][1],pnm[m][2],pnm[m][3],pnm[m][4]);
printf("   %3d%3d%3d%3d   ",pnm[m][1],pnm[m][2],pnm[m][3],pnm[m][4]);
printf("%3d%3d%3d%3d   %3d%3d%3d%3d\n",
       snm[m][1],snm[m][2],snm[m][3],snm[m][4],tnm[m][1],tnm[m][2],tnm[m][3],tnm[m][4]);
printf("   | %2d--+-%2d   | %2d--+-%2d",pnm[m][9],pnm[m][10],pnm[m][11],pnm[m][12]);
printf("   %3d%3d%3d%3d   ",pnm[m][5],pnm[m][6],pnm[m][7],pnm[m][8]);
printf("%3d%3d%3d%3d   %3d%3d%3d%3d\n",
       snm[m][5],snm[m][6],snm[m][7],snm[m][8],tnm[m][5],tnm[m][6],tnm[m][7],tnm[m][8]);
printf("%5d--l-%2d |%4d--l-%2d |",pnm[m][5],pnm[m][6],pnm[m][7],pnm[m][8]);
printf("   %3d%3d%3d%3d   ",pnm[m][9],pnm[m][10],pnm[m][11],pnm[m][12]);
printf("%3d%3d%3d%3d   %3d%3d%3d%3d\n",
       snm[m][9],snm[m][10],snm[m][11],snm[m][12],tnm[m][9],tnm[m][10],tnm[m][11],tnm[m][12]);
printf("%8d----%2d%7d----%2d",pnm[m][13],pnm[m][14],pnm[m][15],pnm[m][16]);
printf("   %3d%3d%3d%3d   ",pnm[m][13],pnm[m][14],pnm[m][15],pnm[m][16]);
printf("%3d%3d%3d%3d   %3d%3d%3d%3d\n",
       snm[m][13],snm[m][14],snm[m][15],snm[m][16],tnm[m][13],tnm[m][14],tnm[m][15],tnm[m][16]);
}
}
//
void solsort(void){
int d0,d1;
short mx,n,f;
for(mx=tcnt-1;mx>0;mx--){
do{f=0;
for(n=0;n<mx;n++){
d0=((pnm[n][1]*16+pnm[n][2])*16+pnm[n][3])*16+pnm[n][4])*16+pnm[n][5];
d1=((pnm[n+1][1]*16+pnm[n+1][2])*16+pnm[n+1][3])*16+pnm[n+1][4])*16+pnm[n+1][5];
if(d0>d1){exc(n); f=1;}
if((d0==d1)&&(pnm[n][6]>pnm[n+1][6])){exc(n); f=1;}
}
}while(f>0);
}
}
//
void exc(short x){
short n,d;
for(n=1;n<17;n++){d=pnm[x][n]; pnm[x][n]=pnm[x+1][n]; pnm[x+1][n]=d;}
}
//

```

This program may give you a little different impression from the other old ones. It is very short, shorter than any other old programs. It runs very fast, say, faster than any other programs I have ever written before.

It has a new, unique style of programming. You could find nothing like any old calculations familiar to you, even no definitions with many simultaneous equations, either. Nor you could find any kind of check procedures here.

Though it may look peculiar, it will surely give you a normal, reasonable result.

Let me list out the result, but part of the 'primitive' solutions of 2 types of MS44.

**** Compose 2 Types of Magic Squares 4^2 by the Newest Method Using All Developed View-Diagrams of the Extra-Cubic Objects 2^4 ****

**** List of the 384 Prototype Squares and 2 Types of MS44 Composed ****

| 1/d0 | /d1 | PT/ | SC/ | CP/ |
|----------|----------|-------------|-----------|-----------|
| 1---- 2 | 3---- 4 | 1 2 3 4 | 1 15 14 4 | 1 15 4 14 |
| 9--+-10 | 11--+-12 | 5 6 7 8 | 12 6 7 9 | 12 6 9 7 |
| 5-- - 6 | 7-- - 8 | 9 10 11 12 | 8 10 11 5 | 13 3 16 2 |
| 13----14 | 15----16 | 13 14 15 16 | 13 3 2 16 | 8 10 5 11 |

| | | | | |
|--------------|------------|-------------|------------|------------|
| 2/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 2 | 3---- 4 | 1 2 3 4 | 1 15 14 4 | 1 15 4 14 |
| 5---+ 6 | 7---+ 8 | 9 10 11 12 | 8 10 11 5 | 8 10 5 11 |
| 9-- -10 | 11-- -12 | 5 6 7 8 | 12 6 7 9 | 13 3 16 2 |
| 13----14 | 15----16 | 13 14 15 16 | 13 3 2 16 | 12 6 9 7 |
| 3/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 2 | 5---- 6 | 1 2 5 6 | 1 15 12 6 | 1 15 6 12 |
| 9---+10 | 13---+14 | 3 4 7 8 | 14 4 7 9 | 14 4 9 7 |
| 3-- - 4 | 7-- - 8 | 9 10 13 14 | 8 10 13 3 | 11 5 16 2 |
| 11----12 | 15----16 | 11 12 15 16 | 11 5 2 16 | 8 10 3 13 |
| 4/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 2 | 5---- 6 | 1 2 5 6 | 1 15 12 6 | 1 15 6 12 |
| 3---+ 4 | 7---+ 8 | 9 10 13 14 | 8 10 13 3 | 8 10 3 13 |
| 9-- -10 | 13-- -14 | 3 4 7 8 | 14 4 7 9 | 11 5 16 2 |
| 11----12 | 15----16 | 11 12 15 16 | 11 5 2 16 | 14 4 9 7 |
| 5/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 2 | 9----10 | 1 2 9 10 | 1 15 8 10 | 1 15 10 8 |
| 5---+ 6 | 13---+14 | 3 4 11 12 | 14 4 11 5 | 14 4 5 11 |
| 3-- - 4 | 11-- -12 | 5 6 13 14 | 12 6 13 3 | 7 9 16 2 |
| 7---- 8 | 15----16 | 7 8 15 16 | 7 9 2 16 | 12 6 3 13 |
| 6/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 2 | 9----10 | 1 2 9 10 | 1 15 8 10 | 1 15 10 8 |
| 3---+ 4 | 11---+12 | 5 6 13 14 | 12 6 13 3 | 12 6 3 13 |
| 5-- - 6 | 13-- -14 | 3 4 11 12 | 14 4 11 5 | 7 9 16 2 |
| 7---- 8 | 15----16 | 7 8 15 16 | 7 9 2 16 | 14 4 5 11 |
| 7/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 2---- 4 | 1 3 2 4 | 1 14 15 4 | 1 14 4 15 |
| 9---+11 | 10---+12 | 5 7 6 8 | 12 7 6 9 | 12 7 9 6 |
| 5-- - 7 | 6-- - 8 | 9 11 10 12 | 8 11 10 5 | 13 2 16 3 |
| 13----15 | 14----16 | 13 15 14 16 | 13 2 3 16 | 8 11 5 10 |
| 8/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 2---- 4 | 1 3 2 4 | 1 14 15 4 | 1 14 4 15 |
| 5---+ 7 | 6---+ 8 | 9 11 10 12 | 8 11 10 5 | 8 11 5 10 |
| 9-- -11 | 10-- -12 | 5 7 6 8 | 12 7 6 9 | 13 2 16 3 |
| 13----15 | 14----16 | 13 15 14 16 | 13 2 3 16 | 12 7 9 6 |
| 9/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 5---- 7 | 1 3 5 7 | 1 14 12 7 | 1 14 7 12 |
| 9---+11 | 13---+15 | 2 4 6 8 | 15 4 6 9 | 15 4 9 6 |
| 2-- - 4 | 6-- - 8 | 9 11 13 15 | 8 11 13 2 | 10 5 16 3 |
| 10----12 | 14----16 | 10 12 14 16 | 10 5 3 16 | 8 11 2 13 |
| 10/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 5---- 7 | 1 3 5 7 | 1 14 12 7 | 1 14 7 12 |
| 2---+ 4 | 6---+ 8 | 9 11 13 15 | 8 11 13 2 | 8 11 2 13 |
| 9-- -11 | 13-- -15 | 2 4 6 8 | 15 4 6 9 | 10 5 16 3 |
| 10----12 | 14----16 | 10 12 14 16 | 10 5 3 16 | 15 4 9 6 |
| 11/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 9----11 | 1 3 9 11 | 1 14 8 11 | 1 14 11 8 |
| 5---+ 7 | 13---+15 | 2 4 10 12 | 15 4 10 5 | 15 4 5 10 |
| 2-- - 4 | 10-- -12 | 5 7 13 15 | 12 7 13 2 | 6 9 16 3 |
| 6---- 8 | 14----16 | 6 8 14 16 | 6 9 3 16 | 12 7 2 13 |
| 12/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 3 | 9----11 | 1 3 9 11 | 1 14 8 11 | 1 14 11 8 |
| 2---+ 4 | 10---+12 | 5 7 13 15 | 12 7 13 2 | 12 7 2 13 |
| 5-- - 7 | 13-- -15 | 2 4 10 12 | 15 4 10 5 | 6 9 16 3 |
| 6---- 8 | 14----16 | 6 8 14 16 | 6 9 3 16 | 15 4 5 10 |

| | | | | |
|----------|----------|-------------|-----------|-----------|
| 13/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 2---- 6 | 1 5 2 6 | 1 12 15 6 | 1 12 6 15 |
| 9---13 | 10---14 | 3 7 4 8 | 14 7 4 9 | 14 7 9 4 |
| 3-- - 7 | 4-- - 8 | 9 13 10 14 | 8 13 10 3 | 11 2 16 5 |
| 11----15 | 12----16 | 11 15 12 16 | 11 2 5 16 | 8 13 3 10 |
| 14/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 2---- 6 | 1 5 2 6 | 1 12 15 6 | 1 12 6 15 |
| 3--- 7 | 4--- 8 | 9 13 10 14 | 8 13 10 3 | 8 13 3 10 |
| 9-- -13 | 10-- -14 | 3 7 4 8 | 14 7 4 9 | 11 2 16 5 |
| 11----15 | 12----16 | 11 15 12 16 | 11 2 5 16 | 14 7 9 4 |
| 15/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 3---- 7 | 1 5 3 7 | 1 12 14 7 | 1 12 7 14 |
| 9---13 | 11---15 | 2 6 4 8 | 15 6 4 9 | 15 6 9 4 |
| 2-- - 6 | 4-- - 8 | 9 13 11 15 | 8 13 11 2 | 10 3 16 5 |
| 10----14 | 12----16 | 10 14 12 16 | 10 3 5 16 | 8 13 2 11 |
| 16/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 3---- 7 | 1 5 3 7 | 1 12 14 7 | 1 12 7 14 |
| 2--- 6 | 4--- 8 | 9 13 11 15 | 8 13 11 2 | 8 13 2 11 |
| 9-- -13 | 11-- -15 | 2 6 4 8 | 15 6 4 9 | 10 3 16 5 |
| 10----14 | 12----16 | 10 14 12 16 | 10 3 5 16 | 15 6 9 4 |
| 17/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 9----13 | 1 5 9 13 | 1 12 8 13 | 1 12 13 8 |
| 3--- 7 | 11---15 | 2 6 10 14 | 15 6 10 3 | 15 6 3 10 |
| 2-- - 6 | 10-- -14 | 3 7 11 15 | 14 7 11 2 | 4 9 16 5 |
| 4---- 8 | 12----16 | 4 8 12 16 | 4 9 5 16 | 14 7 2 11 |
| 18/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 5 | 9----13 | 1 5 9 13 | 1 12 8 13 | 1 12 13 8 |
| 2--- 6 | 10---14 | 3 7 11 15 | 14 7 11 2 | 14 7 2 11 |
| 3-- - 7 | 11-- -15 | 2 6 10 14 | 15 6 10 3 | 4 9 16 5 |
| 4---- 8 | 12----16 | 4 8 12 16 | 4 9 5 16 | 15 6 3 10 |
| 19/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 2----10 | 1 9 2 10 | 1 8 15 10 | 1 8 10 15 |
| 5---13 | 6---14 | 3 11 4 12 | 14 11 4 5 | 14 11 5 4 |
| 3-- -11 | 4-- -12 | 5 13 6 14 | 12 13 6 3 | 7 2 16 9 |
| 7----15 | 8----16 | 7 15 8 16 | 7 2 9 16 | 12 13 3 6 |
| 20/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 2----10 | 1 9 2 10 | 1 8 15 10 | 1 8 10 15 |
| 3---11 | 4---12 | 5 13 6 14 | 12 13 6 3 | 12 13 3 6 |
| 5-- -13 | 6-- -14 | 3 11 4 12 | 14 11 4 5 | 7 2 16 9 |
| 7----15 | 8----16 | 7 15 8 16 | 7 2 9 16 | 14 11 5 4 |
| 21/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 3----11 | 1 9 3 11 | 1 8 14 11 | 1 8 11 14 |
| 5---13 | 7---15 | 2 10 4 12 | 15 10 4 5 | 15 10 5 4 |
| 2-- -10 | 4-- -12 | 5 13 7 15 | 12 13 7 2 | 6 3 16 9 |
| 6----14 | 8----16 | 6 14 8 16 | 6 3 9 16 | 12 13 2 7 |
| 22/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 3----11 | 1 9 3 11 | 1 8 14 11 | 1 8 11 14 |
| 2---10 | 4---12 | 5 13 7 15 | 12 13 7 2 | 12 13 2 7 |
| 5-- -13 | 7-- -15 | 2 10 4 12 | 15 10 4 5 | 6 3 16 9 |
| 6----14 | 8----16 | 6 14 8 16 | 6 3 9 16 | 15 10 5 4 |
| 23/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 5----13 | 1 9 5 13 | 1 8 12 13 | 1 8 13 12 |
| 3---11 | 7---15 | 2 10 6 14 | 15 10 6 3 | 15 10 3 6 |
| 2-- -10 | 6-- -14 | 3 11 7 15 | 14 11 7 2 | 4 5 16 9 |
| 4----12 | 8----16 | 4 12 8 16 | 4 5 9 16 | 14 11 2 7 |

| | | | | |
|-----------|----------|-------------|-----------|-----------|
| 24/d0 | /d1 | PT/ | SC/ | CP/ |
| 1---- 9 | 5----13 | 1 9 5 13 | 1 8 12 13 | 1 8 13 12 |
| 2---+10 | 6---+14 | 3 11 7 15 | 14 11 7 2 | 14 11 2 7 |
| 3-- -11 | 7-- -15 | 2 10 6 14 | 15 10 6 3 | 4 5 16 9 |
| 4----12 | 8----16 | 4 12 8 16 | 4 5 9 16 | 15 10 3 6 |
| 25/d0 | /d1 | PT/ | SC/ | CP/ |
| 2---- 1 | 4---- 3 | 2 1 4 3 | 2 16 13 3 | 2 16 3 13 |
| 10---+ 9 | 12---+11 | 6 5 8 7 | 11 5 8 10 | 11 5 10 8 |
| 6-- - 5 | 8-- - 7 | 10 9 12 11 | 7 9 12 6 | 14 4 15 1 |
| 14----13 | 16----15 | 14 13 16 15 | 14 4 1 15 | 7 9 6 12 |
| | | | | |
| 48/d0 | /d1 | PT/ | SC/ | CP/ |
| 2----10 | 6----14 | 2 10 6 14 | 2 7 11 14 | 2 7 14 11 |
| 1---+ 9 | 5---+13 | 4 12 8 16 | 13 12 8 1 | 13 12 1 8 |
| 4-- -12 | 8-- -16 | 1 9 5 13 | 16 9 5 4 | 3 6 15 10 |
| 3----11 | 7----15 | 3 11 7 15 | 3 6 10 15 | 16 9 4 5 |
| 49/d0 | /d1 | PT/ | SC/ | CP/ |
| 3---- 1 | 4---- 2 | 3 1 4 2 | 3 16 13 2 | 3 16 2 13 |
| 11---+ 9 | 12---+10 | 7 5 8 6 | 10 5 8 11 | 10 5 11 8 |
| 7-- - 5 | 8-- - 6 | 11 9 12 10 | 6 9 12 7 | 15 4 14 1 |
| 15----13 | 16----14 | 15 13 16 14 | 15 4 1 14 | 6 9 7 12 |
| 50/d0 | /d1 | PT/ | SC/ | CP/ |
| 3---- 1 | 4---- 2 | 3 1 4 2 | 3 16 13 2 | 3 16 2 13 |
| 7---+ 5 | 8---+ 6 | 11 9 12 10 | 6 9 12 7 | 6 9 7 12 |
| 11-- - 9 | 12-- -10 | 7 5 8 6 | 10 5 8 11 | 15 4 14 1 |
| 15----13 | 16----14 | 15 13 16 14 | 15 4 1 14 | 10 5 11 8 |
| | | | | |
| 72/d0 | /d1 | PT/ | SC/ | CP/ |
| 3----11 | 7----15 | 3 11 7 15 | 3 6 10 15 | 3 6 15 10 |
| 1---+ 9 | 5---+13 | 4 12 8 16 | 13 12 8 1 | 13 12 1 8 |
| 4-- -12 | 8-- -16 | 1 9 5 13 | 16 9 5 4 | 2 7 14 11 |
| 2----10 | 6----14 | 2 10 6 14 | 2 7 11 14 | 16 9 4 5 |
| 73/d0 | /d1 | PT/ | SC/ | CP/ |
| 4---- 2 | 3---- 1 | 4 2 3 1 | 4 15 14 1 | 4 15 1 14 |
| 12---+10 | 11---+ 9 | 8 6 7 5 | 9 6 7 12 | 9 6 12 7 |
| 8-- - 6 | 7-- - 5 | 12 10 11 9 | 5 10 11 8 | 16 3 13 2 |
| 16----14 | 15----13 | 16 14 15 13 | 16 3 2 13 | 5 10 8 11 |
| 74/d0 | /d1 | PT/ | SC/ | CP/ |
| 4---- 2 | 3---- 1 | 4 2 3 1 | 4 15 14 1 | 4 15 1 14 |
| 8---+ 6 | 7---+ 5 | 12 10 11 9 | 5 10 11 8 | 5 10 8 11 |
| 12-- -10 | 11-- - 9 | 8 6 7 5 | 9 6 7 12 | 16 3 13 2 |
| 16----14 | 15----13 | 16 14 15 13 | 16 3 2 13 | 9 6 12 7 |
| | | | | |
| 96/d0 | /d1 | PT/ | SC/ | CP/ |
| 4----12 | 8----16 | 4 12 8 16 | 4 5 9 16 | 4 5 16 9 |
| 2---+10 | 6---+14 | 3 11 7 15 | 14 11 7 2 | 14 11 2 7 |
| 3-- -11 | 7-- -15 | 2 10 6 14 | 15 10 6 3 | 1 8 13 12 |
| 1---- 9 | 5----13 | 1 9 5 13 | 1 8 12 13 | 15 10 3 6 |
| 97/d0 | /d1 | PT/ | SC/ | CP/ |
| 5---- 1 | 6---- 2 | 5 1 6 2 | 5 16 11 2 | 5 16 2 11 |
| 13---+ 9 | 14---+10 | 7 3 8 4 | 10 3 8 13 | 10 3 13 8 |
| 7-- - 3 | 8-- - 4 | 13 9 14 10 | 4 9 14 7 | 15 6 12 1 |
| 15----11 | 16----12 | 15 11 16 12 | 15 6 1 12 | 4 9 7 14 |
| 98/d0 | /d1 | PT/ | SC/ | CP/ |
| 5---- 1 | 6---- 2 | 5 1 6 2 | 5 16 11 2 | 5 16 2 11 |
| 7---+ 3 | 8---+ 4 | 13 9 14 10 | 4 9 14 7 | 4 9 7 14 |

| | | | | |
|-----------|----------|-------------|-----------|-----------|
| 13-- - 9 | 14-- -10 | 7 3 8 4 | 10 3 8 13 | 15 6 12 1 |
| 15----11 | 16----12 | 15 11 16 12 | 15 6 1 12 | 10 3 13 8 |
| | | | | |
| 120/d0 | /d1 | PT/ | SC/ | CP/ |
| 5----13 | 7----15 | 5 13 7 15 | 5 4 10 15 | 5 4 15 10 |
| 1---+ 9 | 3---+11 | 6 14 8 16 | 11 14 8 1 | 11 14 1 8 |
| 6-- -14 | 8-- -16 | 1 9 3 11 | 16 9 3 6 | 2 7 12 13 |
| 2----10 | 4----12 | 2 10 4 12 | 2 7 13 12 | 16 9 6 3 |
| 121/d0 | /d1 | PT/ | SC/ | CP/ |
| 6---- 2 | 5---- 1 | 6 2 5 1 | 6 15 12 1 | 6 15 1 12 |
| 14---+10 | 13---+ 9 | 8 4 7 3 | 9 4 7 14 | 9 4 14 7 |
| 8-- - 4 | 7-- - 3 | 14 10 13 9 | 3 10 13 8 | 16 5 11 2 |
| 16----12 | 15----11 | 16 12 15 11 | 16 5 2 11 | 3 10 8 13 |
| 122/d0 | /d1 | PT/ | SC/ | CP/ |
| 6---- 2 | 5---- 1 | 6 2 5 1 | 6 15 12 1 | 6 15 1 12 |
| 8---+ 4 | 7---+ 3 | 14 10 13 9 | 3 10 13 8 | 3 10 8 13 |
| 14-- -10 | 13-- - 9 | 8 4 7 3 | 9 4 7 14 | 16 5 11 2 |
| 16----12 | 15----11 | 16 12 15 11 | 16 5 2 11 | 9 4 14 7 |
| | | | | |
| 192/d0 | /d1 | PT/ | SC/ | CP/ |
| 8----16 | 7----15 | 8 16 7 15 | 8 1 10 15 | 8 1 15 10 |
| 4---+12 | 3---+11 | 6 14 5 13 | 11 14 5 4 | 11 14 4 5 |
| 6-- -14 | 5-- -13 | 4 12 3 11 | 13 12 3 6 | 2 7 9 16 |
| 2----10 | 1---- 9 | 2 10 1 9 | 2 7 16 9 | 13 12 6 3 |
| 193/d0 | /d1 | PT/ | SC/ | CP/ |
| 9---- 1 | 10---- 2 | 9 1 10 2 | 9 16 7 2 | 9 16 2 7 |
| 13---+ 5 | 14---+ 6 | 11 3 12 4 | 6 3 12 13 | 6 3 13 12 |
| 11-- - 3 | 12-- - 4 | 13 5 14 6 | 4 5 14 11 | 15 10 8 1 |
| 15---- 7 | 16---- 8 | 15 7 16 8 | 15 10 1 8 | 4 5 11 14 |
| 194/d0 | /d1 | PT/ | SC/ | CP/ |
| 9---- 1 | 10---- 2 | 9 1 10 2 | 9 16 7 2 | 9 16 2 7 |
| 11---+ 3 | 12---+ 4 | 13 5 14 6 | 4 5 14 11 | 4 5 11 14 |
| 13-- - 5 | 14-- - 6 | 11 3 12 4 | 6 3 12 13 | 15 10 8 1 |
| 15---- 7 | 16---- 8 | 15 7 16 8 | 15 10 1 8 | 6 3 13 12 |
| | | | | |
| 379/d0 | /d1 | PT/ | SC/ | CP/ |
| 16----15 | 8---- 7 | 16 15 8 7 | 16 2 9 7 | 16 2 7 9 |
| 14---+13 | 6---+ 5 | 12 11 4 3 | 5 11 4 14 | 5 11 14 4 |
| 12-- -11 | 4-- - 3 | 14 13 6 5 | 3 13 6 12 | 10 8 1 15 |
| 10---- 9 | 2---- 1 | 10 9 2 1 | 10 8 15 1 | 3 13 12 6 |
| 380/d0 | /d1 | PT/ | SC/ | CP/ |
| 16----15 | 8---- 7 | 16 15 8 7 | 16 2 9 7 | 16 2 7 9 |
| 12---+11 | 4---+ 3 | 14 13 6 5 | 3 13 6 12 | 3 13 12 6 |
| 14-- -13 | 6-- - 5 | 12 11 4 3 | 5 11 4 14 | 10 8 1 15 |
| 10---- 9 | 2---- 1 | 10 9 2 1 | 10 8 15 1 | 5 11 14 4 |
| 381/d0 | /d1 | PT/ | SC/ | CP/ |
| 16----15 | 12----11 | 16 15 12 11 | 16 2 5 11 | 16 2 11 5 |
| 14---+13 | 10---+ 9 | 8 7 4 3 | 9 7 4 14 | 9 7 14 4 |
| 8-- - 7 | 4-- - 3 | 14 13 10 9 | 3 13 10 8 | 6 12 1 15 |
| 6---- 5 | 2---- 1 | 6 5 2 1 | 6 12 15 1 | 3 13 8 10 |
| 382/d0 | /d1 | PT/ | SC/ | CP/ |
| 16----15 | 12----11 | 16 15 12 11 | 16 2 5 11 | 16 2 11 5 |
| 8---+ 7 | 4---+ 3 | 14 13 10 9 | 3 13 10 8 | 3 13 8 10 |
| 14-- -13 | 10-- - 9 | 8 7 4 3 | 9 7 4 14 | 6 12 1 15 |
| 6---- 5 | 2---- 1 | 6 5 2 1 | 6 12 15 1 | 9 7 14 4 |


```

/** Newest Method of Composing Complete Pan-magic Squares of Order 4^2 **
/** Using All View-Diagrams of Developed Extra-Cubic Objects 2^4 **
/** File: 'S3NewMS4.c' Dictated by Kanji Setsuda on **
/** Apr.26,'05 and Jan.24,'06 with MacOSX & Xcode 2.1 **
/** Recompiled on Mar.17, 2015 with MacOSX & Xcode 6.2 **
//
#include <stdio.h>
//
short cnt, tcnt;
short vc, pc;
short tv[16][4];
short td[24][4];
short nm[17];
short pnm[385][17], tnm[49][17];
//
void mkfv16(void), prmt24(void);
void d24(short x, short y);
void mksol24(void);
void pr32ans(short x, short y);
void solsort(void), exc(short x);
//
/** Main Program *
int main(){
short m,n;
printf("\n");
printf("*** Newest Method of making Complete Pan-magic Squares of Order 4^2: **\n");
printf("*** Using All Developed View-Diagrams of Extra-Cubic Objects 2^4 **\n");
printf("*** Comparative List of the 48 Pairs of Standard Solutions:\n");
printf("    Prototype Squares and Complete Pan-magic Squares 4x4 composed **\n");
printf(" (Normalizing Inequality Conditions: n1<n4, n1<n13, n1<n16 and n2>n5;)\n");
vc=0; mkfv16();
pc=0; prmt24();
tcnt=pc*vc;
for(m=0;m<vc;m++){for(n=0;n<pc;n++){d24(m,n);}}
solsort();
cnt=0;
mksol24();
pr32ans(1,cnt);
printf("\n");
printf(" [Counts(PT/CP) = %d/%d] OK!\n",tcnt,cnt);
printf("\n");
printf("*** Recompiled and Listed by Kanji Setsuda on\n");
printf("    Mar.17, 2015 with MacOSX 10.10.2 & Xcode 6.2 **\n");
printf("\n");
return 0;
}
//
/** Sub-Procedures for EC02^4 *
//
void mkfv16(void){
short d0,d1,d2,d3;
for(d0=0;d0<2;d0++){
for(d1=0;d1<2;d1++){
for(d2=0;d2<2;d2++){
for(d3=0;d3<2;d3++){
tv[vc][0]=d0; tv[vc][1]=d1; tv[vc][2]=d2; tv[vc][3]=d3;
vc++;
}
}
}
}
}
//
void prmt24(void){
short d0,d1,d2,d3,n;

```

```

short uflg[4];
for(n=0;n<4;n++){uflg[n]=0;}
for(d0=0;d0<4;d0++){
  uflg[d0]=1;
  for(d1=0;d1<4;d1++){
    if(uflg[d1]==0){uflg[d1]=1;
      for(d2=0;d2<4;d2++){
        if(uflg[d2]==0){uflg[d2]=1;
          for(d3=0;d3<4;d3++){
            if(uflg[d3]==0){uflg[d3]=1;
              td[pc][0]=d0; td[pc][1]=d1; td[pc][2]=d2; td[pc][3]=d3;
              pc++;
              uflg[d3]=0;
            }
          }
          uflg[d2]=0;
        }
      }
      uflg[d1]=0;
    }
  }
  uflg[d0]=0;
}
}
//
void d24(short x, short y){
short d0,d1,d2,d3;
short t0,t1,t2,t3;
short CC,c,n;
short s[4], t[4][2];
CC=1;
for(n=0;n<4;n++){
  t[n][0]=tv[x][n]; t[n][1]=CC-tv[x][n];}
//
c=0;
for(d0=0;d0<2;d0++){
  for(d1=0;d1<2;d1++){
    for(d2=0;d2<2;d2++){
      for(d3=0;d3<2;d3++){c++;
        s[0]=t[0][d0]; s[1]=t[1][d1]; s[2]=t[2][d2]; s[3]=t[3][d3];
        t0=td[y][0]; t1=td[y][1]; t2=td[y][2]; t3=td[y][3];
        pnm[x*pc+y][c]=((s[t0]*2+s[t1])*2+s[t2])*2+s[t3]+1;
      }
    }
  }
}
}
//
/* 'DAM Transformation' from Prototype into Complete Pan-magic 4x4 *
void mkso124(void){
short m,n;
for(m=0;m<tcnt;m++){
  nm[1]=pnm[m][1]; nm[2]=pnm[m][15]; nm[3]=pnm[m][4]; nm[4]=pnm[m][14];
  nm[5]=pnm[m][12]; nm[6]=pnm[m][6]; nm[7]=pnm[m][9]; nm[8]=pnm[m][7];
  nm[9]=pnm[m][13]; nm[10]=pnm[m][3]; nm[11]=pnm[m][16]; nm[12]=pnm[m][2];
  nm[13]=pnm[m][8]; nm[14]=pnm[m][10]; nm[15]=pnm[m][5]; nm[16]=pnm[m][11];
  if((nm[1]<nm[4])&&(nm[1]<nm[13])&&(nm[1]<nm[16])&&(nm[2]>nm[5])){
    for(n=1;n<17;n++){tnm[cnt][n]=nm[n];}
    tnm[cnt][0]=m; cnt++;
  }
}
}
//
/* Print each Prototype and Object Solutions */
void pr32ans(short x, short y){
short m,l,l4,n,p,c;
for(m=x-1;m<y;m=m+3){
  printf("%10d/PT %3d/CP %16d/PT %3d/CP %16d/PT %3d/CP\n",

```

```

        tnm[m][0]+1,m+1,tnm[m+1][0]+1,m+2,tnm[m+2][0]+1,m+3);
for(l=0;l<4;l++){l4=l*4;
for(p=0;p<3;p++){c=tnm[m+p][0];
printf(" ");
for(n=0;n<4;n++){printf("%3d",pnm[c][l4+n+1]);}
printf(" ");
for(n=0;n<4;n++){printf("%3d",tnm[m+p][l4+n+1]);}
if(p<2){printf(" ");}
}
printf("\n");
}
}
}
//
/* Sort Program for the Smart List of Solutions */
void solsort(void){
int d0,d1;
short mx,n,f;
for(mx=tcnt-1;mx>0;mx--){
do{f=0;
for(n=0;n<mx;n++){
d0=(((pnm[n][1]*16+pnm[n][2])*16+pnm[n][3])*16+pnm[n][4])*16+pnm[n][5];
d1=(((pnm[n+1][1]*16+pnm[n+1][2])*16+pnm[n+1][3])*16+pnm[n+1][4])*16+pnm[n+1][5];
if(d0>d1){exc(n); f=1;}
if((d0==d1)&&(pnm[n][6]>pnm[n+1][6])){exc(n); f=1;}
}
}while(f>0);
}
}
//
void exc(short x){
short n,d;
for(n=1;n<17;n++){d=pnm[x][n]; pnm[x][n]=pnm[x+1][n]; pnm[x+1][n]=d;}
}

```

Here you are at the execution result of my newest program above for CPMS44.

```

** Newest Method of making Complete Pan-magic Squares of Order 4^2: **
** Using All Developed View-Diagrams of Extra-Cubic Objects 2^4 **
** Comparative List of the 48 Pairs of Standard Solutions:
    Prototype Squares and Complete Pan-magic Squares 4x4 composed **
    (Normalizing Inequality Conditions: n1<n4, n1<n13, n1<n16 and n2>n5;)

```

| 1/PT | | | | 1/CP | | | | 2/PT | | | | 2/CP | | | | 3/PT | | | | 3/CP | | | |
|-------|----|----|----|-------|----|----|----|-------|----|----|----|-------|----|----|----|-------|----|----|----|-------|----|----|----|
| 1 | 2 | 3 | 4 | 1 | 15 | 4 | 14 | 1 | 2 | 3 | 4 | 1 | 15 | 4 | 14 | 1 | 2 | 5 | 6 | 1 | 15 | 6 | 12 |
| 5 | 6 | 7 | 8 | 12 | 6 | 9 | 7 | 9 | 10 | 11 | 12 | 8 | 10 | 5 | 11 | 3 | 4 | 7 | 8 | 14 | 4 | 9 | 7 |
| 9 | 10 | 11 | 12 | 13 | 3 | 16 | 2 | 5 | 6 | 7 | 8 | 13 | 3 | 16 | 2 | 9 | 10 | 13 | 14 | 11 | 5 | 16 | 2 |
| 13 | 14 | 15 | 16 | 8 | 10 | 5 | 11 | 13 | 14 | 15 | 16 | 12 | 6 | 9 | 7 | 11 | 12 | 15 | 16 | 8 | 10 | 3 | 13 |
| 4/PT | | | | 4/CP | | | | 5/PT | | | | 5/CP | | | | 6/PT | | | | 6/CP | | | |
| 1 | 2 | 5 | 6 | 1 | 15 | 6 | 12 | 1 | 2 | 9 | 10 | 1 | 15 | 10 | 8 | 1 | 2 | 9 | 10 | 1 | 15 | 10 | 8 |
| 9 | 10 | 13 | 14 | 8 | 10 | 3 | 13 | 3 | 4 | 11 | 12 | 14 | 4 | 5 | 11 | 5 | 6 | 13 | 14 | 12 | 6 | 3 | 13 |
| 3 | 4 | 7 | 8 | 11 | 5 | 16 | 2 | 5 | 6 | 13 | 14 | 7 | 9 | 16 | 2 | 3 | 4 | 11 | 12 | 7 | 9 | 16 | 2 |
| 11 | 12 | 15 | 16 | 14 | 4 | 9 | 7 | 7 | 8 | 15 | 16 | 12 | 6 | 3 | 13 | 7 | 8 | 15 | 16 | 14 | 4 | 5 | 11 |
| 7/PT | | | | 7/CP | | | | 8/PT | | | | 8/CP | | | | 10/PT | | | | 9/CP | | | |
| 1 | 3 | 2 | 4 | 1 | 14 | 4 | 15 | 1 | 3 | 2 | 4 | 1 | 14 | 4 | 15 | 1 | 3 | 5 | 7 | 1 | 14 | 7 | 12 |
| 5 | 7 | 6 | 8 | 12 | 7 | 9 | 6 | 9 | 11 | 10 | 12 | 8 | 11 | 5 | 10 | 9 | 11 | 13 | 15 | 8 | 11 | 2 | 13 |
| 9 | 11 | 10 | 12 | 13 | 2 | 16 | 3 | 5 | 7 | 6 | 8 | 13 | 2 | 16 | 3 | 2 | 4 | 6 | 8 | 10 | 5 | 16 | 3 |
| 13 | 15 | 14 | 16 | 8 | 11 | 5 | 10 | 13 | 15 | 14 | 16 | 12 | 7 | 9 | 6 | 10 | 12 | 14 | 16 | 15 | 4 | 9 | 6 |
| 12/PT | | | | 10/CP | | | | 14/PT | | | | 11/CP | | | | 16/PT | | | | 12/CP | | | |
| 1 | 3 | 9 | 11 | 1 | 14 | 11 | 8 | 1 | 5 | 2 | 6 | 1 | 12 | 6 | 15 | 1 | 5 | 3 | 7 | 1 | 12 | 7 | 14 |
| 5 | 7 | 13 | 15 | 12 | 7 | 2 | 13 | 9 | 13 | 10 | 14 | 8 | 13 | 3 | 10 | 9 | 13 | 11 | 15 | 8 | 13 | 2 | 11 |
| 2 | 4 | 10 | 12 | 6 | 9 | 16 | 3 | 3 | 7 | 4 | 8 | 11 | 2 | 16 | 5 | 2 | 6 | 4 | 8 | 10 | 3 | 16 | 5 |
| 6 | 8 | 14 | 16 | 15 | 4 | 5 | 10 | 11 | 15 | 12 | 16 | 14 | 7 | 9 | 4 | 10 | 14 | 12 | 16 | 15 | 6 | 9 | 4 |

| | | | | | |
|-------------|-----------|-------------|-----------|-------------|-----------|
| 25/PT | 13/CP | 26/PT | 14/CP | 27/PT | 15/CP |
| 2 1 4 3 | 2 16 3 13 | 2 1 4 3 | 2 16 3 13 | 2 1 6 5 | 2 16 5 11 |
| 6 5 8 7 | 11 5 10 8 | 10 9 12 11 | 7 9 6 12 | 4 3 8 7 | 13 3 10 8 |
| 10 9 12 11 | 14 4 15 1 | 6 5 8 7 | 14 4 15 1 | 10 9 14 13 | 12 6 15 1 |
| 14 13 16 15 | 7 9 6 12 | 14 13 16 15 | 11 5 10 8 | 12 11 16 15 | 7 9 4 14 |
| 28/PT | 16/CP | 29/PT | 17/CP | 30/PT | 18/CP |
| 2 1 6 5 | 2 16 5 11 | 2 1 10 9 | 2 16 9 7 | 2 1 10 9 | 2 16 9 7 |
| 10 9 14 13 | 7 9 4 14 | 4 3 12 11 | 13 3 6 12 | 6 5 14 13 | 11 5 4 14 |
| 4 3 8 7 | 12 6 15 1 | 6 5 14 13 | 8 10 15 1 | 4 3 12 11 | 8 10 15 1 |
| 12 11 16 15 | 13 3 10 8 | 8 7 16 15 | 11 5 4 14 | 8 7 16 15 | 13 3 6 12 |
| 31/PT | 19/CP | 32/PT | 20/CP | 34/PT | 21/CP |
| 2 4 1 3 | 2 13 3 16 | 2 4 1 3 | 2 13 3 16 | 2 4 6 8 | 2 13 8 11 |
| 6 8 5 7 | 11 8 10 5 | 10 12 9 11 | 7 12 6 9 | 10 12 14 16 | 7 12 1 14 |
| 10 12 9 11 | 14 1 15 4 | 6 8 5 7 | 14 1 15 4 | 1 3 5 7 | 9 6 15 4 |
| 14 16 13 15 | 7 12 6 9 | 14 16 13 15 | 11 8 10 5 | 9 11 13 15 | 16 3 10 5 |
| 36/PT | 22/CP | 38/PT | 23/CP | 40/PT | 24/CP |
| 2 4 10 12 | 2 13 12 7 | 2 6 1 5 | 2 11 5 16 | 2 6 4 8 | 2 11 8 13 |
| 6 8 14 16 | 11 8 1 14 | 10 14 9 13 | 7 14 4 9 | 10 14 12 16 | 7 14 1 12 |
| 1 3 9 11 | 5 10 15 4 | 4 8 3 7 | 12 1 15 6 | 1 5 3 7 | 9 4 15 6 |
| 5 7 13 15 | 16 3 6 9 | 12 16 11 15 | 13 8 10 3 | 9 13 11 15 | 16 5 10 3 |
| 49/PT | 25/CP | 50/PT | 26/CP | 51/PT | 27/CP |
| 3 1 4 2 | 3 16 2 13 | 3 1 4 2 | 3 16 2 13 | 3 1 7 5 | 3 16 5 10 |
| 7 5 8 6 | 10 5 11 8 | 11 9 12 10 | 6 9 7 12 | 4 2 8 6 | 13 2 11 8 |
| 11 9 12 10 | 15 4 14 1 | 7 5 8 6 | 15 4 14 1 | 11 9 15 13 | 12 7 14 1 |
| 15 13 16 14 | 6 9 7 12 | 15 13 16 14 | 10 5 11 8 | 12 10 16 14 | 6 9 4 15 |
| 52/PT | 28/CP | 53/PT | 29/CP | 54/PT | 30/CP |
| 3 1 7 5 | 3 16 5 10 | 3 1 11 9 | 3 16 9 6 | 3 1 11 9 | 3 16 9 6 |
| 11 9 15 13 | 6 9 4 15 | 4 2 12 10 | 13 2 7 12 | 7 5 15 13 | 10 5 4 15 |
| 4 2 8 6 | 12 7 14 1 | 7 5 15 13 | 8 11 14 1 | 4 2 12 10 | 8 11 14 1 |
| 12 10 16 14 | 13 2 11 8 | 8 6 16 14 | 10 5 4 15 | 8 6 16 14 | 13 2 7 12 |
| 55/PT | 31/CP | 56/PT | 32/CP | 58/PT | 33/CP |
| 3 4 1 2 | 3 13 2 16 | 3 4 1 2 | 3 13 2 16 | 3 4 7 8 | 3 13 8 10 |
| 7 8 5 6 | 10 8 11 5 | 11 12 9 10 | 6 12 7 9 | 11 12 15 16 | 6 12 1 15 |
| 11 12 9 10 | 15 1 14 4 | 7 8 5 6 | 15 1 14 4 | 1 2 5 6 | 9 7 14 4 |
| 15 16 13 14 | 6 12 7 9 | 15 16 13 14 | 10 8 11 5 | 9 10 13 14 | 16 2 11 5 |
| 60/PT | 34/CP | 73/PT | 35/CP | 74/PT | 36/CP |
| 3 4 11 12 | 3 13 12 6 | 4 2 3 1 | 4 15 1 14 | 4 2 3 1 | 4 15 1 14 |
| 7 8 15 16 | 10 8 1 15 | 8 6 7 5 | 9 6 12 7 | 12 10 11 9 | 5 10 8 11 |
| 1 2 9 10 | 5 11 14 4 | 12 10 11 9 | 16 3 13 2 | 8 6 7 5 | 16 3 13 2 |
| 5 6 13 14 | 16 2 7 9 | 16 14 15 13 | 5 10 8 11 | 16 14 15 13 | 9 6 12 7 |
| 75/PT | 37/CP | 76/PT | 38/CP | 77/PT | 39/CP |
| 4 2 8 6 | 4 15 6 9 | 4 2 8 6 | 4 15 6 9 | 4 2 12 10 | 4 15 10 5 |
| 3 1 7 5 | 14 1 12 7 | 12 10 16 14 | 5 10 3 16 | 3 1 11 9 | 14 1 8 11 |
| 12 10 16 14 | 11 8 13 2 | 3 1 7 5 | 11 8 13 2 | 8 6 16 14 | 7 12 13 2 |
| 11 9 15 13 | 5 10 3 16 | 11 9 15 13 | 14 1 12 7 | 7 5 15 13 | 9 6 3 16 |
| 78/PT | 40/CP | 79/PT | 41/CP | 80/PT | 42/CP |
| 4 2 12 10 | 4 15 10 5 | 4 3 2 1 | 4 14 1 15 | 4 3 2 1 | 4 14 1 15 |
| 8 6 16 14 | 9 6 3 16 | 8 7 6 5 | 9 7 12 6 | 12 11 10 9 | 5 11 8 10 |
| 3 1 11 9 | 7 12 13 2 | 12 11 10 9 | 16 2 13 3 | 8 7 6 5 | 16 2 13 3 |
| 7 5 15 13 | 14 1 8 11 | 16 15 14 13 | 5 11 8 10 | 16 15 14 13 | 9 7 12 6 |
| 82/PT | 43/CP | 84/PT | 44/CP | 98/PT | 45/CP |
| 4 3 8 7 | 4 14 7 9 | 4 3 12 11 | 4 14 11 5 | 5 1 6 2 | 5 16 2 11 |
| 12 11 16 15 | 5 11 2 16 | 8 7 16 15 | 9 7 2 16 | 13 9 14 10 | 4 9 7 14 |
| 2 1 6 5 | 10 8 13 3 | 2 1 10 9 | 6 12 13 3 | 7 3 8 4 | 15 6 12 1 |
| 10 9 14 13 | 15 1 12 6 | 6 5 14 13 | 15 1 8 10 | 15 11 16 12 | 10 3 13 8 |
| 100/PT | 46/CP | 122/PT | 47/CP | 124/PT | 48/CP |
| 5 1 7 3 | 5 16 3 10 | 6 2 5 1 | 6 15 1 12 | 6 2 8 4 | 6 15 4 9 |
| 13 9 15 11 | 4 9 6 15 | 14 10 13 9 | 3 10 8 13 | 14 10 16 12 | 3 10 5 16 |
| 6 2 8 4 | 14 7 12 1 | 8 4 7 3 | 16 5 11 2 | 5 1 7 3 | 13 8 11 2 |
| 14 10 16 12 | 11 2 13 8 | 16 12 15 11 | 9 4 14 7 | 13 9 15 11 | 12 1 14 7 |

[Counts(PT/CP) = 384/48] OK!

EC/D2i

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 0--1 | 1--0 | 0--1 | 1--0 | 0--1 | 0--1 | 0--0 | 1--1 |
| 0--1 | 1--0 | 1--0 | 0--1 | 1--0 | 1--0 | 1--1 | 0--0 |
| 1- 0 | 0- 1 | 0- 1 | 1- 0 | 1- 0 | 1- 0 | 1- 1 | 0- 0 |
| 1--0 | 0--1 | 1--0 | 0--1 | 0--1 | 0--1 | 0--0 | 1--1 |
| /2^3 | /2^2 | /2^1 | /2^0 | | | | |

SC/D2i

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| 0 1 1 0 | 0 1 1 0 | 0 1 0 1 | 0 0 1 1 | 0 1 0 1 | 0 1 0 1 | 0 1 1 0 | 0 0 1 1 |
| 1 0 0 1 | 0 1 1 0 | 1 0 1 0 | 1 1 0 0 | 1 0 1 0 | 0 1 0 1 | 1 0 0 1 | 1 1 0 0 |
| 0 1 1 0 | 1 0 0 1 | 1 0 1 0 | 1 1 0 0 | 1 0 1 0 | 1 0 1 0 | 0 1 1 0 | 0 0 1 1 |
| 1 0 0 1 | 1 0 0 1 | 0 1 0 1 | 0 0 1 1 | 0 1 0 1 | 1 0 1 0 | 1 0 0 1 | 1 1 0 0 |
| /2^3 | /^2 | /^1 | /^0 | /2^3 | /^2 | /^1 | /^0 |

PD/D2i

[2]

PT/d0

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

/d1

SC/

PD/

EC/D2i

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 0--0 | 0--0 | 0--0 | 1--1 | 0--0 | 0--0 | 0--1 | 0--1 |
| 1--1 | 1--1 | 0--0 | 1--1 | 0--0 | 0--0 | 0--1 | 0--1 |
| 0- 0 | 0- 0 | 0- 0 | 1- 1 | 1- 1 | 1- 1 | 0- 1 | 0- 1 |
| 1--1 | 1--1 | 0--0 | 1--1 | 1--1 | 1--1 | 0--1 | 0--1 |
| /2^3 | /2^2 | /2^1 | /2^0 | | | | |

SC/D2i

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| 0 0 0 0 | 0 0 1 1 | 0 0 0 0 | 0 1 0 1 | 0 0 0 0 | 0 0 1 1 | 0 0 0 0 | 0 1 1 0 |
| 0 0 0 0 | 0 0 1 1 | 1 1 1 1 | 0 1 0 1 | 0 0 0 0 | 0 0 1 1 | 1 1 1 1 | 0 1 1 0 |
| 1 1 1 1 | 0 0 1 1 | 0 0 0 0 | 0 1 0 1 | 1 1 1 1 | 0 0 1 1 | 1 1 1 1 | 0 1 1 0 |
| 1 1 1 1 | 0 0 1 1 | 1 1 1 1 | 0 1 0 1 | 1 1 1 1 | 0 0 1 1 | 0 0 0 0 | 0 1 1 0 |
| /2^3 | /^2 | /^1 | /^0 | /2^3 | /^2 | /^1 | /^0 |

PD/D2i

S2/d0

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

/d1

SC/

PD/

EC/D2i

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 0--1 | 1--0 | 0--1 | 0--1 | 0--1 | 1--0 | 0--0 | 1--1 |
| 0--1 | 1--0 | 1--0 | 1--0 | 1--0 | 0--1 | 1--1 | 0--0 |
| 1- 0 | 0- 1 | 1- 0 | 1- 0 | 0- 1 | 1- 0 | 1- 1 | 0- 0 |
| 1--0 | 0--1 | 0--1 | 0--1 | 1--0 | 0--1 | 0--0 | 1--1 |
| /2^3 | /2^2 | /2^1 | /2^0 | | | | |

SC/D2i

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| 0 1 1 0 | 0 1 0 1 | 0 1 1 0 | 0 0 1 1 | 0 1 0 1 | 0 1 1 0 | 0 1 0 1 | 0 0 1 1 |
| 1 0 0 1 | 1 0 1 0 | 0 1 1 0 | 1 1 0 0 | 1 0 1 0 | 1 0 0 1 | 0 1 0 1 | 1 1 0 0 |
| 0 1 1 0 | 1 0 1 0 | 1 0 0 1 | 1 1 0 0 | 1 0 1 0 | 0 1 1 0 | 1 0 1 0 | 0 0 1 1 |
| 1 0 0 1 | 0 1 0 1 | 1 0 0 1 | 0 0 1 1 | 0 1 0 1 | 1 0 0 1 | 1 0 1 0 | 1 1 0 0 |
| /2^3 | /^2 | /^1 | /^0 | /2^3 | /^2 | /^1 | /^0 |

PD/D2i

[3]

PT/d0

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

/d1

SC/

PD/

EC/D2i

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 0--0 | 1--1 | 0--0 | 0--0 | 0--0 | 0--0 | 0--1 | 0--1 |
| 0--0 | 1--1 | 1--1 | 1--1 | 0--0 | 0--0 | 0--1 | 0--1 |

| | | | |
|-------------|-------------|-------------|-------------|
| 0- 0 1- 1 | 0- 0 0- 0 | 1- 1 1- 1 | 0- 1 0- 1 |
| 0--0 1--1 | 1--1 1--1 | 1--1 1--1 | 0--1 0--1 |
| /2^3 | /2^2 | /2^1 | /2^0 |
| SC/D2i | | PD/D2i | |
| 0 0 1 1 | 0 0 0 0 | 0 0 0 0 | 0 1 0 1 |
| 0 0 1 1 | 0 0 0 0 | 1 1 1 1 | 0 1 0 1 |
| 0 0 1 1 | 1 1 1 1 | 0 0 0 0 | 0 1 0 1 |
| 0 0 1 1 | 1 1 1 1 | 1 1 1 1 | 0 0 1 1 |
| /2^3 | /2^2 | /2^1 | /2^0 |

| | | | |
|----------|----------|-----------|-----------|
| S3/d0 | /d1 | SC/ | PD/ |
| 1----15 | 8----10 | 1 15 8 10 | 1 15 10 8 |
| 12---+ 6 | 13---+ 3 | 14 4 11 5 | 14 4 5 11 |
| 14-- - 4 | 11-- - 5 | 12 6 13 3 | 7 9 16 2 |
| 7---- 9 | 2----16 | 7 9 2 16 | 12 6 3 13 |

| | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 0--1 | 0--1 | 1--0 | 0--1 | 1--0 | 0--0 | 1--1 |
| 1--0 | 1--0 | 0--1 | 1--0 | 1--0 | 0--1 | 1--1 |
| 1- 0 | 1- 0 | 1- 0 | 0- 1 | 0- 1 | 1- 0 | 1- 1 |
| 0--1 | 0--1 | 1--0 | 0--1 | 1--0 | 0--1 | 0--0 |
| /2^3 | /2^2 | /2^1 | /2^1 | /2^1 | /2^0 | /2^0 |
| SC/D2i | | | PD/D2i | | | |
| 0 1 0 1 | 0 1 1 0 | 0 1 1 0 | 0 0 1 1 | 0 1 1 0 | 0 1 0 1 | 0 1 0 1 |
| 1 0 1 0 | 1 0 0 1 | 0 1 1 0 | 1 1 0 0 | 1 0 0 1 | 1 0 1 0 | 0 1 0 1 |
| 1 0 1 0 | 0 1 1 0 | 1 0 0 1 | 1 1 0 0 | 0 1 1 0 | 1 0 1 0 | 1 0 1 0 |
| 0 1 0 1 | 1 0 0 1 | 1 0 0 1 | 0 0 1 1 | 1 0 0 1 | 0 1 0 1 | 1 0 1 0 |
| /2^3 | /2^2 | /2^1 | /2^0 | /2^3 | /2^2 | /2^1 |

Will you watch the next diagrams above with binary decompositions, please?
 I put them to both the prototype and corresponding object solutions.
 What do they mean?

Watch the last patterns of each group especially, please.

Do you notice the fact all the solutions are 'Complete Euler Squares' of order 4? Every row and column of the solutions has the same number pattern of {0,0,1,1} in any layer of binary decompositions. Each pandiagonal has also the same combination of numbers. Every little square of 2 by 2 in any layer has the same thing, too. It means the mathematical basis of the same 'magic constant' for all of them.

Yes. We prepared everything in order to make 'Complete Euler Squares' of order 4 for our objects without any consciousness.

We know any 'CES44' has the same count of primitive solutions as many as 384.

We actually make the 'prototype squares' by drawing all possible view-forms of the same ECO, and make them into our objects, 'CEulerS44', by 'DAM Transformation'.

That is the true reason for our success, I believe.

What is the meaning of the fact both view-forms of ECO and the solutions of our object have the same count 384?

I think it means ECO² has the only one form in the 4-dimensional world.

Only Divine Being might enjoy the original form as it is.

But it appears in the 384 different view forms to us. Human beings can only enjoy them individually as they are in this world.

Imagine if any object had 1152 solutions while we could draw only 384 pictures for ECO, and we could have guessed there might be 3 original forms of ECO in the 4-dimensional world, and there might be 3 most fundamental solutions.

I am excited most by my own intuition that there might be a great relationship

among 'Binary Number System', 'Complete Euler Squares', 'High Dimensional Extra-Cubic Objects', 'Prototype Squares' and 'DAM Transformation'. For they are all the special topics that I have always studied as hard as I could.

This 'great relationship' might be one of the 'greatest mysteries' revealed to us by our Divine Being.

My philosophical mind is getting more active and would hardly sleep any longer.

#6. Additional Report

Is it true we can really have the only one best Model for our 'Do-it-After-the-Model Transformation'?

In our previous experiment we selected the next Model to compose the 384 object solutions of Self-complementary MS44 from the 384 Basic Forms and we assumed such a transformation method as shown below again.

```

/**
/** Concept of DAM Transformation *
BD/d0      /d1      PT/
 1---- 2      3---- 4      1 2 3 4
 | 9---10    | 11---12    5 6 7 8
5--|- 6 |    7--|- 8 |    9 10 11 12
 13----14    15----16    13 14 15 16
MD/d0      /d1      SC/   ↓
 1----15    14---- 4      1 15 14 4
 | 8---10    | 11--- 5    12 6 7 9
12--|- 6 |    7--|- 9 |    8 10 11 5
 13---- 3      2----16    13 3 2 16
//
/** Self-Complementary Transformation for Half *
CC=17;
y[1]=x[1];   y[2]=CC-x[2];   y[3]=CC-x[3];   y[4]=x[4];
y[5]=CC-x[5]; y[6]=x[6];     y[7]=x[7];     y[8]=CC-x[8];
y[9]=CC-x[9]; y[10]=x[10];    y[11]=x[11];    y[12]=CC-x[12];
y[13]=x[13];  y[14]=CC-x[14]; y[15]=CC-x[15]; y[16]=x[16];
//

```

I must confess I like this model and this style of transformation best of all, but is it really true that it is the only one best model that can compose the complete set of object solutions? I know a few other solutions can perform well for the model during my study of Prototype squares and 'DAM Transformation' for S-C MS44.

I felt I had to make any additional experiments to examine precisely if it is true.

At first I took the next solution for our temporary model and wrote such a program for its new DAM Transformation as follows.

| 1/PT | | | | 8/SC Model | | | | * DAM Transformation * | | | | |
|------|----|----|----|------------|----|----|----|------------------------|--------------|-------------|-------------|--------------|
| 1 | 2 | 3 | 4 | 1 | 14 | 15 | 4 | | y[1]=x[1]; | y[2]=x[14]; | y[3]=x[15]; | y[4]=x[4]; |
| 5 | 6 | 7 | 8 | 8 | 11 | 10 | 5 | | y[5]=x[8]; | y[6]=x[11]; | y[7]=x[10]; | y[8]=x[5]; |
| 9 | 10 | 11 | 12 | 12 | 7 | 6 | 9 | | y[9]=x[12]; | y[10]=x[7]; | y[11]=x[6]; | y[12]=x[9]; |
| 13 | 14 | 15 | 16 | 13 | 2 | 3 | 16 | | y[13]=x[13]; | y[14]=x[2]; | y[15]=x[3]; | y[16]=x[16]; |

Please take your kind look at the next list that shows the execution result of our new experiment. I have changed nothing about the Basic Forms.

** Comparative List of the 48 Pairs of Standard Solutions:
 Prototype Squares and Self-complementary Magic Squares 4x4 composed **

(Normalizing Inequality Conditions: $n1 < n4$, $n1 < n13$, $n1 < n16$ and $n2 > n5$;))

| | | | | | |
|-------------|-----------|-------------|-----------|-------------|-----------|
| 1/PT | 1/SC | 2/PT | 2/SC | 3/PT | 3/SC |
| 1 2 3 4 | 1 14 15 4 | 1 2 3 4 | 1 14 15 4 | 1 2 5 6 | 1 12 15 6 |
| 5 6 7 8 | 8 11 10 5 | 9 10 11 12 | 12 7 6 9 | 3 4 7 8 | 8 13 10 3 |
| 9 10 11 12 | 12 7 6 9 | 5 6 7 8 | 8 11 10 5 | 9 10 13 14 | 14 7 4 9 |
| 13 14 15 16 | 13 2 3 16 | 13 14 15 16 | 13 2 3 16 | 11 12 15 16 | 11 2 5 16 |
| 7/PT | 4/SC | 8/PT | 5/SC | 9/PT | 6/SC |
| 1 3 2 4 | 1 15 14 4 | 1 3 2 4 | 1 15 14 4 | 1 3 5 7 | 1 12 14 7 |
| 5 7 6 8 | 8 10 11 5 | 9 11 10 12 | 12 6 7 9 | 2 4 6 8 | 8 13 11 2 |
| 9 11 10 12 | 12 6 7 9 | 5 7 6 8 | 8 10 11 5 | 9 11 13 15 | 15 6 4 9 |
| 13 15 14 16 | 13 3 2 16 | 13 15 14 16 | 13 3 2 16 | 10 12 14 16 | 10 3 5 16 |
| 13/PT | 7/SC | 14/PT | 8/SC | 15/PT | 9/SC |
| 1 5 2 6 | 1 15 12 6 | 1 5 2 6 | 1 15 12 6 | 1 5 3 7 | 1 14 12 7 |
| 3 7 4 8 | 8 10 13 3 | 9 13 10 14 | 14 4 7 9 | 2 6 4 8 | 8 11 13 2 |
| 9 13 10 14 | 14 4 7 9 | 3 7 4 8 | 8 10 13 3 | 9 13 11 15 | 15 4 6 9 |
| 11 15 12 16 | 11 5 2 16 | 11 15 12 16 | 11 5 2 16 | 10 14 12 16 | 10 5 3 16 |
| 19/PT | 10/SC | 20/PT | 11/SC | 21/PT | 12/SC |
| 1 9 2 10 | 1 15 8 10 | 1 9 2 10 | 1 15 8 10 | 1 9 3 11 | 1 14 8 11 |
| 3 11 4 12 | 12 6 13 3 | 5 13 6 14 | 14 4 11 5 | 2 10 4 12 | 12 7 13 2 |
| 5 13 6 14 | 14 4 11 5 | 3 11 4 12 | 12 6 13 3 | 5 13 7 15 | 15 4 10 5 |
| 7 15 8 16 | 7 9 2 16 | 7 15 8 16 | 7 9 2 16 | 6 14 8 16 | 6 9 3 16 |
| 25/PT | 13/SC | 26/PT | 14/SC | 27/PT | 15/SC |
| 2 1 4 3 | 2 13 16 3 | 2 1 4 3 | 2 13 16 3 | 2 1 6 5 | 2 11 16 5 |
| 6 5 8 7 | 7 12 9 6 | 10 9 12 11 | 11 8 5 10 | 4 3 8 7 | 7 14 9 4 |
| 10 9 12 11 | 11 8 5 10 | 6 5 8 7 | 7 12 9 6 | 10 9 14 13 | 13 8 3 10 |
| 14 13 16 15 | 14 1 4 15 | 14 13 16 15 | 14 1 4 15 | 12 11 16 15 | 12 1 6 15 |
| 31/PT | 16/SC | 32/PT | 17/SC | 33/PT | 18/SC |
| 2 4 1 3 | 2 16 13 3 | 2 4 1 3 | 2 16 13 3 | 2 4 6 8 | 2 11 13 8 |
| 6 8 5 7 | 7 9 12 6 | 10 12 9 11 | 11 5 8 10 | 1 3 5 7 | 7 14 12 1 |
| 10 12 9 11 | 11 5 8 10 | 6 8 5 7 | 7 9 12 6 | 10 12 14 16 | 16 5 3 10 |
| 14 16 13 15 | 14 4 1 15 | 14 16 13 15 | 14 4 1 15 | 9 11 13 15 | 9 4 6 15 |
| 37/PT | 19/SC | 38/PT | 20/SC | 39/PT | 21/SC |
| 2 6 1 5 | 2 16 11 5 | 2 6 1 5 | 2 16 11 5 | 2 6 4 8 | 2 13 11 8 |
| 4 8 3 7 | 7 9 14 4 | 10 14 9 13 | 13 3 8 10 | 1 5 3 7 | 7 12 14 1 |
| 10 14 9 13 | 13 3 8 10 | 4 8 3 7 | 7 9 14 4 | 10 14 12 16 | 16 3 5 10 |
| 12 16 11 15 | 12 6 1 15 | 12 16 11 15 | 12 6 1 15 | 9 13 11 15 | 9 6 4 15 |
| 43/PT | 22/SC | 44/PT | 23/SC | 45/PT | 24/SC |
| 2 10 1 9 | 2 16 7 9 | 2 10 1 9 | 2 16 7 9 | 2 10 4 12 | 2 13 7 12 |
| 4 12 3 11 | 11 5 14 4 | 6 14 5 13 | 13 3 12 6 | 1 9 3 11 | 11 8 14 1 |
| 6 14 5 13 | 13 3 12 6 | 4 12 3 11 | 11 5 14 4 | 6 14 8 16 | 16 3 9 6 |
| 8 16 7 15 | 8 10 1 15 | 8 16 7 15 | 8 10 1 15 | 5 13 7 15 | 5 10 4 15 |
| 51/PT | 25/SC | 57/PT | 26/SC | 61/PT | 27/SC |
| 3 1 7 5 | 3 10 16 5 | 3 4 7 8 | 3 10 13 8 | 3 7 1 5 | 3 16 10 5 |
| 4 2 8 6 | 6 15 9 4 | 1 2 5 6 | 6 15 12 1 | 4 8 2 6 | 6 9 15 4 |
| 11 9 15 13 | 13 8 2 11 | 11 12 15 16 | 16 5 2 11 | 11 15 9 13 | 13 2 8 11 |
| 12 10 16 14 | 12 1 7 14 | 9 10 13 14 | 9 4 7 14 | 12 16 10 14 | 12 7 1 14 |
| 62/PT | 28/SC | 63/PT | 29/SC | 67/PT | 30/SC |
| 3 7 1 5 | 3 16 10 5 | 3 7 4 8 | 3 13 10 8 | 3 11 1 9 | 3 16 6 9 |
| 11 15 9 13 | 13 2 8 11 | 1 5 2 6 | 6 12 15 1 | 4 12 2 10 | 10 5 15 4 |
| 4 8 2 6 | 6 9 15 4 | 11 15 12 16 | 16 2 5 11 | 7 15 5 13 | 13 2 12 7 |
| 12 16 10 14 | 12 7 1 14 | 9 13 10 14 | 9 7 4 14 | 8 16 6 14 | 8 11 1 14 |
| 68/PT | 31/SC | 69/PT | 32/SC | 75/PT | 33/SC |
| 3 11 1 9 | 3 16 6 9 | 3 11 4 12 | 3 13 6 12 | 4 2 8 6 | 4 9 15 6 |
| 7 15 5 13 | 13 2 12 7 | 1 9 2 10 | 10 8 15 1 | 3 1 7 5 | 5 16 10 3 |
| 4 12 2 10 | 10 5 15 4 | 7 15 8 16 | 16 2 9 7 | 12 10 16 14 | 14 7 1 12 |
| 8 16 6 14 | 8 11 1 14 | 5 13 6 14 | 5 11 4 14 | 11 9 15 13 | 11 2 8 13 |
| 81/PT | 34/SC | 85/PT | 35/SC | 86/PT | 36/SC |
| 4 3 8 7 | 4 9 14 7 | 4 8 2 6 | 4 15 9 6 | 4 8 2 6 | 4 15 9 6 |
| 2 1 6 5 | 5 16 11 2 | 3 7 1 5 | 5 10 16 3 | 12 16 10 14 | 14 1 7 12 |
| 12 11 16 15 | 15 6 1 12 | 12 16 10 14 | 14 1 7 12 | 3 7 1 5 | 5 10 16 3 |
| 10 9 14 13 | 10 3 8 13 | 11 15 9 13 | 11 8 2 13 | 11 15 9 13 | 11 8 2 13 |

| | | | | | |
|-------------|-----------|-------------|-----------|-------------|-----------|
| 87/PT | 37/SC | 91/PT | 38/SC | 92/PT | 39/SC |
| 4 8 3 7 | 4 14 9 7 | 4 12 2 10 | 4 15 5 10 | 4 12 2 10 | 4 15 5 10 |
| 2 6 1 5 | 5 11 16 2 | 3 11 1 9 | 9 6 16 3 | 8 16 6 14 | 14 1 11 8 |
| 12 16 11 15 | 15 1 6 12 | 8 16 6 14 | 14 1 11 8 | 3 11 1 9 | 9 6 16 3 |
| 10 14 9 13 | 10 8 3 13 | 7 15 5 13 | 7 12 2 13 | 7 15 5 13 | 7 12 2 13 |
| 93/PT | 40/SC | 105/PT | 41/SC | 111/PT | 42/SC |
| 4 12 3 11 | 4 14 5 11 | 5 6 7 8 | 5 10 11 8 | 5 7 6 8 | 5 11 10 8 |
| 2 10 1 9 | 9 7 16 2 | 1 2 3 4 | 4 15 14 1 | 1 3 2 4 | 4 14 15 1 |
| 8 16 7 15 | 15 1 10 8 | 13 14 15 16 | 16 3 2 13 | 13 15 14 16 | 16 2 3 13 |
| 6 14 5 13 | 6 12 3 13 | 9 10 11 12 | 9 6 7 12 | 9 11 10 12 | 9 7 6 12 |
| 115/PT | 43/SC | 116/PT | 44/SC | 129/PT | 45/SC |
| 5 13 1 9 | 5 16 4 9 | 5 13 1 9 | 5 16 4 9 | 6 5 8 7 | 6 9 12 7 |
| 6 14 2 10 | 10 3 15 6 | 7 15 3 11 | 11 2 14 7 | 2 1 4 3 | 3 16 13 2 |
| 7 15 3 11 | 11 2 14 7 | 6 14 2 10 | 10 3 15 6 | 14 13 16 15 | 15 4 1 14 |
| 8 16 4 12 | 8 13 1 12 | 8 16 4 12 | 8 13 1 12 | 10 9 12 11 | 10 5 8 11 |
| 135/PT | 46/SC | 139/PT | 47/SC | 140/PT | 48/SC |
| 6 8 5 7 | 6 12 9 7 | 6 14 2 10 | 6 15 3 10 | 6 14 2 10 | 6 15 3 10 |
| 2 4 1 3 | 3 13 16 2 | 5 13 1 9 | 9 4 16 5 | 8 16 4 12 | 12 1 13 8 |
| 14 16 13 15 | 15 1 4 14 | 8 16 4 12 | 12 1 13 8 | 5 13 1 9 | 9 4 16 5 |
| 10 12 9 11 | 10 8 5 11 | 7 15 3 11 | 7 14 2 11 | 7 15 3 11 | 7 14 2 11 |

[Counts(PT/SC) = 384/48] OK!

** Recompiled and Listed by Kanji Setsuda on
Mar.17, 2015 with MacOSX 10.10.2 & Xcode 6.2 **

Do you notice it is all right with this new model and new DAM Transformation and they could successfully compose all what we want to have? It was really surprising.

After I made many experiments with other models, I knew every solution of 12 Self-complementary MS44 with $n_1=1$ could perform well for the representative Model and compose the complete set of 48 object solutions, as well as the best one I once supposed. I came to know everything was born equal in its ability and activity.

There are really many beautiful bridges built between the two parallel worlds: of the Prototype squares and of the object squares, or of the sets of Basic Forms and object solutions. It is truly amazing, isn't it?

It implies there certainly exists the high grade of 'symmetry' and 'concordance' in the magic square world. I want to find more about what it really is.

(The original was written in English by Kanji Setsuda on May 11, 2005;
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