

Part 3 : "New Algebraic Study of Magic Squares"  
 Chapter 9 : Fundamental Study of "Composite" Squares:  
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**Section1 : Study of "Composite" Squares of Order 6**

**#0. What is a 'Composite' Square?**

A 'Composite' square has such a strict condition as "every 4 entries of any 2 x 2 block within must add up to the magic constant". The simultaneous equations below may be easier for you to understand this property. In the case of order 6 there are 25 simultaneous equations required at least.

The name 'Composite' was once given by Prof. Mutsumi Suzuki with his beautiful picture of Japanese royal flower in his page. I know there are some other names such as "Most-perfect" or "Compact", but I like this name 'Composite' best of all.

Let's study about this type of square of order 6. For we once failed in constructing any pan-diagonal magic squares or any self-complementary magic ones. This would be the last hope for us to make something like magic square of order 6.

See the basic diagram and the smallest set of Composite Conditions below.

[Figure 1: Basic Form and the Smallest Set of "Composite" Conditions]

	Composite Conditions:
----- n6   n1   n2   n3   n4   n5   n6   n1   -+--+--+--+--+--+   12   n7   n8   n9   10   11   12   n7   -+--+--+--+--+--+   18   13   14   15   16   17   18   13   -+--+--+--+--+--+   24   19   20   21   22   23   24   19   -+--+--+--+--+--+   30   25   26   27   28   29   30   25   -+--+--+--+--+--+   36   31   32   33   34   35   36   31 -----	$n1+ n2+ n7 +n8 = S \dots (1)$ $n2+ n3+ n8+ n9 = S \dots (2)$ $n3+ n4+ n9+n10 = S \dots (3)$ $n4+ n5+n10+n11 = S \dots (4)$ $n5+ n6+n11+n12 = S \dots (5)$ $n7+ n8+n13+n14 = S \dots (6)$ $n8+ n9+n14+n15 = S \dots (7)$ $n9+n10+n15+n16 = S \dots (8)$ $n10+n11+n16+n17 = S \dots (9)$ $n11+n12+n17+n18 = S \dots (10)$ $n13+n14+n19+n20 = S \dots (11)$ $n14+n15+n20+n21 = S \dots (12)$ $n15+n16+n21+n22 = S \dots (13)$
$n16+n17+n22+n23 = S \dots (14)$	$n23+n24+n29+n30 = S \dots (20)$
$n17+n18+n23+n24 = S \dots (15)$	$n25+n26+n31+n32 = S \dots (21)$
$n19+n20+n25+n26 = S \dots (16)$	$n26+n27+n32+n33 = S \dots (22)$
$n20+n21+n26+n27 = S \dots (17)$	$n27+n28+n33+n34 = S \dots (23)$
$n21+n22+n27+n28 = S \dots (18)$	$n28+n29+n34+n35 = S \dots (24)$
$n22+n23+n28+n29 = S \dots (19)$	$n29+n30+n35+n36 = S \dots (25)$

**#1. What do these 'Composite Conditions' mean?**

Let's make some simple Algebraic calculations under these definitions.

First of all let's decide what value the above constant 'S(um)' should take.

$$(1)+(3)+(5)+(11)+(13+(15)+(21)+(23)+(25)$$

$$n1+n2+n3+n4+n5+n6+n7+n8+ \dots +n33+n34+n35+n36 = 9*S;$$

$$1+2+3+4+5+6+7+8+9+ \dots +32+33+34+35+36 = 9*S;$$

$$(1+36)+(2+35)+(3+34)+(4+33)+(5+32)+ \dots +(17+20)+(18+19) = 9*S;$$

$$37*18 = 9*S;$$

Therefore S=74;

Next let's examine whether we can make the so-called 'Pan-magic Shift' move rows

and columns far to the opposite sides or not.

$$\begin{array}{llll} n1+n7+n2+n8=S & \dots(1)'; & n2+n8+n3+n9=S & \dots(2)'; & \rightarrow & n1+n7=n3+n9; \\ n2+n8+n3+n9=S & \dots(2)'; & n3+n9+n4+n10=S & \dots(3)'; & \rightarrow & n2+n8=n4+n10; \\ n3+n9+n4+n10=S & \dots(3)'; & n4+n10+n5+n11=S & \dots(4)'; & \rightarrow & n3+n9=n5+n11; \\ n4+n10+n5+n11=S & \dots(4)'; & n5+n11+n6+n12=S & \dots(5)'; & \rightarrow & n4+n10=n6+n12; \end{array}$$

Therefore  $n1+n7=n3+n9=n5+n11=P1$ ;  $n2+n8=n4+n10=n6+n12=P2$ ; and  $P1+P2=S$ ;

Consequently  $n6+n1+n12+n7=(n1+n7)+(n6+n12)=P1+P2=S \dots(C1)$ ;

In the same way

$$\begin{array}{llll} n7+n13+n8+n14=S & \dots(6)'; & n8+n14+n9+n15=S & \dots(7)'; & \rightarrow & n7+n13=n9+n15; \\ n8+n14+n9+n15=S & \dots(7)'; & n9+n15+n10+n16=S & \dots(8)'; & \rightarrow & n8+n14=n10+n16; \\ n9+n15+n10+n16=S & \dots(8)'; & n10+n16+n11+n17=S & \dots(9)'; & \rightarrow & n9+n15=n11+n17; \\ n10+n16+n11+n17=S & \dots(9)'; & n11+n17+n12+n18=S & \dots(10)'; & \rightarrow & n10+n16=n12+n18; \end{array}$$

Therefore  $n7+n13=n9+n15=n11+n17=P3$ ;  $n8+n14=n10+n16=n12+n18=P4$ ; and  $P3+P4=S$ ;

Consequently  $n12+n7+n18+n13=(n7+n13)+(n12+n18)=P3+P4=S \dots(C2)$ ;

In the same way

$$n13+n19=n15+n21=n17+n23=P5; \quad n14+n20=n16+n22=n18+n24=P6; \quad \text{and } P5+P6=S;$$

Consequently  $n18+n13+n24+n19=(n13+n19)+(n18+n24)=P5+P6=S \dots(C3)$ ;

$$n19+n25=n21+n27=n23+n29=P7; \quad n20+n26=n22+n28=n24+n30=P8; \quad \text{and } P7+P8=S;$$

Consequently  $n24+n19+n30+n25=(n19+n25)+(n24+n30)=P7+P8=S \dots(C4)$ ;

$$n25+n31=n27+n33=n29+n35=P9; \quad n26+n32=n28+n34=n30+n36=P10; \quad \text{and } P9+P10=S;$$

Consequently  $n30+n25+n36+n31=(n25+n31)+(n30+n36)=P9+P10=S \dots(C5)$ ;

In the same way

$$\begin{array}{llll} n1+n2+n7+n8=S & \dots(1); & n7+n8+n13+n14=S & \dots(6); & \rightarrow & n1+n2=n13+n14; \\ n7+n8+n13+n14=S & \dots(7); & n13+n14+n19+n20=S & \dots(11); & \rightarrow & n7+n8=n19+n20; \\ n13+n14+n19+n20=S & \dots(11); & n19+n20+n25+n26=S & \dots(16); & \rightarrow & n13+n14=n25+n26; \\ n19+n20+n25+n26=S & \dots(16); & n25+n26+n31+n32=S & \dots(21); & \rightarrow & n19+n20=n31+n32; \end{array}$$

Therefore  $n1+n2=n13+n14=n25+n26=P11$ ;  $n7+n8=n19+n20=n31+n32=P12$ ; and  $P11+P12=S$ ;

Consequently  $n31+n32+n1+n2=P12+P11=S \dots(C6)$ ;

In the same way

$$n2+n3=n14+n15=n26+n27=P13; \quad n8+n9=n20+n21=n32+n33=P14; \quad \text{and } P13+P14=S;$$

Consequently  $n32+n33+n2+n3=P14+P13=S \dots(C7)$ ;

$$n3+n4=n15+n16=n27+n28=P15; \quad n9+n10=n21+n22=n33+n34=P16; \quad \text{and } P15+P16=S;$$

Consequently  $n33+n34+n3+n4=P16+P15=S \dots(C8)$ ;

$$n4+n5=n16+n17=n28+n29=P17; \quad n10+n11=n22+n23=n34+n35=P18; \quad \text{and } P17+P18=S;$$

Consequently  $n34+n35+n4+n5=P18+P17=S \dots(C9)$ ;

$$n5+n6=n17+n18=n29+n30=P19; \quad n11+n12=n23+n24=n35+n36=P20; \quad \text{and } P19+P20=S;$$

Consequently  $n35+n36+n5+n6=P20+P19=S \dots(C10)$ ;

In the same way

$$\begin{array}{llll} n6+n1+n12+n7=S & \dots(C1); & n12+n7+n18+n13=S & \dots(C2); & \rightarrow & n6+n1=n18+n13; \\ n18+n13+n24+n19=S & \dots(C3); & n24+n19+n30+n25=S & \dots(C4); & \rightarrow & n18+n13=n30+n25; \\ n12+n7+n18+n13=S & \dots(C2); & n18+n13+n24+n19=S & \dots(C3); & \rightarrow & n12+n7=n24+n19; \\ n24+n19+n30+n25=S & \dots(C4); & n30+n25+n36+n31=S & \dots(C5); & \rightarrow & n24+n19=n36+n31; \end{array}$$

Therefore  $n6+n1=n18+n13=n30+n25=P13$ ;  $n12+n7=n24+n19=n36+n31=P14$ ; and  $P13+P14=S$ ;

Consequently  $n36+n31+n6+n1=P14+P13=S \dots(C11)$ ;

What do these conclusions (C1)~(C11) mean?

They mean the cylindrical structure of our object in two dimensions and the 'Pan-magic Shift' of rows and columns are surely possible to move each of them far to the opposite side. Any shift could never break those Composite Conditions, although it means no guarantee of any constant sum of rows, columns and pan-diagonals.

We can now draw the new Basic Form in the extended space as shown below.

We can also remake the definition of our 'Composite' Squares of Order 6 for the new extended one, adding our new knowledge of these properties.

## #2. The New Definition of Basic Form and Composite Conditions

[Figure 2: New Basic Form and the Largest Set of Composite Conditions]

<pre> 36 31 32 33 34 35 36 31 .----- n6 n1 n2 n3 n4 n5 n6 n1  ---+---+---+---+---+---  12 n7 n8 n9 10 11 12 n7  ---+---+---+---+---+---  18 13 14 15 16 17 18 13  ---+---+---+---+---+---  24 19 20 21 22 23 24 19  ---+---+---+---+---+---  30 25 26 27 28 29 30 25  ---+---+---+---+---+---  36 31 32 33 34 35 36 31 '-----' n6 n1 n2 n3 n4 n5 n6 n1 </pre>	<p><b>Composite Conditions:</b></p> <p>n1+ n2+ n7 +n8 = S ....(1)  n2+ n3+ n8+ n9 = S ....(2)  n3+ n4+ n9+n10 = S ....(3)  n4+ n5+n10+n11 = S ....(4)  n5+ n6+n11+n12 = S ....(5)  n6+ n1+n12+ n7 = S ....(6)  n7+ n8+n13+n14 = S ....(7)  n8+ n9+n14+n15 = S ....(8)  n9+n10+n15+n16 = S ....(9)  n10+n11+n16+n17 = S ... (10)  n11+n12+n17+n18 = S ... (11)  n12+ n7+n18+n13 = S ... (12)  n13+n14+n19+n20 = S ... (13)  n14+n15+n20+n21 = S ... (14)</p> <hr/> <p>n15+n16+n21+n22 = S ... (15)   n26+n27+n32+n33 = S ... (26)  n16+n17+n22+n23 = S ... (16)   n27+n28+n33+n34 = S ... (27)  n17+n18+n23+n24 = S ... (17)   n28+n29+n34+n35 = S ... (28)  n18+n13+n24+n19 = S ... (18)   n29+n30+n35+n36 = S ... (29)  n19+n20+n25+n26 = S ... (19)   n30+n25+n36+n31 = S ... (30)  n20+n21+n26+n27 = S ... (20)   n31+n32+ n1+ n2 = S ... (31)  n21+n22+n27+n28 = S ... (21)   n32+n33+ n2+ n3 = S ... (32)  n22+n23+n28+n29 = S ... (22)   n33+n34+ n3+ n4 = S ... (33)  n23+n24+n29+n30 = S ... (23)   n34+n35+ n4+ n5 = S ... (34)  n24+n19+n30+n25 = S ... (24)   n35+n36+ n5+ n6 = S ... (35)  n25+n26+n31+n32 = S ... (25)   n36+n31+ n6+ n1 = S ... (36)</p>
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### #3. What can you find if you take these new Composite Conditions?

Keep taking only these 36 simultaneous equations now, and making some more Algebraic Calculations. What properties can you find for your object, then?

(1)+(3)+(5): (n1+n2+n3+n4+n5+n6)+(n7+n8+n9+n10+n11+n12)=L1+L7=3\*S  
(7)+(9)+(11): (n7+n8+n9+n10+n11+n12)+(n13+n14+n15+n16+n17+n18)=L7+L13=3\*S  
(13)+(15)+(17): (n13+n14+n15+n16+n17+n18)+(n19+n20+n21+n22+n23+n24)=L13+L19=3\*S  
(19)+(21)+(23): (n19+n20+n21+n22+n23+n24)+(n25+n26+n27+n28+n29+n30)=L19+L25=3\*S  
(25)+(27)+(29): (n25+n26+n27+n28+n29+n30)+(n31+n32+n33+n34+n35+n36)=L25+L31=3\*S  
(31)+(33)+(35): (n31+n32+n33+n34+n35+n36)+(n1+n2+n3+n4+n5+n6)=L31+L1=3\*S

Therefore, L1=L13=L25=LS1; L7=L19=L31=LS2; and LS1+LS2=3\*S=3 x 74=222;

But you cannot yet say LS1=LS2=111.

In the same way

(1)+(13)+(25): (n1+n7+n13+n19+n25+n31)+(n2+n8+n14+n20+n26+n32)=R1+R2=3\*S  
(2)+(14)+(26): (n2+n8+n14+n20+n26+n32)+(n3+n9+n15+n21+n27+n33)=R2+R3=3\*S  
(3)+(15)+(27): (n3+n9+n15+n21+n27+n33)+(n4+n10+n16+n22+n28+n34)=R3+R4=3\*S  
(4)+(16)+(28): (n4+n10+n16+n22+n28+n34)+(n5+n11+n17+n23+n29+n35)=R4+R5=3\*S  
. . . . .

Therefore, R1=R3=R5=RS1; R2=R4=R6=RS2; and RS1+RS2=3\*S=222

But you cannot yet say RS1=RS2=111.

If you want every row and every column to have the Constant Magic Sum 111, you must explicitly define as L1=R1=111 at first by yourself.

Only n1+n2+n3+n4+n5+n6=111; n1+n7+n13+n19+n25+n31=111 are essentially required.

### #4. Some Other Interesting Properties

Before studying about pan-diagonals of object, I like to study about some other interesting properties.

(1) Complementary Pairs Again

$$\begin{array}{llll} n1+n2+n7+n8=S; & n7+n8+n13+n14=S; & \text{-->} & n1+n2=n13+n14=P1 \\ n7+n8+n13+n14=S; & n13+n14+n19+n20=S; & \text{-->} & n7+n8=n19+n20=Q1 \\ n13+n14+n19+n20=S; & n19+n20+n25+n26=S; & \text{-->} & n13+n14=n25+n26=P1 \\ n19+n20+n25+n26=S; & n25+n26+n31+n32=S; & \text{-->} & n19+n20=n31+n32=Q1 \end{array}$$

Therefore, you will find two groups of complementary pairs such as:  
 $n1+n2=n13+n14=n25+n26=P1$ ;  $n7+n8=n19+n20=n31+n32=Q1$ ;  $(P1+Q1=S=74)$

$$\begin{array}{llll} n1+n7+n2+n8=S; & n2+n8+n3+n9=S; & \text{-->} & n1+n7=n3+n9=P2 \\ n2+n8+n3+n9=S; & n3+n9+n4+n10=S; & \text{-->} & n2+n8=n4+n10=Q2 \\ n3+n9+n4+n10=S; & n4+n10+n5+n11=S; & \text{-->} & n3+n9=n5+n11=P2 \\ n4+n10+n5+n11=S; & n5+n11+n6+n12=S; & \text{-->} & n4+n10=n6+n12=Q2 \end{array}$$

You will also find another groups of complementary pairs:  
 $n1+n7=n3+n9=n5+n11=P2$ ;  $n2+n8=n4+n10=n6+n12=Q2$ ;  $(P2+Q2=S)$

In the same way you may find many other groups of complementary pairs.

$$\begin{array}{ll} n2+n3=n14+n15=n26+n27=P3; & n8+n9=n20+n21=n32+n33=Q3 \\ n7+n13=n9+n15=n11+n17=P4; & n8+n14=n10+n16=n12+n18=Q4 \\ n3+n4=n15+n16=n27+n28=P5; & n9+n10=n21+n22=n33+n34=Q5 \\ n13+n19=n15+n21=n17+n23=P6; & n14+n20=n16+n22=n18+n24=Q6; \end{array}$$

$$\dots \dots \dots P3+Q3=S; P4+Q4=S; P5+Q5=S; \dots \text{-->} Pn+Qn=S=74$$

But  $Pn=Qn=37$  is not always true. It appears in a few cases.

(2) What relationship can you find among n1, n3, n13 and n15?

$$n1+n7=n3+n9=P2; n7+n13=n9+n15=P5; \text{-->} n1+n15=n3+n13$$

This is an example of 'Equality of Cross-sums', isn't it?

$$n8+n14=n10+n16=Q4; n14+n20=n16+n22=Q6; \text{-->} n8+n22=n10+n20$$

.....

What about n1, n4, n19 and n22?

$$\begin{array}{l} n1+n2=P1; n3+n4=P5; n19+n20=Q1; n21+n22=Q5; \\ n1+n2+n3+n4=P1+P5; n19+n20+n21+n22=Q1+Q5; \\ n1+n2+n3+n4+n19+n20+n21+n22=(P1+Q1)+(P5+Q5)=S+S=2*S \end{array}$$

But  $n2+n3=P3$ ;  $n20+n21=Q3$ ;  $n2+n3+n20+n21=P3+Q3=S$

Therefore  $n1+n4+n19+n22=2*S-S=S$

This is an example of 'Composite-sums of Middle-size Block', isn't it?

[Figure 2(Again): Extended Form of Composite Object 6\*6]

<pre> 36 31 32 33 34 35 36 31 .----- n6 n1 n2 n3 n4 n5 n6 n1  ---+---+---+---+---  12 n7 n8 n9 10 11 12 n7  ---+---+---+---+---  18 13 14 15 16 17 18 13  ---+---+---+---+---  24 19 20 21 22 23 24 19  ---+---+---+---+---  30 25 26 27 28 29-30-25  ---+---+---+---+---  36 31 32 33 34 35 36 31 '----- ----'   n6 n1 n2 n3 n4 n5-n6-n1 </pre>	<p>{n1, n5, n25, n29} are 4 tops of 5 x 5 block within. They are also 4 tops of 3 x 3 block at the corner on the right hand side bottom.</p> <p><math>n29+n30=n5+n6</math>  <math>\rightarrow n30+n25=n6+n1</math></p> <p>-----  <math>n29-n25=n5-n1</math>  Therefore <math>n1+n29=n5+n25</math></p> <p>It is an example of 'Equality of Cross-sums,' isn't it?</p> <p><math>n1+n6+n31+n36=S</math> is the largest 'composite 4 tops' and is also the smallest 'composite 4 tops' at the corner on the right hand side bottom at the same time.</p>
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Every 4 tops of any block with 2x2, 4x4, and 6x6 entries must add up to the same Constant Sum 74.

Every 4 tops of any block with 3x3 and 5x5 entries must obey the property "the Cross-sums are equal to each other."

### #5. Pan-Diagonals of 'Composite' Squares

What can you find about Pan-diagonals if you accept those Composite Conditions?

[Figure 3: Extended Form and the Pan-Diagonal Conditions]

n4	n5	n6	n1	n2	n3	n4	n5	n6	n1	n2	n3	$n1 + n8 + n15 + n22 + n29 + n36 = K11$
												$n1 + n12 + n17 + n22 + n27 + n32 = K12$
10	11	12	n7	n8	n9	10	11	12	n7	n8	n9	$n2 + n9 + n16 + n23 + n30 + n31 = K21$
												$n2 + n7 + n18 + n23 + n28 + n33 = K22$
16	17	18	13	14	15	16	17	18	13	14	15	$n3 + n10 + n17 + n24 + n25 + n32 = K31$
												$n3 + n8 + n13 + n24 + n29 + n34 = K32$
22	23	24	19	20	21	22	23	24	19	20	21	$n4 + n11 + n18 + n19 + n26 + n33 = K41$
												$n4 + n9 + n14 + n19 + n30 + n35 = K42$
28	29	30	25	26	27	28	29	30	25	26	27	$n5 + n12 + n13 + n20 + n27 + n34 = K51$
												$n5 + n10 + n15 + n20 + n25 + n36 = K52$
34	35	36	31	32	33	34	35	36	31	32	33	$n6 + n7 + n14 + n21 + n28 + n35 = K61$
												$n6 + n11 + n16 + n21 + n26 + n31 = K62$

[1]  $n1 + n15 = n3 + n13$ ;  $n22 + n36 = n24 + n34$ ; ('Equality of Cross-sums' of 3x3 blocks.)

Add both sides to each other and add the same ( $n8 + n29$ ) to the both sides.

$$n1 + n8 + n15 + n22 + n29 + n36 = n3 + n8 + n13 + n24 + n29 + n34 = K11 = K32;$$

[2]  $n3 + n17 = n5 + n15$ ;  $n24 + n32 = n20 + n36$ ; (Cross-sums of 3 x 3 blocks)

and add ( $n10 + n25$ ) to the both sides.

$$n3 + n10 + n17 + n24 + n25 + n32 = n5 + n10 + n15 + n20 + n25 + n36 = K31 = K52;$$

[3]  $n5 + n13 = n1 + n17$ ;  $n20 + n34 = n22 + n32$ ; Add ( $n12 + n27$ ) to both sides.

$$n5 + n12 + n13 + n20 + n27 + n34 = n1 + n12 + n17 + n22 + n27 + n32 = K51 = K12;$$

[4]  $n1 + n27 = n3 + n25$  (Cross-sum of 5 x 5 block);

$n12 + n22 = n10 + n24$  (Cross-sum of 3 x 3 block); Add ( $n17 + n32$ ) to the both sides.

$$n1 + n12 + n17 + n22 + n27 + n32 = n3 + n10 + n17 + n24 + n25 + n32 = K12 = K31;$$

[5]  $n1 + n29 = n5 + n25$  (Cross-sum of 5 x 5 block);

$n8 + n22 = n10 + n20$  (Cross-sum of 3 x 3 block); Add ( $n15 + n36$ ) to the both sides.

$$n1 + n8 + n15 + n22 + n29 + n36 = n5 + n10 + n15 + n20 + n25 + n36 = K11 = K52;$$

[6]  $n8 + n36 = n12 + n31$  (Cross-sum of 5 x 5 block);

$n15 + n29 = n17 + n27$  (the same of 3 x 3 block); Add ( $n1 + n22$ ) to the both sides.

$$n1 + n8 + n15 + n22 + n29 + n36 = n1 + n12 + n17 + n22 + n27 + n32 = K11 = K12;$$

After all  $K11 = K12 = K31 = K32 = K51 = K52 = PD1$

In the same way  $K21 = K22 = K41 = K42 = K61 = K62 = PD2$

All pan-diagonals are classified into two groups according to their sums:

(1) Six pandiagonals with  $n1$ ,  $n3$  or  $n5$ , and (2) six ones with  $n2$ ,  $n4$  or  $n6$ .

Although this conclusion seems almost the same as the usual pan-diagonal type, you cannot yet say  $PD1 = PD2$ . When you want all pandiagonals to be equal, you must explicitly give the definition  $K11 (= K62) = 111$  at first by yourself.

Only  $n1 + n8 + n15 + n22 + n29 + n36 (= n6 + n11 + n16 + n21 + n26 + n31) = 111$ ; is essentially necessary to make our object become 'Pan-diagonal' or 'Complete' type.

### #4. Can't we make any Composite Pan-Magic Square of Order 6?

Suppose you add the next 3 equations to our list of Composite Conditions defined.

$$(1) n1 + n2 + n3 + n4 + n5 + n6 = 111; \quad (2) n1 + n7 + n13 + n19 + n25 + n31 = 111;$$

$$(3) n1 + n8 + n15 + n22 + n29 + n36 (= n6 + n11 + n16 + n21 + n26 + n31) = 111;$$

And then you will necessarily fail in making your object. Your computer must reply

after a hard calculation, "No answers could be found at all!".

You may already know that there exists neither a 'self-complementary' type nor a 'complete' type of magic square of order 6 in general.

Here you can see a sample of logical proof for this impossibility.

**Proof by Reductio ad Absurdum:**

[Figure 4: Four Blocks of Complete Magic Square of Order 6]

<p><b>Block P</b></p> <pre> -----  n1 n2 n3   n4 n5 n6   ---+---+---   ---+---+---   n7 n8 n9   10 11 12   ---+---+---   ---+---+---   13 14 15   16 17 18   -----   -----  </pre> <p><b>Block R</b></p> <pre> -----  19 20 21   22 23 24   ---+---+---   ---+---+---   25 26 27   28 29 30   ---+---+---   ---+---+---   31 32 33   34 35 36   -----   -----  </pre>	<p><b>Block Q</b></p> <pre> -----  n4 n5 n6   n7 n8 n9   ---+---+---   ---+---+---   10 11 12   13 14 15   ---+---+---   ---+---+---   16 17 18   19 20 21   -----   -----  </pre> <p><b>Block S</b></p> <pre> -----  22 23 24   25 26 27   ---+---+---   ---+---+---   28 29 30   31 32 33   ---+---+---   ---+---+---   34 35 36   37 38 39   -----   -----  </pre>	<p>Any Complete Magic type of Order 6 has all complementary pairs of 37 only on the pan-diagonals: <math>n1+n22=37</math>; <math>n2+n23=37</math>; <math>n3+n24=37</math>; <math>n7+n28=37</math>; <math>n8+n29=37</math>; <math>n9+n30=37</math>; <math>n13+n34=37</math>; <math>n14+n35=37</math>; <math>n15+n36=37</math>; ...</p> <p>Therefore, <b>Block P + Block S</b> = <math>37 \times 9 = 333</math>          But <b>Block P + Block Q</b> = <math>111 \times 3 = 333</math>  <math>(n1+n2+n3+n4+n5+n6=111</math>;  <math>n7+n8+n9+n10+n11+n12=111</math>;  <math>n13+n14+n15+n16+n17+n18=111)</math></p> <p>Also <b>Block Q + Block S</b> = 333  <math>(n4+n10+n16+n22+n28+n34=111</math>;  <math>n5+n11+n17+n23+n29+n35=111</math>;  <math>n6+n12+n18+n24+n30+n36=111)</math></p> <p>Therefore, <b>Block Q = Block S</b> = <math>(333 / 2)</math>          But this quotient is not an integer at all.          Sums of both Q and S must be integers.</p>
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These conclusions are so contradictory to each other that they should demonstrate that we cannot make any Complete Magic Squares of Order 6. (This proof was once worked out by Prof. Mutsumi Suzuki and Kanji Setsuda.)

Is it impossible even in the case of 'Composite Squares'?

Impossible. If you take all the conditions mentioned above, you cannot really make any kind of Pan-magic Square of Order 6 at all.

**#5. What type of 'Composite Squares' of Order 6 can we make, then?**

Let's now have the following experiments to make any 'Composite Squares':

- (1) Simply 'Composite' Squares of Order 6 only under the 'Composite Conditions'
- (2) 'Composite Pandiagonal' Squares of Order 6 under the Composite Conditions and only with  $n1+n8+n15+n22+n29+n36 (=n6+n11+n16+n21+n26+n31) = 111$ .
- (3) 'Composite Semi-panmagic' Squares of Order 6 under the Composite Conditions and only with  $n1+n2+n3+n4+n5+n6 = 111$ ;  $n1+n7+n13+n19+n25+n31 = 111$ .

**5-1. Result List of the Simply 'Composite' Squares of Order 6**

The next list demonstrates the recent result of my experiment to make the simply 'Composite' Squares only under the 36 'Composite Conditions' in the list of #2.

**\*\* Simply 'Composite' Squares of Order 6: \*\***

[List of Standard Solutions with Check-Sums:(Part): by Kanji Setsuda]

1/ Row PD1\						612289/ Row PD1\						1210945/ Row PD1\					
1	36	3	34	5	32 111 62\	2	36	3	33	5	31 110 57\	3	36	2	33	5	31 110 57\
35	2	33	4	31	6 111 160\	35	1	34	4	32	6 112 165\	34	1	35	4	32	6 112 165\
7	30	9	28	11	26 111 62\	8	30	9	27	11	25 110 57\	9	30	8	27	11	25 110 57\
29	8	27	10	25	12 111 160\	29	7	28	10	26	12 112 165\	28	7	29	10	26	12 112 165\
13	24	15	22	17	20 111 62\	14	24	15	21	17	19 110 57\	15	24	14	21	17	19 110 57\
18	19	16	21	14	23 111 160\	23	13	22	16	20	18 112 165\	22	13	23	16	20	18 112 165\
103 119 103 119 103 119  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/ 62/160/ 62/160/ 62/160/ PD2Sum						/ 57/165/ 57/165/ 57/165/ PD2Sum						/ 57/165/ 57/165/ 57/165/ PD2Sum					

1795297/ Row PD1\ 4 36 2 34 5 31 112  57\ 33 1 35 3 32 6 110 165\ 10 30 8 28 11 25 112  57\ 27 7 29 9 26 12 110 165\ 16 24 14 22 17 19 112  57\ 21 13 23 15 20 18 110 165\  111 111 111 111 111 111  CoLumn / 57/165/ 57/165/ 57/165  PD2Sum							2339969/ Row PD1\ 5 36 2 34 4 31 112  57\ 32 1 35 3 33 6 110 165\ 11 30 8 28 10 25 112  57\ 26 7 29 9 27 12 110 165\ 17 24 14 22 16 19 112  57\ 20 13 23 15 21 18 110 165\  111 111 111 111 111 111  CoLumn / 57/165/ 57/165/ 57/165  PD2Sum							2867217/ Row PD1\ 6 36 2 34 4 32 114  63\ 31 1 35 3 33 5 108 159\ 12 30 8 28 10 26 114  63\ 25 7 29 9 27 11 108 159\ 18 24 14 22 16 20 114  63\ 13 19 17 21 15 23 108 159\  105 117 105 117 105 117  CoLumn / 63/159/ 63/159/ 63/159  PD2Sum						
3359025/ Row PD1\ 7 36 2 34 4 32 115  94\ 30 1 35 3 33 5 107 128\ 19 24 14 22 16 20 115  94\ 6 25 11 27 9 29 107 128\ 31 12 26 10 28 8 115  94\ 18 13 23 15 21 17 107 128\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum							3770945/ Row PD1\ 8 36 2 34 4 31 115  96\ 29 1 35 3 33 6 107 126\ 20 24 14 22 16 19 115  96\ 5 25 11 27 9 30 107 126\ 32 12 26 10 28 7 115  96\ 17 13 23 15 21 18 107 126\  111 111 111 111 111 111  CoLumn / 96/126/ 96/126/ 96/126  PD2Sum							4138625/ Row PD1\ 9 36 2 34 5 31 117  98\ 28 1 35 3 32 6 105 124\ 21 24 14 22 17 19 117  98\ 4 25 11 27 8 30 105 124\ 33 12 26 10 29 7 117  98\ 16 13 23 15 20 18 105 124\  111 111 111 111 111 111  CoLumn / 98/124/ 98/124/ 98/124  PD2Sum						
4488049/ Row PD1\ 10 36 2 34 11 25 118  57\ 27 1 35 3 26 12 104 165\ 13 33 5 31 14 22 118  57\ 24 4 32 6 23 15 104 165\ 16 30 8 28 17 19 118  57\ 21 7 29 9 20 18 104 165\  111 111 111 111 111 111  CoLumn / 57/165/ 57/165/ 57/165  PD2Sum							4723745/ Row PD1\ 11 36 2 34 4 25 112  85\ 26 1 35 3 33 12 110 137\ 17 30 8 28 10 19 112  85\ 6 21 15 23 13 32 110 137\ 31 16 22 14 24 5 112  85\ 20 7 29 9 27 18 110 137\  111 111 111 111 111 111  CoLumn / 85/137/ 85/137/ 85/137  PD2Sum							4932993/ Row PD1\ 12 36 2 34 4 26 114  85\ 25 1 35 3 33 11 108 137\ 18 30 8 28 10 20 114  85\ 5 21 15 23 13 31 108 137\ 32 16 22 14 24 6 114  85\ 19 7 29 9 27 17 108 137\  111 111 111 111 111 111  CoLumn / 85/137/ 85/137/ 85/137  PD2Sum						
5109969/ Row PD1\ 13 36 2 34 4 23 112  61\ 24 1 35 3 33 14 110 161\ 17 32 6 30 8 19 112  61\ 20 5 31 7 29 18 110 161\ 21 28 10 26 12 15 112  61\ 16 9 27 11 25 22 110 161\  111 111 111 111 111 111  CoLumn / 61/161/ 61/161/ 61/161  PD2Sum							5248865/ Row PD1\ 14 36 2 34 4 24 114  61\ 23 1 35 3 33 13 108 161\ 18 32 6 30 8 20 114  61\ 19 5 31 7 29 17 108 161\ 22 28 10 26 12 16 114  61\ 15 9 27 11 25 21 108 161\  111 111 111 111 111 111  CoLumn / 61/161/ 61/161/ 61/161  PD2Sum							5361505/ Row PD1\ 15 36 2 34 4 24 115  62\ 22 1 35 3 33 13 107 160\ 19 32 6 30 8 20 115  62\ 14 9 27 11 25 21 107 160\ 23 28 10 26 12 16 115  62\ 18 5 31 7 29 17 107 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum						
5449729/ Row PD1\ 16 36 2 34 4 23 115  64\ 21 1 35 3 33 14 107 158\ 20 32 6 30 8 19 115  64\ 13 9 27 11 25 22 107 158\ 24 28 10 26 12 15 115  64\ 17 5 31 7 29 18 107 158\  111 111 111 111 111 111  CoLumn / 64/158/ 64/158/ 64/158  PD2Sum							5486177/ Row PD1\ 17 36 1 35 2 20 111  76\ 16 5 32 6 31 21 111 146\ 24 29 8 28 9 13 111  76\ 10 11 26 12 25 27 111 146\ 30 23 14 22 15 7 111  76\ 18 3 34 4 33 19 111 146\  115 107 115 107 115 107  CoLumn / 76/146/ 76/146/ 76/146  PD2Sum							[Count = 5510592] OK!						

## 5-2. Result List of the 'Composite Pan-diagonal' Squares of Order 6

The following list demonstrates the recent result of my experiment to make the 'Composite Pan-diagonal' Squares under the 36 'Composite Conditions' and only with  $n1+n8+n15+n22+n29+n36(=n6+n11+n16+n21+n26+n31)=111$ ; for our definition.

### \*\* 'Composite Pan-diagonal' Squares of Order 6 with Check-sums: Part \*\*

1/ Row PD1\ 1 36 4 33 7 30 111 111\ 34 3 31 6 28 9 111 111\ 19 18 22 15 25 12 111 111\ 17 20 14 23 11 26 111 111\ 21 16 24 13 27 10 111 111\ 8 29 5 32 2 35 111 111\  100 122 100 122 100 122  CoLumn /111/111/111/111/111/111  PD2Sum							21889/ Row PD1\ 2 36 5 31 10 28 112 111\ 33 3 30 8 25 11 110 111\ 14 24 17 19 22 16 112 111\ 21 15 18 20 13 23 110 111\ 26 12 29 7 34 4 112 111\ 9 27 6 32 1 35 110 111\  105 117 105 117 105 117  CoLumn /111/111/111/111/111/111  PD2Sum							43777/ Row PD1\ 3 36 7 29 9 26 110 111\ 34 1 30 8 28 11 112 111\ 15 24 19 17 21 14 110 111\ 22 13 18 20 16 23 112 111\ 27 12 31 5 33 2 110 111\ 10 25 6 32 4 35 112 111\  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum						
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

65185/ Row PD1\ 4 36 7 27 16 24 114 111\ 32 2 29 11 20 14 108 111\ 6 34 9 25 18 22 114 111\ 15 19 12 28 3 31 108 111\ 23 17 26 8 35 5 114 111\ 13 21 10 30 1 33 108 111\ -----   93 129  93 129  93 129  CoLumn /111/111/111/111/111/111  PD2Sum							85153/ Row PD1\ 5 36 3 30 11 28 113 111\ 31 2 33 8 25 10 109 111\ 17 24 15 18 23 16 113 111\ 19 14 21 20 13 22 109 111\ 29 12 27 6 35 4 113 111\ 7 26 9 32 1 34 109 111\ -----  108 114 108 114 108 114  CoLumn /111/111/111/111/111/111  PD2Sum							104641/ Row PD1\ 6 36 2 32 10 28 114 111\ 29 3 33 7 25 11 108 111\ 18 24 14 20 22 16 114 111\ 5 27 9 31 1 35 108 111\ 30 12 26 8 34 4 114 111\ 17 15 21 19 13 23 108 111\ -----  105 117 105 117 105 117  CoLumn /111/111/111/111/111/111  PD2Sum						
122785/ Row PD1\ 7 36 3 29 9 26 110 111\ 30 1 34 8 28 11 112 111\ 19 24 15 17 21 14 110 111\ 6 25 10 32 4 35 112 111\ 31 12 27 5 33 2 110 111\ 18 13 22 20 16 23 112 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum							137473/ Row PD1\ 8 36 3 30 9 26 112 111\ 29 1 34 7 28 11 110 111\ 20 24 15 18 21 14 112 111\ 5 25 10 31 4 35 110 111\ 32 12 27 6 33 2 112 111\ 17 13 22 19 16 23 110 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum							150145/ Row PD1\ 9 36 3 30 8 26 112 111\ 28 1 34 7 29 11 110 111\ 21 24 15 18 20 14 112 111\ 4 25 10 31 5 35 110 111\ 33 12 27 6 32 2 112 111\ 16 13 22 19 17 23 110 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum						
162849/ Row PD1\ 10 36 4 30 16 24 120 111\ 26 2 32 8 20 14 102 111\ 28 18 22 12 34 6 120 111\ 7 21 13 27 1 33 102 111\ 29 17 23 11 35 5 120 111\ 25 3 31 9 19 15 102 111\ -----  125  97 125  97 125  97  CoLumn /111/111/111/111/111/111  PD2Sum							169729/ Row PD1\ 11 36 3 30 8 28 116 111\ 26 1 34 7 29 9 106 111\ 23 24 15 18 20 16 116 111\ 2 25 10 31 5 33 106 111\ 35 12 27 6 32 4 116 111\ 14 13 22 19 17 21 106 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum							176449/ Row PD1\ 12 36 2 34 10 26 120 111\ 22 4 32 6 24 14 102 111\ 30 18 20 16 28 8 120 111\ 1 25 11 27 3 35 102 111\ 33 15 23 13 31 5 120 111\ 19 7 29 9 21 17 102 111\ -----  117 105 117 105 117 105  CoLumn /111/111/111/111/111/111  PD2Sum						
182305/ Row PD1\ 13 36 3 12 27 22 113 111\ 23 2 33 26 9 16 109 111\ 17 32 7 8 31 18 113 111\ 19 6 29 30 5 20 109 111\ 21 28 11 4 35 14 113 111\ 15 10 25 34 1 24 109 111\ -----  108 114 108 114 108 114  CoLumn /111/111/111/111/111/111  PD2Sum							187201/ Row PD1\ 14 36 2 30 8 24 114 111\ 21 3 33 9 27 15 108 111\ 32 18 20 12 26 6 114 111\ 1 23 13 29 7 35 108 111\ 34 16 22 10 28 4 114 111\ 19 5 31 11 25 17 108 111\ -----  121 101 121 101 121 101  CoLumn /111/111/111/111/111/111  PD2Sum							191553/ Row PD1\ 15 36 3 12 27 21 114 111\ 22 1 34 25 10 16 108 111\ 19 32 7 8 31 17 114 111\ 14 9 26 33 2 24 108 111\ 23 28 11 4 35 13 114 111\ 18 5 30 29 6 20 108 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum						
195137/ Row PD1\ 16 36 3 12 27 22 116 111\ 21 1 34 25 10 15 106 111\ 20 32 7 8 31 18 116 111\ 13 9 26 33 2 23 106 111\ 24 28 11 4 35 14 116 111\ 17 5 30 29 6 19 106 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum							196193/ Row PD1\ 17 32 6 8 30 19 112 111\ 24 1 35 25 11 14 110 111\ 15 34 4 10 28 21 112 111\ 16 9 27 33 3 22 110 111\ 23 26 12 2 36 13 112 111\ 18 7 29 31 5 20 110 111\ -----  113 109 113 109 113 109  CoLumn /111/111/111/111/111/111  PD2Sum							[Count = 196992] OK!						

Of course, this set of solutions makes the 'Sub-set' of the solutions of 'Simply Composite Squares' of Order 6, as the former included in the latter.

You may be impressed with the several solutions of 'almost Magic' type.

Here you see the part list of my collections of such the almost magic objects.

**\*\* Composite Pan-diagonal Squares 6x6: Collection of Almost Magic Type: Part \*\***

1/ Row PD1\ 1 36 5 32 9 28 111 111\ 34 3 30 7 26 11 111 111\ 15 22 19 18 23 14 111 111\ 21 16 17 20 13 24 111 111\ 27 10 31 6 35 2 111 111\ 12 25 8 29 4 33 111 111\ -----  110 112 110 112 110 112  CoLumn /111/111/111/111/111/111  PD2Sum						193/ Row PD1\ 1 34 15 21 27 12 110 111\ 32 7 18 20 6 29 112 111\ 5 30 19 17 31 8 110 111\ 36 3 22 16 10 25 112 111\ 9 26 23 13 35 4 110 111\ 28 11 14 24 2 33 112 111\ -----  111 111 111 111 111 111  CoLumn /111/111/111/111/111/111  PD2Sum						321/ Row PD1\ 1 32 5 36 9 28 111 111\ 22 19 18 15 14 23 111 111\ 16 17 20 21 24 13 111 111\ 34 7 30 3 26 11 111 111\ 27 6 31 10 35 2 111 111\ 12 29 8 25 4 33 111 111\ -----  112 110 112 110 112 110  CoLumn /111/111/111/111/111/111  PD2Sum					
---	--	--	--	--	--	---	--	--	--	--	--	---	--	--	--	--	--



385/ Row PD1\ 1 30 8 34 11 28 112 111\ 24 19 17 15 14 21 110 111\ 13 18 20 22 23 16 112 111\ 36 7 29 3 26 9 110 111\ 25 6 32 10 35 4 112 111\ 12 31 5 27 2 33 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							417/ Row PD1\ 1 29 7 34 11 28 110 111\ 24 20 18 15 14 21 112 111\ 13 17 19 22 23 16 110 111\ 36 8 30 3 26 9 112 111\ 25 5 31 10 35 4 110 111\ 12 32 6 27 2 33 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							449/ Row PD1\ 1 28 7 34 11 29 110 111\ 24 21 18 15 14 20 112 111\ 13 16 19 22 23 17 110 111\ 36 9 30 3 26 8 112 111\ 25 4 31 10 35 5 110 111\ 12 33 6 27 2 32 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
577/ Row PD1\ 2 35 6 31 10 27 111 111\ 33 4 29 8 25 12 111 111\ 13 24 17 20 21 16 111 111\ 23 14 19 18 15 22 111 111\ 28 9 32 5 36 1 111 111\ 11 26 7 30 3 34 111 111\  110 112 110 112 110 112  Co1umn /111/111/111/111/111/111  PD2Sum							769/ Row PD1\ 2 33 13 23 28 11 110 111\ 31 8 20 18 5 30 112 111\ 6 29 17 19 32 7 110 111\ 35 4 24 14 9 26 112 111\ 10 25 21 15 36 3 110 111\ 27 12 16 22 1 34 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							897/ Row PD1\ 2 32 6 33 12 27 112 111\ 23 17 19 16 13 22 110 111\ 14 20 18 21 24 15 112 111\ 35 5 31 4 25 10 110 111\ 26 8 30 9 36 3 112 111\ 11 29 7 28 1 34 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
929/ Row PD1\ 2 31 6 35 10 27 111 111\ 24 17 20 13 16 21 111 111\ 14 19 18 23 22 15 111 111\ 33 8 29 4 25 12 111 111\ 28 5 32 9 36 1 111 111\ 11 30 7 26 3 34 111 111\  112 110 112 110 112 110  Co1umn /111/111/111/111/111/111  PD2Sum							1025/ Row PD1\ 2 27 6 35 10 31 111 111\ 24 21 20 13 16 17 111 111\ 14 15 18 23 22 19 111 111\ 33 12 29 4 25 8 111 111\ 28 1 32 9 36 5 111 111\ 11 34 7 26 3 30 111 111\  112 110 112 110 112 110  Co1umn /111/111/111/111/111/111  PD2Sum							1153/ Row PD1\ 3 36 7 29 9 26 110 111\ 34 1 30 8 28 11 112 111\ 15 24 19 17 21 14 110 111\ 22 13 18 20 16 23 112 111\ 27 12 31 5 33 2 110 111\ 10 25 6 32 4 35 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
1345/ Row PD1\ 3 34 15 22 27 10 111 111\ 30 7 18 19 6 31 111 111\ 8 29 20 17 32 5 111 111\ 36 1 24 13 12 25 111 111\ 9 28 21 16 33 4 111 111\ 26 11 14 23 2 35 111 111\  112 110 112 110 112 110  Co1umn /111/111/111/111/111/111  PD2Sum							1473/ Row PD1\ 3 30 7 34 11 26 111 111\ 22 19 18 15 14 23 111 111\ 16 17 20 21 24 13 111 111\ 36 5 32 1 28 9 111 111\ 25 8 29 12 33 4 111 111\ 10 31 6 27 2 35 111 111\  112 110 112 110 112 110  Co1umn /111/111/111/111/111/111  PD2Sum							1545/ Row PD1\ 3 29 7 36 9 26 110 111\ 22 20 18 13 16 23 112 111\ 15 17 19 24 21 14 110 111\ 34 8 30 1 28 11 112 111\ 27 5 31 12 33 2 110 111\ 10 32 6 25 4 35 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
1665/ Row PD1\ 4 35 5 31 10 25 110 111\ 33 2 32 6 27 12 112 111\ 16 23 17 19 22 13 110 111\ 21 14 20 18 15 24 112 111\ 28 11 29 7 34 1 110 111\ 9 26 8 30 3 36 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							2177/ Row PD1\ 5 36 1 32 9 28 111 111\ 30 3 34 7 26 11 111 111\ 19 22 15 18 23 14 111 111\ 17 16 21 20 13 24 111 111\ 31 10 27 6 35 2 111 111\ 8 25 12 29 4 33 111 111\  110 112 110 112 110 112  Co1umn /111/111/111/111/111/111  PD2Sum							2689/ Row PD1\ 6 35 4 32 10 25 112 111\ 31 2 33 5 27 12 110 111\ 18 23 16 20 22 13 112 111\ 19 14 21 17 15 24 110 111\ 30 11 28 8 34 1 112 111\ 7 26 9 29 3 36 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
3169/ Row PD1\ 7 36 3 29 9 26 110 111\ 30 1 34 8 28 11 112 111\ 19 24 15 17 21 14 110 111\ 6 25 10 32 4 35 112 111\ 31 12 27 5 33 2 110 111\ 18 13 22 20 16 23 112 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							3457/ Row PD1\ 8 36 3 30 9 26 112 111\ 29 1 34 7 28 11 110 111\ 20 24 15 18 21 14 112 111\ 5 25 10 31 4 35 110 111\ 32 12 27 6 33 2 112 111\ 17 13 22 19 16 23 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							3713/ Row PD1\ 9 36 3 30 8 26 112 111\ 28 1 34 7 29 11 110 111\ 21 24 15 18 20 14 112 111\ 4 25 10 31 5 35 110 111\ 33 12 27 6 32 2 112 111\ 16 13 22 19 17 23 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						
3969/ Row PD1\ 10 35 4 32 6 25 112 111\ 27 2 33 5 31 12 110 111\ 22 23 16 20 18 13 112 111\ 3 26 9 29 7 36 110 111\ 34 11 28 8 30 1 112 111\ 15 14 21 17 19 24 110 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							4225/ Row PD1\ 11 34 3 30 7 26 111 111\ 28 1 36 5 32 9 111 111\ 23 22 15 18 19 14 111 111\ 2 27 10 31 6 35 111 111\ 33 12 25 8 29 4 111 111\ 13 16 21 20 17 24 111 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum							4417/ Row PD1\ 12 33 4 29 8 25 111 111\ 27 2 35 6 31 10 111 111\ 21 24 13 20 17 16 111 111\ 1 28 9 32 5 36 111 111\ 34 11 26 7 30 3 111 111\ 15 14 23 18 19 22 111 111\  111 111 111 111 111 111  Co1umn /111/111/111/111/111/111  PD2Sum						

111 111 111 111 111 111						CoLumn	110 112 110 112 110 112						CoLumn	110 112 110 112 110 112						CoLumn
/111/111/111/111/111/111						PD2Sum	/111/111/111/111/111/111						PD2Sum	/111/111/111/111/111/111						PD2Sum
4609/ Row PD1\							4801/ Row PD1\							4961/ Row PD1\						
13	36	1	12	25	24	111 111\	14	35	4	9	26	24	112 111\	15	36	3	10	25	21	110 111\
22	3	34	27	10	15	111 111\	23	2	33	28	11	13	110 111\	22	1	34	27	12	16	112 111\
19	30	7	6	31	18	111 111\	18	31	8	5	30	20	112 111\	19	32	7	6	29	17	110 111\
17	8	29	32	5	20	111 111\	19	6	29	32	7	17	110 111\	14	9	26	35	4	24	112 111\
23	26	11	2	35	14	111 111\	22	27	12	1	34	16	112 111\	23	28	11	2	33	13	110 111\
16	9	28	33	4	21	111 111\	15	10	25	36	3	21	110 111\	18	5	30	31	8	20	112 111\
110 112 110 112 110 112						CoLumn	111 111 111 111 111 111						CoLumn	111 111 111 111 111 111						CoLumn
/111/111/111/111/111/111						PD2Sum	/111/111/111/111/111/111						PD2Sum	/111/111/111/111/111/111						PD2Sum
5057/ Row PD1\							5121/ Row PD1\													
16	36	3	10	25	22	112 111\	17	32	5	8	29	20	111 111\							
21	1	34	27	12	15	110 111\	23	2	35	26	11	14	111 111\							
20	32	7	6	29	18	112 111\	16	33	4	9	28	21	111 111\							
13	9	26	35	4	23	110 111\	13	12	25	36	1	24	111 111\							
24	28	11	2	33	14	112 111\	22	27	10	3	34	15	111 111\							
17	5	30	31	8	19	110 111\	19	6	31	30	7	18	111 111\							
111 111 111 111 111 111						CoLumn	110 112 110 112 110 112						CoLumn							
/111/111/111/111/111/111						PD2Sum	/111/111/111/111/111/111						PD2Sum							[Count = 5184] OK!

[Listed by Kanji Setsuda on August 17, 2010 with MacOSX and Xcode3.1.2]

I myself was much surprised with this big count of solutions. If you had only a few solutions of that kind, they might be naturally considered to be 'accidental'. But, the existence of so many solutions may hardly be considered to be accidental essentially. They do exist in the way as they should do, to my impression.

You may expect you should very soon have got the real Magic type with both rows and columns adding up to the same constant sum 111.

But, you should not be able to have got any piece of such the real Magic ones, ever never, I am sorry to say.

### 5-3. Result List of the 'Composite Semi-panmagic' Squares of Order 6

The next list shows the result of my effort to make the 'Composite Semi-panmagic' Squares under the 36 'Composite Conditions' and only with  $n_1+n_2+n_3+n_4+n_5+n_6 = 111$ ;  $n_1+n_7+n_{13}+n_{19}+n_{25}+n_{31} = 111$ ; for our definitions.

This list is certainly new, printed recently, while the calculation itself has often been made for a long time since 2001. The first result was reported by Prof. Mutsumi Suzuki in his page, and I verified it by my own calculation just after that.

#### \* Composite Semi-panmagic Squares of Order 6: Part List with Check-Sums \*

1/ Row PD1\						1969/ Row PD1\						3057/ Row PD1\								
1	36	4	33	7	30	111  64\	1	35	2	36	3	34	111  60\	1	34	2	36	3	35	111  60\
35	2	32	5	29	8	111 158\	33	5	32	4	31	6	111 162\	33	6	32	4	31	5	111 162\
3	34	6	31	9	28	111  64\	7	29	8	30	9	28	111  60\	7	28	8	30	9	29	111  60\
27	10	24	13	21	16	111 158\	27	11	26	10	25	12	111 162\	27	12	26	10	25	11	111 162\
19	18	22	15	25	12	111  64\	19	17	20	18	21	16	111  60\	19	16	20	18	21	17	111  60\
26	11	23	14	20	17	111 158\	24	14	23	13	22	15	111 162\	24	15	23	13	22	14	111 162\
111 111 111 111 111 111						CoLumn	111 111 111 111 111 111						CoLumn	111 111 111 111 111 111						CoLumn
/ 64/158/ 64/158/ 64/158						PD2Sum	/ 60/162/ 60/162/ 60/162						PD2Sum	/ 60/162/ 60/162/ 60/162						PD2Sum
3537/ Row PD1\							4337/ Row PD1\							4817/ Row PD1\						
1	33	3	35	15	24	111  62\	1	32	3	35	7	33	111  94\	1	31	3	35	8	33	111  96\
32	8	30	6	18	17	111 160\	24	17	22	14	18	16	111 128\	24	18	22	14	17	16	111 126\
5	29	7	31	19	20	111  62\	13	20	15	23	19	21	111  94\	13	19	15	23	20	21	111  96\
36	4	34	2	22	13	111 160\	36	5	34	2	30	4	111 128\	36	6	34	2	29	4	111 126\
9	25	11	27	23	16	111  62\	25	8	27	11	31	9	111  94\	25	7	27	11	32	9	111  96\
28	12	26	10	14	21	111 160\	12	29	10	26	6	28	111 128\	12	30	10	26	5	28	111 126\
111 111 111 111 111 111						CoLumn	111 111 111 111 111 111						CoLumn	111 111 111 111 111 111						CoLumn
/ 62/160/ 62/160/ 62/160						PD2Sum	/ 94/128/ 94/128/ 94/128						PD2Sum	/ 96/126/ 96/126/ 96/126						PD2Sum

5009/ Row PD1\ 1 30 4 36 7 33 111  64\ 27 16 24 10 21 13 111 158\ 3 28 6 34 9 31 111  64\ 35 8 32 2 29 5 111 158\ 19 12 22 18 25 15 111  64\ 26 17 23 11 20 14 111 158\  111 111 111 111 111 111  CoLumn / 64/158/ 64/158/ 64/158  PD2Sum								5393/ Row PD1\ 1 29 4 36 8 33 111  74\ 25 19 22 12 18 15 111 148\ 3 27 6 34 10 31 111  74\ 35 9 32 2 28 5 111 148\ 23 7 26 14 30 11 111  74\ 24 20 21 13 17 16 111 148\  111 111 111 111 111 111  CoLumn / 74/148/ 74/148/ 74/148  PD2Sum								5425/ Row PD1\ 1 28 5 36 9 32 111  62\ 24 21 20 13 16 17 111 160\ 3 26 7 34 11 30 111  62\ 35 10 31 2 27 6 111 160\ 15 14 19 22 23 18 111  62\ 33 12 29 4 25 8 111 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum							
5713/ Row PD1\ 1 27 7 35 8 33 111 104\ 24 22 18 14 17 16 111 118\ 13 15 19 23 20 21 111 104\ 36 10 30 2 29 4 111 118\ 25 3 31 11 32 9 111 104\ 12 34 6 26 5 28 111 118\  111 111 111 111 111 111  CoLumn /104/118/104/118/104/118  PD2Sum								5905/ Row PD1\ 2 36 4 34 5 30 111  94\ 35 1 33 3 32 7 111 128\ 14 24 16 22 17 18 111  94\ 23 13 21 15 20 19 111 128\ 26 12 28 10 29 6 111  94\ 11 25 9 27 8 31 111 128\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum								7297/ Row PD1\ 2 35 5 32 8 29 111  64\ 34 3 31 6 28 9 111 158\ 10 27 13 24 16 21 111  64\ 36 1 33 4 30 7 111 158\ 11 26 14 23 17 20 111  64\ 18 19 15 22 12 25 111 158\  111 111 111 111 111 111  CoLumn / 64/158/ 64/158/ 64/158  PD2Sum							
8961/ Row PD1\ 2 34 1 36 3 35 111  60\ 32 6 33 4 31 5 111 162\ 8 28 7 30 9 29 111  60\ 26 12 27 10 25 11 111 162\ 20 16 19 18 21 17 111  60\ 23 15 24 13 22 14 111 162\  111 111 111 111 111 111  CoLumn / 60/162/ 60/162/ 60/162  PD2Sum								9969/ Row PD1\ 2 32 5 35 8 29 111  64\ 18 22 15 19 12 25 111 158\ 10 24 13 27 16 21 111  64\ 36 4 33 1 30 7 111 158\ 11 23 14 26 17 20 111  64\ 34 6 31 3 28 9 111 158\  111 111 111 111 111 111  CoLumn / 64/158/ 64/158/ 64/158  PD2Sum								10233/ Row PD1\ 2 31 6 35 10 27 111  62\ 22 19 18 15 14 23 111 160\ 4 29 8 33 12 25 111  62\ 36 5 32 1 28 9 111 160\ 13 20 17 24 21 16 111  62\ 34 7 30 3 26 11 111 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum							
10485/ Row PD1\ 2 30 4 36 5 34 111  94\ 23 19 21 13 20 15 111 128\ 14 18 16 24 17 22 111  94\ 35 7 33 1 32 3 111 128\ 26 6 28 12 29 10 111  94\ 11 31 9 25 8 27 111 128\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum								10653/ Row PD1\ 2 29 4 36 6 34 111  96\ 23 20 21 13 19 15 111 126\ 14 17 16 24 18 22 111  96\ 35 8 33 1 31 3 111 126\ 26 5 28 12 30 10 111  96\ 11 32 9 25 7 27 111 126\  111 111 111 111 111 111  CoLumn / 96/126/ 96/126/ 96/126  PD2Sum								11073/ Row PD1\ 2 28 5 36 6 34 111  98\ 23 21 20 13 19 15 111 124\ 14 16 17 24 18 22 111  98\ 35 9 32 1 31 3 111 124\ 26 4 29 12 30 10 111  98\ 11 33 8 25 7 27 111 124\  111 111 111 111 111 111  CoLumn / 98/124/ 98/124/ 98/124  PD2Sum							
11253/ Row PD1\ 2 27 6 35 10 31 111  62\ 22 23 18 15 14 19 111 160\ 4 25 8 33 12 29 111  62\ 36 9 32 1 28 5 111 160\ 13 16 17 24 21 20 111  62\ 34 11 30 3 26 7 111 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum								11505/ Row PD1\ 3 36 1 35 2 34 111  60\ 31 4 33 5 32 6 111 162\ 9 30 7 29 8 28 111  60\ 25 10 27 11 26 12 111 162\ 21 18 19 17 20 16 111  60\ 22 13 24 14 23 15 111 162\  111 111 111 111 111 111  CoLumn / 60/162/ 60/162/ 60/162  PD2Sum								11985/ Row PD1\ 3 35 1 33 7 32 111  94\ 34 2 36 4 30 5 111 128\ 15 23 13 21 19 20 111  94\ 22 14 24 16 18 17 111 128\ 27 11 25 9 31 8 111  94\ 10 26 12 28 6 29 111 128\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum							
13377/ Row PD1\ 3 34 7 30 11 26 111  62\ 33 4 29 8 25 12 111 160\ 1 36 5 32 9 28 111  62\ 35 2 31 6 27 10 111 160\ 15 22 19 18 23 14 111  62\ 24 13 20 17 16 21 111 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum								15041/ Row PD1\ 3 33 1 35 15 24 111  62\ 30 8 32 6 18 17 111 160\ 7 29 5 31 19 20 111  62\ 34 4 36 2 22 13 111 160\ 11 25 9 27 23 16 111  62\ 26 12 28 10 14 21 111 160\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum								15377/ Row PD1\ 3 32 1 35 7 33 111  94\ 22 17 24 14 18 16 111 128\ 15 20 13 23 19 21 111  94\ 34 5 36 2 30 4 111 128\ 27 8 25 11 31 9 111  94\ 10 29 12 26 6 28 111 128\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum							
15545/ Row PD1\ 3 31 6 34 9 28 111  64\ 27 13 24 10 21 16 111 158\ 1 33 4 36 7 30 111  64\ 35 5 32 2 29 8 111 158\ 19 15 22 18 25 12 111  64\ 26 14 23 11 20 17 111 158\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum								16073/ Row PD1\ 3 30 7 34 11 26 111  62\ 24 17 20 13 16 21 111 160\ 1 32 5 36 9 28 111  62\ 35 6 31 2 27 10 111 160\ 15 18 19 22 23 14 111  62\ 33 8 29 4 25 12 111 160\  111 111 111 111 111 111  CoLumn / 94/128/ 94/128/ 94/128  PD2Sum								16325/ Row PD1\ 3 28 6 34 9 31 111  64\ 27 16 24 10 21 13 111 158\ 1 30 4 36 7 33 111  64\ 35 8 32 2 29 5 111 158\ 19 12 22 18 25 15 111  64\ 26 17 23 11 20 14 111 158\  111 111 111 111 111 111  CoLumn / 62/160/ 62/160/ 62/160  PD2Sum							

111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 62/160/ 62/160/ 62/160/	PD2Sum	/ 64/158/ 64/158/ 64/158/	PD2Sum
16661/ Row PD1\		16685/ Row PD1\		16937/ Row PD1\	
3 27 6 34 10 31 111  74\		3 26 7 34 11 30 111  62\		3 25 7 35 8 33 111 108\	
25 19 22 12 18 15 111 148\		24 21 20 13 16 17 111 160\		22 24 18 14 17 16 111 114\	
1 29 4 36 8 33 111  74\		1 28 5 36 9 32 111  62\		15 13 19 23 20 21 111 108\	
35 9 32 2 28 5 111 148\		35 10 31 2 27 6 111 160\		34 12 30 2 29 4 111 114\	
23 7 26 14 30 11 111  74\		15 14 19 22 23 18 111  62\		27 1 31 11 32 9 111 108\	
24 20 21 13 17 16 111 148\		33 12 29 4 25 8 111 160\		10 36 6 26 5 28 111 114\	
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 74/148/ 74/148/ 74/148/	PD2Sum	/ 62/160/ 62/160/ 62/160/	PD2Sum	/108/114/108/114/108/114/	PD2Sum
17105/ Row PD1\		22225/ Row PD1\		27121/ Row PD1\	
4 36 2 34 5 30 111  94\		5 36 2 34 4 30 111  94\		6 36 2 34 4 29 111  96\	
33 1 35 3 32 7 111 128\		32 1 35 3 33 7 111 128\		31 1 35 3 33 8 111 126\	
16 24 14 22 17 18 111  94\		17 24 14 22 16 18 111  94\		18 24 14 22 16 17 111  96\	
21 13 23 15 20 19 111 128\		20 13 23 15 21 19 111 128\		19 13 23 15 21 20 111 126\	
28 12 26 10 29 6 111  94\		29 12 26 10 28 6 111  94\		30 12 26 10 28 5 111  96\	
9 25 11 27 8 31 111 128\		8 25 11 27 9 31 111 128\		7 25 11 27 9 32 111 126\	
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 94/128/ 94/128/ 94/128/	PD2Sum	/ 94/128/ 94/128/ 94/128/	PD2Sum	/ 96/126/ 96/126/ 96/126/	PD2Sum
31745/ Row PD1\		35249/ Row PD1\		38625/ Row PD1\	
7 36 1 33 4 30 111  64\		8 36 1 33 4 29 111  74\		9 36 1 32 5 28 111  62\	
29 2 35 5 32 8 111 158\		28 2 35 5 32 9 111 148\		27 2 35 6 31 10 111 160\	
9 34 3 31 6 28 111  64\		10 34 3 31 6 27 111  74\		11 34 3 30 7 26 111  62\	
21 10 27 13 24 16 111 158\		18 12 25 15 22 19 111 148\		25 4 33 8 29 12 111 160\	
25 18 19 15 22 12 111  64\		30 14 23 11 26 7 111  74\		23 22 15 18 19 14 111  62\	
20 11 26 14 23 17 111 158\		17 13 24 16 21 20 111 148\		16 13 24 17 20 21 111 160\	
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 74/148/ 74/148/ 74/148/	PD2Sum	/ 62/160/ 62/160/ 62/160/	PD2Sum
41809/ Row PD1\		44305/ Row PD1\		46801/ Row PD1\	
10 36 2 34 11 18 111  64\		11 36 2 34 10 18 111  64\		12 36 2 34 10 17 111  66\	
27 1 35 3 26 19 111 158\		26 1 35 3 27 19 111 158\		25 1 35 3 27 20 111 156\	
13 33 5 31 14 15 111  64\		14 33 5 31 13 15 111  64\		15 33 5 31 13 14 111  66\	
24 4 32 6 23 22 111 158\		23 4 32 6 24 22 111 158\		22 4 32 6 24 23 111 156\	
16 30 8 28 17 12 111  64\		17 30 8 28 16 12 111  64\		18 30 8 28 16 11 111  66\	
21 7 29 9 20 25 111 158\		20 7 29 9 21 25 111 158\		19 7 29 9 21 26 111 156\	
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 66/156/ 66/156/ 66/156/	PD2Sum
49057/ Row PD1\		50737/ Row PD1\		51985/ Row PD1\	
13 36 2 34 4 22 111  62\		14 36 2 34 4 21 111  64\		15 35 1 33 3 24 111  62\	
24 1 35 3 33 15 111 160\		23 1 35 3 33 16 111 158\		22 2 36 4 34 13 111 160\	
17 32 6 30 8 18 111  62\		18 32 6 30 8 17 111  64\		19 31 5 29 7 20 111  62\	
20 5 31 7 29 19 111 160\		19 5 31 7 29 20 111 158\		14 10 28 12 26 21 111 160\	
21 28 10 26 12 14 111  62\		22 28 10 26 12 13 111  64\		23 27 9 25 11 16 111  62\	
16 9 27 11 25 23 111 160\		15 9 27 11 25 24 111 158\		18 6 32 8 30 17 111 160\	
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn
/ 62/160/ 62/160/ 62/160/	PD2Sum	/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 62/160/ 62/160/ 62/160/	PD2Sum
52657/ Row PD1\		52945/ Row PD1\			
16 35 1 33 3 23 111  64\		17 32 5 8 29 20 111  94\			
21 2 36 4 34 14 111 158\		24 1 36 25 12 13 111 128\			
20 31 5 29 7 19 111  64\		14 35 2 11 26 23 111  94\			
13 10 28 12 26 22 111 158\		22 3 34 27 10 15 111 128\			
24 27 9 25 11 15 111  64\		16 33 4 9 28 21 111  94\			
17 6 32 8 30 18 111 158\		18 7 30 31 6 19 111 128\			
111 111 111 111 111 111	CoTumn	111 111 111 111 111 111	CoTumn		
/ 64/158/ 64/158/ 64/158/	PD2Sum	/ 94/128/ 94/128/ 94/128/	PD2Sum	[Count = 53136] OK!	

The next list shows my collection of 'Almost Pan-magic Type' with the sums of all pandiagonals almost equal to the Constant Value 111.

\*\* 'Composite Semi-Panmagic' Squares 6x6: Almost Pan-magic Type \*\*

1/ Row PD1\ 1 36 5 32 9 28 111 110\ 33 4 29 8 25 12 111 112\ 15 22 19 18 23 14 111 110\ 24 13 20 17 16 21 111 112\ 27 10 31 6 35 2 111 110\ 11 26 7 30 3 34 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							193/ Row PD1\ 1 33 15 24 27 11 111 110\ 32 8 18 17 6 30 111 112\ 5 29 19 20 31 7 111 110\ 36 4 22 13 10 26 111 112\ 9 25 23 16 35 3 111 110\ 28 12 14 21 2 34 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							321/ Row PD1\ 1 32 5 36 9 28 111 110\ 24 17 20 13 16 21 111 112\ 15 18 19 22 23 14 111 110\ 33 8 29 4 25 12 111 112\ 27 6 31 10 35 2 111 110\ 11 30 7 26 3 34 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
417/ Row PD1\ 1 31 8 33 11 27 111 112\ 24 18 17 16 14 22 111 110\ 13 19 20 21 23 15 111 112\ 36 6 29 4 26 10 111 110\ 25 7 32 9 35 3 111 112\ 12 30 5 28 2 34 111 110\  111 111 111 111 111 111  Co1umn /112/110/112/110/112/110  PD2Sum							449/ Row PD1\ 1 28 5 36 9 32 111 110\ 24 21 20 13 16 17 111 112\ 15 14 19 22 23 18 111 110\ 33 12 29 4 25 8 111 112\ 27 2 31 10 35 6 111 110\ 11 34 7 26 3 30 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							513/ Row PD1\ 1 27 7 33 11 32 111 110\ 24 22 18 16 14 17 111 112\ 13 15 19 21 23 20 111 110\ 36 10 30 4 26 5 111 112\ 25 3 31 9 35 8 111 110\ 12 34 6 28 2 29 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
577/ Row PD1\ 2 35 6 31 10 27 111 110\ 34 3 30 7 26 11 111 112\ 13 24 17 20 21 16 111 110\ 22 15 18 19 14 23 111 112\ 28 9 32 5 36 1 111 110\ 12 25 8 29 4 33 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							769/ Row PD1\ 2 34 13 22 28 12 111 110\ 31 7 20 19 5 29 111 112\ 6 30 17 18 32 8 111 110\ 35 3 24 15 9 25 111 112\ 10 26 21 14 36 4 111 110\ 27 11 16 23 1 33 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							897/ Row PD1\ 2 31 6 35 10 27 111 110\ 22 19 18 15 14 23 111 112\ 13 20 17 24 21 16 111 110\ 34 7 30 3 26 11 111 112\ 28 5 32 9 36 1 111 110\ 12 29 8 25 4 33 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
961/ Row PD1\ 2 30 5 34 12 28 111 110\ 23 19 20 15 13 21 111 112\ 14 18 17 22 24 16 111 110\ 35 7 32 3 25 9 111 112\ 26 6 29 10 36 4 111 110\ 11 31 8 27 1 33 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							993/ Row PD1\ 2 29 6 34 12 28 111 112\ 23 20 19 15 13 21 111 110\ 14 17 18 22 24 16 111 112\ 35 8 31 3 25 9 111 110\ 26 5 30 10 36 4 111 112\ 11 32 7 27 1 33 111 110\  111 111 111 111 111 111  Co1umn /112/110/112/110/112/110  PD2Sum							1025/ Row PD1\ 2 28 5 34 12 30 111 110\ 23 21 20 15 13 19 111 112\ 14 16 17 22 24 18 111 110\ 35 9 32 3 25 7 111 112\ 26 4 29 10 36 6 111 110\ 11 33 8 27 1 31 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
1089/ Row PD1\ 2 27 6 35 10 31 111 110\ 22 23 18 15 14 19 111 112\ 13 16 17 24 21 20 111 110\ 34 11 30 3 26 7 111 112\ 28 1 32 9 36 5 111 110\ 12 33 8 25 4 29 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							1153/ Row PD1\ 3 35 7 32 9 25 111 110\ 34 2 30 5 28 12 111 112\ 15 23 19 20 21 13 111 110\ 22 14 18 17 16 24 111 112\ 27 11 31 8 33 1 111 110\ 10 26 6 29 4 36 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							1345/ Row PD1\ 3 34 15 22 27 10 111 110\ 32 5 20 17 8 29 111 112\ 7 30 19 18 31 6 111 110\ 35 2 23 14 11 26 111 112\ 9 28 21 16 33 4 111 110\ 25 12 13 24 1 36 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
1473/ Row PD1\ 3 32 7 35 9 25 111 110\ 22 17 18 14 16 24 111 112\ 15 20 19 23 21 13 111 110\ 34 5 30 2 28 12 111 112\ 27 8 31 11 33 1 111 110\ 10 29 6 26 4 36 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							1497/ Row PD1\ 3 31 8 35 9 25 111 112\ 22 18 17 14 16 24 111 110\ 15 19 20 23 21 13 111 112\ 34 6 29 2 28 12 111 110\ 27 7 32 11 33 1 111 112\ 10 30 5 26 4 36 111 110\  111 111 111 111 111 111  Co1umn /112/110/112/110/112/110  PD2Sum							1521/ Row PD1\ 3 30 7 34 11 26 111 110\ 24 17 20 13 16 21 111 112\ 15 18 19 22 23 14 111 110\ 35 6 31 2 27 10 111 112\ 25 8 29 12 33 4 111 110\ 9 32 5 28 1 36 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						
1665/ Row PD1\ 4 36 5 30 10 26 111 110\ 33 1 32 7 27 11 111 112\ 16 24 17 18 22 14 111 110\ 21 13 20 19 15 23 111 112\ 28 12 29 6 34 2 111 110\ 9 25 8 31 3 35 111 112\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum							2177/ Row PD1\ 5 36 4 30 10 26 111 110\ 32 1 33 7 27 11 111 112\ 17 24 16 18 22 14 111 110\ 20 13 21 19 15 23 111 112\ 29 12 28 6 34 2 111 110\ 8 25 9 31 3 35 111 112\  111 111 111 111 111 111  Co1umn /112/110/112/110/112/110  PD2Sum							2689/ Row PD1\ 6 36 4 29 10 26 111 112\ 31 1 33 8 27 11 111 110\ 18 24 16 17 22 14 111 112\ 19 13 21 20 15 23 111 110\ 30 12 28 5 34 2 111 112\ 7 25 9 32 3 35 111 110\  111 111 111 111 111 111  Co1umn /110/112/110/112/110/112  PD2Sum						

111 111 111 111 111 111	Co1umn	111 111 111 111 111 111	Co1umn	111 111 111 111 111 111	Co1umn
/110/112/110/112/110/112	PD2Sum	/110/112/110/112/110/112	PD2Sum	/112/110/112/110/112/110	PD2Sum
3201/ Row PD1\		3457/ Row PD1\		3713/ Row PD1\	
7 35 3 32 9 25 111 110\		8 35 3 31 9 25 111 112\		9 36 1 32 5 28 111 110\	
30 2 34 5 28 12 111 112\		29 2 34 6 28 12 111 110\		25 4 33 8 29 12 111 112\	
19 23 15 20 21 13 111 110\		20 23 15 19 21 13 111 112\		23 22 15 18 19 14 111 110\	
6 26 10 29 4 36 111 112\		5 26 10 30 4 36 111 110\		3 26 11 30 7 34 111 112\	
31 11 27 8 33 1 111 110\		32 11 27 7 33 1 111 112\		35 10 27 6 31 2 111 110\	
18 14 22 17 16 24 111 112\		17 14 22 18 16 24 111 110\		16 13 24 17 20 21 111 112\	
3969/ Row PD1\		4225/ Row PD1\		4417/ Row PD1\	
10 36 4 30 5 26 111 110\		11 34 3 30 7 26 111 110\		12 34 2 30 5 28 111 110\	
27 1 33 7 32 11 111 112\		27 2 35 6 31 10 111 112\		25 3 35 7 32 9 111 112\	
22 24 16 18 17 14 111 110\		23 22 15 18 19 14 111 110\		24 22 14 18 17 16 111 110\	
3 25 9 31 8 35 111 112\		1 28 9 32 5 36 111 112\		1 27 11 31 8 33 111 112\	
34 12 28 6 29 2 111 110\		33 12 25 8 29 4 111 110\		36 10 26 6 29 4 111 110\	
15 13 21 19 20 23 111 112\		16 13 24 17 20 21 111 112\		13 15 23 19 20 21 111 112\	
4609/ Row PD1\		4801/ Row PD1\		4993/ Row PD1\	
13 36 4 10 26 22 111 110\		14 36 4 10 26 21 111 112\		15 35 3 9 25 24 111 110\	
24 1 33 27 11 15 111 112\		23 1 33 27 11 16 111 110\		22 2 34 28 12 13 111 112\	
17 32 8 6 30 18 111 110\		18 32 8 6 30 17 111 112\		19 31 7 5 29 20 111 110\	
20 5 29 31 7 19 111 112\		19 5 29 31 7 20 111 110\		14 10 26 36 4 21 111 112\	
21 28 12 2 34 14 111 110\		22 28 12 2 34 13 111 112\		23 27 11 1 33 16 111 110\	
16 9 25 35 3 23 111 112\		15 9 25 35 3 24 111 110\		18 6 30 32 8 17 111 112\	
5057/ Row PD1\		5121/ Row PD1\			
16 35 3 9 25 23 111 112\		17 32 5 8 29 20 111 110\			
21 2 34 28 12 14 111 110\		24 1 36 25 12 13 111 112\			
20 31 7 5 29 19 111 112\		16 33 4 9 28 21 111 110\			
13 10 26 36 4 22 111 110\		14 11 26 35 2 23 111 112\			
24 27 11 1 33 15 111 112\		22 27 10 3 34 15 111 110\			
17 6 30 32 8 18 111 110\		18 7 30 31 6 19 111 112\			
[Count = 5184] OK!					

[Listed by Kanji Setsuda on August 17, 2010 with MacOSX and Xcode3.1.2]

'Almost Panmagic' objects also count so many as 5184, far more pieces than the 'accidental' existence. They do surely exist as they should do.

Their solution counts are the same with those of Almost Magic type of Composite Pandiagonal objects. It does not seem to be a sheer coincidence.

### 5-3. Fundamental Solutions of 'Composite Semi-panmagic' Squares of Order 6

Let's make the list of Fundamental Solutions of Composite Semi-panmagic Squares of Order 6, under the following guidance of Prof. Mutsumi Suzuki in 2001.

#### List-forming Inequality Conditions: Solution Counts

n1=1, n2>n7, n2>n4>n6, n3>n5, n13>n25, n7>n19>n31	41 Solutions
n1<n6, n1<n31, n1<n36, n2>n7	53136 = 41x36x36

(Based upon the Table of Prof. M. Suzuki made in 2001)

\*\* Composite Semi-Panmagic Squares of Order 6: Fundamental Solutions \*\*

1/ Row PD1\					2/ Row PD1\					3/ Row PD1\							
1	36	4	33	7	30	1	36	4	33	7	30	1	36	4	33	7	30
35	2	32	5	29	8	35	2	32	5	29	8	35	2	32	5	29	8
3	34	6	31	9	28	3	34	6	31	9	28	3	34	6	31	9	28
27	10	24	13	21	16	27	10	24	13	21	16	26	11	23	14	20	17
19	18	22	15	25	12	20	17	23	14	26	11	21	16	24	13	27	10
26	11	23	14	20	17	25	12	22	15	19	18	25	12	22	15	19	18
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/ 64/158/ 64/158/ 64/158/					/ 66/156/ 66/156/ 66/156/					/ 68/154/ 68/154/ 68/154/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
4/ Row PD1\					5/ Row PD1\					6/ Row PD1\							
1	36	4	33	7	30	1	36	4	33	7	30	1	36	4	33	7	30
35	2	32	5	29	8	35	2	32	5	29	8	35	2	32	5	29	8
19	18	22	15	25	12	19	18	22	15	25	12	20	17	23	14	26	11
27	10	24	13	21	16	26	11	23	14	20	17	25	12	22	15	19	18
20	17	23	14	26	11	21	16	24	13	27	10	21	16	24	13	27	10
9	28	6	31	3	34	9	28	6	31	3	34	9	28	6	31	3	34
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/ 98/124/ 98/124/ 98/124/					/100/122/100/122/100/122/					/102/120/102/120/102/120/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
7/ Row PD1\					8/ Row PD1\					9/ Row PD1\							
1	36	4	33	8	29	1	36	5	32	9	28	1	36	5	32	9	28
35	2	32	5	28	9	35	2	31	6	27	10	35	2	31	6	27	10
3	34	6	31	10	27	3	34	7	30	11	26	3	34	7	30	11	26
25	12	22	15	18	19	33	4	29	8	25	12	33	4	29	8	25	12
23	14	26	11	30	7	15	22	19	18	23	14	16	21	20	17	24	13
24	13	21	16	17	20	24	13	20	17	16	21	23	14	19	18	15	22
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/ 74/148/ 74/148/ 74/148/					/ 62/160/ 62/160/ 62/160/					/ 64/158/ 64/158/ 64/158/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
10/ Row PD1\					11/ Row PD1\					12/ Row PD1\							
1	36	5	32	9	28	1	36	5	32	9	28	1	36	5	32	9	28
35	2	31	6	27	10	35	2	31	6	27	10	35	2	31	6	27	10
3	34	7	30	11	26	15	22	19	18	23	14	15	22	19	18	23	14
24	13	20	17	16	21	33	4	29	8	25	12	24	13	20	17	16	21
25	12	29	8	33	4	16	21	20	17	24	13	25	12	29	8	33	4
23	14	19	18	15	22	11	26	7	30	3	34	11	26	7	30	3	34
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/ 82/140/ 82/140/ 82/140/					/ 88/134/ 88/134/ 88/134/					/106/116/106/116/106/116/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
13/ Row PD1\					14/ Row PD1\					15/ Row PD1\							
1	36	5	32	9	28	1	36	13	24	25	12	1	36	13	24	25	12
35	2	31	6	27	10	35	2	23	14	11	26	35	2	23	14	11	26
16	21	20	17	24	13	3	34	15	22	27	10	3	34	15	22	27	10
23	14	19	18	15	22	33	4	21	16	9	28	33	4	21	16	9	28
25	12	29	8	33	4	7	30	19	18	31	6	8	29	20	17	32	5
11	26	7	30	3	34	32	5	20	17	8	29	31	6	19	18	7	30
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/108/114/108/114/108/114/					/ 94/128/ 94/128/ 94/128/					/ 96/126/ 96/126/ 96/126/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
16/ Row PD1\					17/ Row PD1\					18/ Row PD1\							
1	36	13	24	25	12	1	36	13	24	25	12	1	36	13	24	25	12
35	2	23	14	11	26	35	2	23	14	11	26	35	2	23	14	11	26
3	34	15	22	27	10	7	30	19	18	31	6	7	30	19	18	31	6
32	5	20	17	8	29	33	4	21	16	9	28	32	5	20	17	8	29
9	28	21	16	33	4	8	29	20	17	32	5	9	28	21	16	33	4
31	6	19	18	7	30	27	10	15	22	3	34	27	10	15	22	3	34
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
/ 98/124/ 98/124/ 98/124/					/104/118/104/118/104/118/					/106/116/106/116/106/116/							
CoLumn					CoLumn					CoLumn							
PD2Sum					PD2Sum					PD2Sum							
19/ Row PD1\					20/ Row PD1\					21/ Row PD1\							
1	36	13	24	25	12	1	36	2	35	3	34	1	36	2	35	3	34
35	2	23	14	11	26	33	4	32	5	31	6	33	4	32	5	31	6
8	29	20	17	32	5	7	30	8	29	9	28	7	30	8	29	9	28
31	6	19	18	7	30	27	10	26	11	25	12	27	10	26	11	25	12
9	28	21	16	33	4	19	18	20	17	21	16	22	15	23	14	24	13
27	10	15	22	3	34	24	13	23	14	22	15	21	16	20	17	19	18
111 111 111 111 111 111					111 111 111 111 111 111					111 111 111 111 111 111							
CoLumn					CoLumn					CoLumn							

/108/114/108/114/108/114 PD2Sum						/ 60/162/ 60/162/ 60/162 PD2Sum						/ 66/156/ 66/156/ 66/156 PD2Sum					
22/ Row PD1\						23/ Row PD1\						24/ Row PD1\					
1	36	2	35	3	34 111 72\	1	36	2	35	3	34 111 90\	1	36	2	35	3	34 111 96\
33	4	32	5	31	6 111 150\	33	4	32	5	31	6 111 132\	33	4	32	5	31	6 111 126\
7	30	8	29	9	28 111 72\	19	18	20	17	21	16 111 90\	19	18	20	17	21	16 111 96\
24	13	23	14	22	15 111 150\	27	10	26	11	25	12 111 132\	24	13	23	14	22	15 111 126\
25	12	26	11	27	10 111 72\	22	15	23	14	24	13 111 90\	25	12	26	11	27	10 111 96\
21	16	20	17	19	18 111 150\	9	28	8	29	7	30 111 132\	9	28	8	29	7	30 111 126\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/ 72/150/ 72/150/ 72/150 PD2Sum						/ 90/132/ 90/132/ 90/132 PD2Sum						/ 96/126/ 96/126/ 96/126 PD2Sum					
25/ Row PD1\						26/ Row PD1\						27/ Row PD1\					
1	36	2	35	3	34 111 102\	1	36	5	32	9	28 111 86\	1	36	5	32	9	28 111 110\
33	4	32	5	31	6 111 120\	33	4	29	8	25	12 111 136\	33	4	29	8	25	12 111 112\
22	15	23	14	24	13 111 102\	3	34	7	30	11	26 111 86\	15	22	19	18	23	14 111 110\
21	16	20	17	19	18 111 120\	24	13	20	17	16	21 111 136\	24	13	20	17	16	21 111 112\
25	12	26	11	27	10 111 102\	27	10	31	6	35	2 111 86\	27	10	31	6	35	2 111 110\
9	28	8	29	7	30 111 120\	23	14	19	18	15	22 111 136\	11	26	7	30	3	34 111 112\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/102/120/102/120/102/120 PD2Sum						/ 86/136/ 86/136/ 86/136 PD2Sum						/110/112/110/112/110/112 PD2Sum					
28/ Row PD1\						29/ Row PD1\						30/ Row PD1\					
1	36	5	32	9	28 111 112\	1	36	13	24	25	12 111 102\	1	36	13	24	25	12 111 110\
33	4	29	8	25	12 111 110\	33	4	21	16	9	28 111 120\	33	4	21	16	9	28 111 112\
16	21	20	17	24	13 111 112\	3	34	15	22	27	10 111 102\	7	30	19	18	31	6 111 110\
23	14	19	18	15	22 111 110\	32	5	20	17	8	29 111 120\	32	5	20	17	8	29 111 112\
27	10	31	6	35	2 111 112\	11	26	23	14	35	2 111 102\	11	26	23	14	35	2 111 110\
11	26	7	30	3	34 111 110\	31	6	19	18	7	30 111 120\	27	10	15	22	3	34 111 112\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/112/110/112/110/112/110 PD2Sum						/102/120/102/120/102/120 PD2Sum						/110/112/110/112/110/112 PD2Sum					
31/ Row PD1\						32/ Row PD1\						33/ Row PD1\					
1	36	13	24	25	12 111 112\	1	36	13	24	25	12 111 114\	1	36	2	35	3	34 111 84\
33	4	21	16	9	28 111 110\	32	5	20	17	8	29 111 108\	27	10	26	11	25	12 111 138\
8	29	20	17	32	5 111 112\	9	28	21	16	33	4 111 114\	7	30	8	29	9	28 111 84\
31	6	19	18	7	30 111 110\	31	6	19	18	7	30 111 108\	24	13	23	14	22	15 111 138\
11	26	23	14	35	2 111 112\	11	26	23	14	35	2 111 114\	31	6	32	5	33	4 111 84\
27	10	15	22	3	34 111 110\	27	10	15	22	3	34 111 108\	21	16	20	17	19	18 111 138\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/112/110/112/110/112/110 PD2Sum						/114/108/114/108/114/108 PD2Sum						/ 84/138/ 84/138/ 84/138 PD2Sum					
34/ Row PD1\						35/ Row PD1\						36/ Row PD1\					
1	36	2	35	3	34 111 108\	1	36	2	35	3	34 111 114\	1	36	4	33	7	30 111 84\
27	10	26	11	25	12 111 114\	27	10	26	11	25	12 111 108\	27	10	24	13	21	16 111 138\
19	18	20	17	21	16 111 108\	22	15	23	14	24	13 111 114\	3	34	6	31	9	28 111 84\
24	13	23	14	22	15 111 114\	21	16	20	17	19	18 111 108\	26	11	23	14	20	17 111 138\
31	6	32	5	33	4 111 108\	31	6	32	5	33	4 111 114\	29	8	32	5	35	2 111 84\
9	28	8	29	7	30 111 114\	9	28	8	29	7	30 111 108\	25	12	22	15	19	18 111 138\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/108/114/108/114/108/114 PD2Sum						/114/108/114/108/114/108 PD2Sum						/ 84/138/ 84/138/ 84/138 PD2Sum					
37/ Row PD1\						38/ Row PD1\						39/ Row PD1\					
1	36	4	33	7	30 111 116\	1	36	4	33	7	30 111 118\	1	36	4	33	7	30 111 120\
27	10	24	13	21	16 111 106\	27	10	24	13	21	16 111 104\	26	11	23	14	20	17 111 102\
19	18	22	15	25	12 111 116\	20	17	23	14	26	11 111 118\	21	16	24	13	27	10 111 120\
26	11	23	14	20	17 111 106\	25	12	22	15	19	18 111 104\	25	12	22	15	19	18 111 102\
29	8	32	5	35	2 111 116\	29	8	32	5	35	2 111 118\	29	8	32	5	35	2 111 120\
9	28	6	31	3	34 111 106\	9	28	6	31	3	34 111 104\	9	28	6	31	3	34 111 102\
111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn						111 111 111 111 111 111  CoLumn					
/116/106/116/106/116/106 PD2Sum						/118/104/118/104/118/104 PD2Sum						/120/102/120/102/120/102 PD2Sum					
40/ Row PD1\						41/ Row PD1\											
1	36	2	35	3	34 111 120\	1	36	5	32	9	28 111 130\						
24	13	23	14	22	15 111 102\	24	13	20	17	16	21 111 92\						
25	12	26	11	27	10 111 120\	25	12	29	8	33	4 111 130\						
21	16	20	17	19	18 111 102\	23	14	19	18	15	22 111 92\						
31	6	32	5	33	4 111 120\	27	10	31	6	35	2 111 130\						
9	28	8	29	7	30 111 102\	11	26	7	30	3	34 111 92\						



```
|111|111|111|111|111|111| Column |111|111|111|111|111|111| Column
/120/102/120/102/120/102| PD2Sum /130/ 92/130/ 92/130/ 92| PD2Sum [Count = 41] OK!
```

[Listed by Kanji Setsuda on August 18, 2010 with MacOSX and Xcode3.1.2]

These 41 Fundamental Solutions were also discovered and reported first by our Prof. Mutsumi Suzuki, and I verified them by my own calculation just after that.

I myself found the transformation system to reconstruct all the 53136 Standard Solutions of that type by these 41 Fundamental Solutions, though I like to skip explaining about it here.

(Original Edition Written in English on Jul.29, 2001;  
Revised on Jul. 8, 2006; and Aug.23, 2010 with MacOSX & Xcode 3.1.2)

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Written by Kanji Setsuda; E-Mail Address: jag12001@nifty.com

### [Appendix] Sample List of My Program:

```
/** 'Composite' Semi-Panmagic Squares 6x6: Fundamental Solutions **/
/** 'CSPMS6F.c' dictated by Kanji Setsuda **/
/** on Jul.29,'01; Jan.16, Aug.18,'10 **/
/** Working with MacOSX & Xcode 3.1.2 **/
/**/
#include <stdio.h>
/* Global Variables */
short int cnt, cnt3;
short LSM, S4N;
short nm[37], uflg[37];
short mnm[6][37];
short sm[5][13], pd[5][13];
/* Sub-Routines */
//void stp01(void);
void stp02(void), stp03(void), stp04(void), stp05(void);
void stp06(void), stp07(void), stp08(void), stp09(void);
void stp10(void), stp11(void), stp12(void), stp13(void);
void stp14(void), stp15(void), stp16(void), stp17(void);
void stp18(void), stp19(void), stp20(void), stp21(void);
void stp22(void), stp23(void), stp24(void), stp25(void);
void stp26(void), stp27(void), stp28(void), stp29(void);
void stp30(void), stp31(void), stp32(void), stp33(void);
void stp34(void), stp35(void), stp36(void), stp37(void);
void stp38(void), stp39(void), stp40(void);
void ansprint(void), printsol(short x);
/**/
/* Main Program: Research */
int main(){
short n;
printf("\n* 'Composite Semi-Panmagic' Squares 6x6: List of 41 Fundamental Solutions *\n");
for(n=0;n<37;n++){nm[n]=0; uflg[n]=0;}
LSM=111; S4N=74; cnt=0; cnt3=0;
nm[1]=1; uflg[1]=1; // Set N1=1
stp02(); // Begin the Calculations
if(cnt3>0){printsol(cnt3);}
printf(" [Count = %d] OK!\n",cnt);
printf(" [Listed by Kanji Setsuda on Aug.18,'10 with MacOSX and Xcode3.1.2]\n");
return 0;
}
/**/
```

```

/* Begin the Calculations */
/* Set N2 */
void stp02(){
  short i;
  for(i=36;i>1;i--){
    if(uflg[i]==0){
      nm[2]=i; uflg[i]=1;
      stp03();
      uflg[i]=0;}
  }
}
/* Set N7(<N2) */
void stp03(){
  short i;
  for(i=nm[2]-1;i>1;i--){
    if(uflg[i]==0){
      nm[7]=i; uflg[i]=1;
      stp04();
      uflg[i]=0;}
  }
}
/* Set n8=74-n1-n2-n7 */
void stp04(){
  short i;
  i=S4N-nm[1]-nm[2]-nm[7];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[8]=i; uflg[i]=1;
      stp05();
      uflg[i]=0;}}
}
/* Set N3 */
void stp05(){
  short i;
  for(i=2;i<37;i++){
    if(uflg[i]==0){
      nm[3]=i; uflg[i]=1;
      stp06();
      uflg[i]=0;}
  }
}
/* Set n9=74-n2-n3-n8 */
void stp06(){
  short i;
  i=S4N-nm[2]-nm[3]-nm[8];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[9]=i; uflg[i]=1;
      stp07();
      uflg[i]=0;}}
}
/* Set N4(<N2) */
void stp07(){
  short i;
  for(i=nm[2]-1;i>1;i--){
    if(uflg[i]==0){
      nm[4]=i; uflg[i]=1;
      stp08();
      uflg[i]=0;}
  }
}

```

```

}
}
/* Set n10=74-n3-n4-n9 */
void stp08(){
short i;
i=S4N-nm[3]-nm[4]-nm[9];
if((1<i)&&(i<37)){
if(uflg[i]==0){
nm[10]=i; uflg[i]=1;
stp09();
uflg[i]=0;}}
}
/* Set N5(>N3) */
void stp09(){
short i;
for(i=nm[3]+1;i<37;i++){
if(uflg[i]==0){
nm[5]=i; uflg[i]=1;
stp10();
uflg[i]=0;}
}
}
/* Set n11=74-n4-n5-n10 */
void stp10(){
short i;
i=S4N-nm[4]-nm[5]-nm[10];
if((1<i)&&(i<37)){
if(uflg[i]==0){
nm[11]=i; uflg[i]=1;
stp11();
uflg[i]=0;}}
}
/* Set N6(<N4) & n1+n2+n3+n4+n5+n6==LSM */
void stp11(){
short i,sm;
for(i=nm[4]-1;i>1;i--){
if(uflg[i]==0){
nm[6]=i; uflg[i]=1;
sm=nm[1]+nm[2]+nm[3]+nm[4]+nm[5]+nm[6];
if(sm==LSM){stp12();}
uflg[i]=0;}
}
}
/* Set n12=74-n5-n6-n11 */
void stp12(){
short i,j;
i=S4N-nm[5]-nm[6]-nm[11];
j=S4N-nm[6]-nm[1]-nm[7];
if((1<i)&&(i<37)&&(i==j)){
if(uflg[i]==0){
nm[12]=i; uflg[i]=1;
stp14();
uflg[i]=0;}}
}
/**/
/* Search Level 2: */
/* Set N13 */
void stp14(){
short i;

```

```

for(i=2;i<37;i++){
    if(uflg[i]==0){
        nm[13]=i; uflg[i]=1;
        stp15();
        uflg[i]=0;}
}
}
/* Set n14=74-n7-n8-n13 */
void stp15(){
    short i;
    i=S4N-nm[7]-nm[8]-nm[13];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[14]=i; uflg[i]=1;
            stp16();
            uflg[i]=0;}}
}
/* Set n15=74-n8-n9-n14 */
void stp16(){
    short i;
    i=S4N-nm[8]-nm[9]-nm[14];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[15]=i; uflg[i]=1;
            stp17();
            uflg[i]=0;}}
}
/* Set n16=74-n9-n10-n15 */
void stp17(){
    short i;
    i=S4N-nm[9]-nm[10]-nm[15];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[16]=i; uflg[i]=1;
            stp18();
            uflg[i]=0;}}
}
/* Set n17=74-n10-n11-n16 */
void stp18(){
    short i;
    i=S4N-nm[10]-nm[11]-nm[16];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[17]=i; uflg[i]=1;
            stp19();
            uflg[i]=0;}}
}
/* Set n18=74-n11-n12-n17 */
void stp19(){
    short i,j;
    i=S4N-nm[11]-nm[12]-nm[17];
    j=S4N-nm[7]-nm[12]-nm[13];
    if((1<i)&&(i<37)&&(i==j)){
        if(uflg[i]==0){
            nm[18]=i; uflg[i]=1;
            stp21();
            uflg[i]=0;}}
}
/**/

```

```

/* Search Level 3: */
/* Set N19(<N7) */
void stp21(){
  short i;
  for(i=nm[7]-1;i>1;i--){
    if(uflg[i]==0){
      nm[19]=i; uflg[i]=1;
      stp22();
      uflg[i]=0;}
  }
}
/* Set n20=74-n13-n14-n19 */
void stp22(){
  short i;
  i=S4N-nm[13]-nm[14]-nm[19];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[20]=i; uflg[i]=1;
      stp23();
      uflg[i]=0;}}
}
/* Set n21=74-n14-n15-n20 */
void stp23(){
  short i;
  i=S4N-nm[14]-nm[15]-nm[20];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[21]=i; uflg[i]=1;
      stp24();
      uflg[i]=0;}}
}
/* Set n22=74-n15-n16-n21 */
void stp24(){
  short i;
  i=S4N-nm[15]-nm[16]-nm[21];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[22]=i; uflg[i]=1;
      stp26();
      uflg[i]=0;}}
}
/* Set n23=74-n16-n17-n22 */
void stp26(){
  short i;
  i=S4N-nm[16]-nm[17]-nm[22];
  if((1<i)&&(i<37)){
    if(uflg[i]==0){
      nm[23]=i; uflg[i]=1;
      stp27();
      uflg[i]=0;}}
}
/* Set n24=74-n17-n18-n23 */
void stp27(){
  short i,j;
  i=S4N-nm[17]-nm[18]-nm[23];
  j=S4N-nm[13]-nm[18]-nm[19];
  if((1<i)&&(i<37)&&(i==j)){
    if(uflg[i]==0){
      nm[24]=i; uflg[i]=1;

```

```

        stp28();
        uflg[i]=0;}}
}
/**/
/* Search Level 4: */
/* Set N25(>N13) */
void stp28(){
    short i;
    for(i=nm[13]+1;i<37;i++){
        if(uflg[i]==0){
            nm[25]=i; uflg[i]=1;
            stp29();
            uflg[i]=0;}
    }
}
/* Set n26=74-n19-n20-n25 */
void stp29(){
    short i;
    i=S4N-nm[19]-nm[20]-nm[25];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[26]=i; uflg[i]=1;
            stp30();
            uflg[i]=0;}}
}
/* Set n27=74-n20-n21-n26 */
void stp30(){
    short i;
    i=S4N-nm[20]-nm[21]-nm[26];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[27]=i; uflg[i]=1;
            stp31();
            uflg[i]=0;}}
}
/* Set n28=74-n21-n22-n27 */
void stp31(){
    short i;
    i=S4N-nm[21]-nm[22]-nm[27];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[28]=i; uflg[i]=1;
            stp32();
            uflg[i]=0;}}
}
/* Set n29=74-n22-n23-n28 */
void stp32(){
    short i;
    i=S4N-nm[22]-nm[23]-nm[28];
    if((1<i)&&(i<37)){
        if(uflg[i]==0){
            nm[29]=i; uflg[i]=1;
            stp33();
            uflg[i]=0;}}
}
/* Set n30=74-n23-n24-n29 */
void stp33(){
    short i,j;
    i=S4N-nm[23]-nm[24]-nm[29];

```

```

j=S4N-nm[24]-nm[19]-nm[25];
if((1<i)&&(i<37)&&(i==j)){
    if((uflg[i]==0)){
        nm[30]=i; uflg[i]=1;
        stp34();
        uflg[i]=0;}}
}
/**/
/* Search Level 5: */
/* Set N31(<N19) & n1+n7+n13+n19+n25+n31==LSM */
void stp34(){
    short i,sm;
    for(i=2;i<nm[19];i++){
        if(uflg[i]==0){
            nm[31]=i; uflg[i]=1;
            sm=nm[1]+nm[7]+nm[13]+nm[19]+nm[25]+nm[31];
            if(sm==LSM){stp35();}
            uflg[i]=0;}
    }
}
/* Set n32=74-n25-n26-n31 */
void stp35(){
    short i,j;
    i=S4N-nm[25]-nm[26]-nm[31];
    j=S4N-nm[31]-nm[1]-nm[2];
    if((1<i)&&(i<37)&&(i==j)){
        if(uflg[i]==0){
            nm[32]=i; uflg[i]=1;
            stp36();
            uflg[i]=0;}}
}
/* Set n33=74-n26-n27-n32 */
void stp36(){
    short i,j;
    i=S4N-nm[26]-nm[27]-nm[32];
    j=S4N-nm[32]-nm[2]-nm[3];
    if((1<i)&&(i<37)&&(i==j)){
        if(uflg[i]==0){
            nm[33]=i; uflg[i]=1;
            stp37();
            uflg[i]=0;}}
}
/* Set n34=74-n27-n28-n33 */
void stp37(){
    short i,j;
    i=S4N-nm[27]-nm[28]-nm[33];
    j=S4N-nm[33]-nm[3]-nm[4];
    if((1<i)&&(i<37)&&(i==j)){
        if(uflg[i]==0){
            nm[34]=i; uflg[i]=1;
            stp38();
            uflg[i]=0;}}
}
/* Set n35=74-n28-n29-n34 */
void stp38(){
    short i,j;
    i=S4N-nm[28]-nm[29]-nm[34];
    j=S4N-nm[34]-nm[4]-nm[5];
    if((1<i)&&(i<37)&&(i==j)){

```

```

    if(uflg[i]==0){
        nm[35]=i; uflg[i]=1;
        stp39();
        uflg[i]=0;}}
}
/* Set n36=74-n29-n30-n35 & n36>N1 */
void stp39(){
    short i,j;
    i=S4N-nm[29]-nm[30]-nm[35];
    j=S4N-nm[35]-nm[5]-nm[6];
    if((1<i)&&(i<37)&&(i==j)){
        if(uflg[i]==0){
            nm[36]=i; uflg[i]=1;
            stp40();
            uflg[i]=0;}}
}
/**/
/* The Last Checks */
void stp40(){
    short sm1,sm2;
    sm1=nm[30]+nm[25]+nm[36]+nm[31];
    sm2=nm[36]+nm[31]+nm[6]+nm[1];
    if((sm1==S4N)&&(sm2==S4N)){ansprint();}
}
/**/
/* Print The Answers */
void ansprint(){
    short n;
    cnt++;
    mnm[cnt3][0]=cnt;
    for(n=1;n<37;n++){mnm[cnt3][n]=nm[n];}
    cnt3++; if(cnt3==4){printsol(cnt3); cnt3=0;}
}
/* Print the List of Answers */
void printsol(short x){
    short l,m,n;
    for(m=0;m<x;m++){
        printf("%17d/",mnm[m][0]);
        if(m+1<x){printf(" ");}
    }
    printf("\n");
    for(l=0;l<6;l++){
        for(m=0;m<x;m++){
            for(n=1;n<7;n++){printf("%3d",mnm[m][l*6+n]);}
            if(m+1<x){printf(" ");}
        }
        printf("\n");
    }
}
//printf("\n");
}
/**/

```