

Part 3: New Algebraic Study of Magic Squares: Kanji Setsuda
Chapter 9: Fundamental Study of Composite Magic Squares:
Section 3: Three-Type Simultaneous Magic Squares of Order 12:
'Composite', Self-Complementary and Pan-diagonal

#1. Make 3-T Simultaneous MS12: Composite, Self-complementary and Pan-diagonal

Let's challenge to the Three-Type Simultaneous Magic Squares of higher orders such as of 12: 'Composite', Self-complementary and Pan-diagonal, shall we?

I guess it will be a big and hard challenge, for we have to deal with 144 variables and write the program modules as many as 72 at least. But I want to do it now.

1-1. Definitions with Basic Form and Basic Equations expressing Pre-conditions.

139	140	141	142	143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134	135	136	137	138
7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
19	20	21	22	23	24	13	14	15	16	17	18	19	20	21	22	23	24	13	14	15	16	17	18
31	32	33	34	35	36	25	26	27	28	29	30	31	32	33	34	35	36	25	26	27	28	29	30
43	44	45	46	47	48	37	38	39	40	41	42	43	44	45	46	47	48	37	38	39	40	41	42
55	56	57	58	59	60	49	50	51	52	53	54	55	56	57	58	59	60	49	50	51	52	53	54
67	68	69	70	71	72	61	62	63	64	65	66	67	68	69	70	71	72	61	62	63	64	65	66
79	80	81	82	83	84	73	74	75	76	77	78	79	80	81	82	83	84	73	74	75	76	77	78
91	92	93	94	95	96	85	86	87	88	89	90	91	92	93	94	95	96	85	86	87	88	89	90
103	104	105	106	107	108	97	98	99	100	101	102	103	104	105	106	107	108	97	98	99	100	101	102
115	116	117	118	119	120	109	110	111	112	113	114	115	116	117	118	119	120	109	110	111	112	113	114
127	128	129	130	131	132	121	122	123	124	125	126	127	128	129	130	131	132	121	122	123	124	125	126
139	140	141	142	143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134	135	136	137	138
7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6

**** Conditions for the Composite Combinations: QC=290 ****

n1+n2+n13+n14=QC ...cc1;	n49+n50+n61+n62=QC ...cc49;	n97+n98+n109+n110=QC ...cc97;
n2+n3+n14+n15=QC ...cc2;	n50+n51+n62+n63=QC ...cc50;	n98+n99+n110+n111=QC ...cc98;
n3+n4+n15+n16=QC ...cc3;	n51+n52+n63+n64=QC ...cc51;	n99+n100+n111+n112=QC ...cc99;
n4+n5+n16+n17=QC ...cc4;	n52+n53+n64+n65=QC ...cc52;	n100+n101+n112+n113=QC ...cc100;
n5+n6+n17+n18=QC ...cc5;	n53+n54+n65+n66=QC ...cc53;	n101+n102+n113+n114=QC ...cc101;
n6+n7+n18+n19=QC ...cc6;	n54+n55+n66+n67=QC ...cc54;	n102+n103+n114+n115=QC ...cc102;
n7+n8+n19+n20=QC ...cc7;	n55+n56+n67+n68=QC ...cc55;	n103+n104+n115+n116=QC ...cc103;
n8+n9+n20+n21=QC ...cc8;	n56+n57+n68+n69=QC ...cc56;	n104+n105+n116+n117=QC ...cc104;
n9+n10+n21+n22=QC ...cc9;	n57+n58+n69+n70=QC ...cc57;	n105+n106+n117+n118=QC ...cc105;
n10+n11+n22+n23=QC ...cc10;	n58+n59+n70+n71=QC ...cc58;	n106+n107+n118+n119=QC ...cc106;
n11+n12+n23+n24=QC ...cc11;	n59+n60+n71+n72=QC ...cc59;	n107+n108+n119+n120=QC ...cc107;
n12+n1+n24+n13=QC ...cc12;	n60+n49+n72+n61=QC ...cc60;	n108+n97+n120+n109=QC ...cc108;
n13+n14+n25+n26=QC ...cc13;	n61+n62+n73+n74=QC ...cc61;	n109+n110+n121+n122=QC ...cc109;
n14+n15+n26+n27=QC ...cc14;	n62+n63+n74+n75=QC ...cc62;	n110+n111+n122+n123=QC ...cc110;
n15+n16+n27+n28=QC ...cc15;	n63+n64+n75+n76=QC ...cc63;	n111+n112+n123+n124=QC ...cc111;
n16+n17+n28+n29=QC ...cc16;	n64+n65+n76+n77=QC ...cc64;	n112+n113+n124+n125=QC ...cc112;
n17+n18+n29+n30=QC ...cc17;	n65+n66+n77+n78=QC ...cc65;	n113+n114+n125+n126=QC ...cc113;
n18+n19+n30+n31=QC ...cc18;	n66+n67+n78+n79=QC ...cc66;	n114+n115+n126+n127=QC ...cc114;
n19+n20+n31+n32=QC ...cc19;	n67+n68+n79+n80=QC ...cc67;	n115+n116+n127+n128=QC ...cc115;
n20+n21+n32+n33=QC ...cc20;	n68+n69+n80+n81=QC ...cc68;	n116+n117+n128+n129=QC ...cc116;
n21+n22+n33+n34=QC ...cc21;	n69+n70+n81+n82=QC ...cc69;	n117+n118+n129+n130=QC ...cc117;
n22+n23+n34+n35=QC ...cc22;	n70+n71+n82+n83=QC ...cc70;	n118+n119+n130+n131=QC ...cc118;
n23+n24+n35+n36=QC ...cc23;	n71+n72+n83+n84=QC ...cc71;	n119+n120+n131+n132=QC ...cc119;
n24+n13+n36+n25=QC ...cc24;	n72+n61+n84+n73=QC ...cc72;	n120+n109+n132+n121=QC ...cc120;

$n25+n26+n37+n38=QC \dots cc25$; | $n73+n74+n85+n86=QC \dots cc73$; | $n121+n122+n133+n134=QC \dots cc121$;
 $n26+n27+n38+n39=QC \dots cc26$; | $n74+n75+n86+n87=QC \dots cc74$; | $n122+n123+n134+n135=QC \dots cc122$;
 $n27+n28+n39+n40=QC \dots cc27$; | $n75+n76+n87+n88=QC \dots cc75$; | $n123+n124+n135+n136=QC \dots cc123$;
 $n28+n29+n40+n41=QC \dots cc28$; | $n76+n77+n88+n89=QC \dots cc76$; | $n124+n125+n136+n137=QC \dots cc124$;
 $n29+n30+n41+n42=QC \dots cc29$; | $n77+n78+n89+n90=QC \dots cc77$; | $n125+n126+n137+n138=QC \dots cc125$;
 $n30+n31+n42+n43=QC \dots cc30$; | $n78+n79+n90+n91=QC \dots cc78$; | $n126+n127+n138+n139=QC \dots cc126$;
 $n31+n32+n43+n44=QC \dots cc31$; | $n79+n80+n91+n92=QC \dots cc79$; | $n127+n128+n139+n140=QC \dots cc127$;
 $n32+n33+n44+n45=QC \dots cc32$; | $n80+n81+n92+n93=QC \dots cc80$; | $n128+n129+n140+n141=QC \dots cc128$;
 $n33+n34+n45+n46=QC \dots cc33$; | $n81+n82+n93+n94=QC \dots cc81$; | $n129+n130+n141+n142=QC \dots cc129$;
 $n34+n35+n46+n47=QC \dots cc34$; | $n82+n83+n94+n95=QC \dots cc82$; | $n130+n131+n142+n143=QC \dots cc130$;
 $n35+n36+n47+n48=QC \dots cc35$; | $n83+n84+n95+n96=QC \dots cc83$; | $n131+n132+n143+n144=QC \dots cc131$;
 $n36+n25+n48+n37=QC \dots cc36$; | $n84+n73+n96+n85=QC \dots cc84$; | $n132+n121+n144+n133=QC \dots cc132$;

 $n37+n38+n49+n50=QC \dots cc37$; | $n85+n86+n97+n98=QC \dots cc85$; | $n133+n134+n1+n2=QC \dots cc133$;
 $n38+n39+n50+n51=QC \dots cc38$; | $n86+n87+n98+n99=QC \dots cc86$; | $n134+n135+n2+n3=QC \dots cc134$;
 $n39+n40+n51+n52=QC \dots cc39$; | $n87+n88+n99+n100=QC \dots cc87$; | $n135+n136+n3+n4=QC \dots cc135$;
 $n40+n41+n52+n53=QC \dots cc40$; | $n88+n89+n100+n101=QC \dots cc88$; | $n136+n137+n4+n5=QC \dots cc136$;
 $n41+n42+n53+n54=QC \dots cc41$; | $n89+n90+n101+n102=QC \dots cc89$; | $n137+n138+n5+n6=QC \dots cc137$;
 $n42+n43+n54+n55=QC \dots cc42$; | $n90+n91+n102+n103=QC \dots cc90$; | $n138+n139+n6+n7=QC \dots cc138$;
 $n43+n44+n55+n56=QC \dots cc43$; | $n91+n92+n103+n104=QC \dots cc91$; | $n139+n140+n7+n8=QC \dots cc139$;
 $n44+n45+n56+n57=QC \dots cc44$; | $n92+n93+n104+n105=QC \dots cc92$; | $n140+n141+n8+n9=QC \dots cc140$;
 $n45+n46+n57+n58=QC \dots cc45$; | $n93+n94+n105+n106=QC \dots cc93$; | $n141+n142+n9+n10=QC \dots cc141$;
 $n46+n47+n58+n59=QC \dots cc46$; | $n94+n95+n106+n107=QC \dots cc94$; | $n142+n143+n10+n11=QC \dots cc142$;
 $n47+n48+n59+n60=QC \dots cc47$; | $n95+n96+n107+n108=QC \dots cc95$; | $n143+n144+n11+n12=QC \dots cc143$;
 $n48+n37+n60+n49=QC \dots cc48$; | $n96+n85+n108+n97=QC \dots cc96$; | $n144+n133+n12+n1=QC \dots cc144$;

**** Basic Conditions for Rows and Columns: C=870 ****

$n1+n2+n3+n4+n5+n6+n7+n8+n9+n10+n11+n12=C \dots rw1$;
 $n1+n13+n25+n37+n49+n61+n73+n85+n97+n109+n121+n133=C \dots c11$;

**** Pan-diagonal Conditions: C=870 ****

$n1+n14+n27+n40+n53+n66+n79+n92+n105+n118+n131+n144=C \dots pd1$;
 $n1+n24+n35+n46+n57+n68+n79+n90+n101+n112+n123+n134=C \dots pb1$;

**** Self-complementary Conditions: CS=145 ****

$n1+n144=n2+n143=n3+n142=n4+n141=n5+n140=n6+n139=n7+n138=n8+n137=n9+n136=n10+n135=n11+n134=n12+n133=$
 $n13+n132=n14+n131=n15+n130=n16+n129=n17+n128=n18+n127=n19+n126=n20+n125=n21+n124=n22+n123=n23+n122=$
 $n24+n121=n25+n120=n26+n119=n27+n118=n28+n117=n29+n116=n30+n115=n31+n114=n32+n113=n33+n112=n34+n111=$
 $n35+n110=n36+n109=n37+n108=n38+n107=n39+n106=n40+n105=n41+n104=n42+n103=n43+n102=n44+n101=n45+n100=$
 $n46+n99=n47+n98=n48+n97=n49+n96=n50+n95=n51+n94=n52+n93=n53+n92=n54+n91=n55+n90=n56+n89=n57+n88=$
 $n58+n87=n59+n86=n60+n85=n61+n84=n62+n83=n63+n82=n64+n81=n65+n80=n66+n79=n67+n78=n68+n77=n69+n76=$
 $n70+n75=n71+n74=n72+n73=CS \dots scc$

I am afraid you may wonder why there are too few Basic Conditions. But, it is all right. We have got such a lot of Composite Conditions and Self-complementary Conditions that we can always restore the full-scale preconditions for all.

Let me demonstrate a few examples of algebraic calculation.

First of all, watch the 44 variables situated on the 4 edges of the square.

$n133+n134+n1+n2=Q \dots cc133$; $n134+n135+n2+n3=Q \dots cc134$; $n135+n136+n3+n4=Q \dots cc135$;
 $n136+n137+n4+n5=Q \dots cc136$; $n137+n138+n5+n6=Q \dots cc137$; $n138+n139+n6+n7=Q \dots cc138$;
 $n139+n140+n7+n8=Q \dots cc139$; $n140+n141+n8+n9=Q \dots cc140$; $n141+n142+n9+n10=Q \dots cc141$;
 $n142+n143+n10+n11=Q \dots cc142$; $n143+n144+n11+n12=Q \dots cc143$; $n144+n133+n12+n1=Q \dots cc144$;

Combine these equations with the next Self-complementary conditions shown as below.

$n1+n144=n2+n143=n3+n142=n4+n141=n5+n140=n6+n139=$
 $n7+n138=n8+n137=n9+n136=n10+n135=n11+n134=n12+n133=CC=145 \dots scc1$
 $n144+n133+n12+n1=QC$; $\dots cc144 \rightarrow (n1+n144)+(n12+n133)=QC$; $\rightarrow CC+CC=QC$; $\rightarrow QC=290$;
 $cc133+cc135+cc137: (n1+n2+n3+n4+n5+n6)+(n133+n134+n135+n136+n137+n138)=3QC=870$;
 $scc1 \rightarrow (n7+n8+n9+n10+n11+n12)+(n133+n134+n135+n136+n137+n138)=6CC=6*145=870$
 Therefore $n1+n2+n3+n4+n5+n6 = n7+n8+n9+n10+n11+n12 \dots RHalf$

In the same way you have:

$n12+n1+n24+n13=Q \dots cc12$; $n24+n13+n36+n25=Q \dots cc24$; $n36+n25+n48+n37=Q \dots cc36$;
 $n48+n37+n60+n49=Q \dots cc48$; $n60+n49+n72+n61=Q \dots cc60$; $n72+n61+n84+n73=Q \dots cc72$;
 $n84+n73+n96+n85=Q \dots cc84$; $n96+n85+n108+n97=Q \dots cc96$; $n108+n97+n120+n109 \dots cc108$;
 $n120+n109+n132+n121=Q \dots cc120$; $n132+n121+n144+n133=Q \dots cc132$; $n144+n133+n12+n1=Q \dots cc144$;
 $n1+n144=n12+n133=n13+n132=n24+n121=n25+n120=n36+n109=$
 $n37+n108=n48+n97=n49+n96=n60+n85=n61+n84=n72+n73=CC=145 \dots scc2$

cc12+cc36+cc60: (n1+n13+n25+n37+n49+n61)+(n12+n24+n36+n48+n60+n72)=3QC=870;
 scc2 -> (n133+n121+n109+n97+n85+n73)+(n12+n24+n36+n48+n60+n72)=6CC=870;
 Therefore n1+n13+n25+n37+n49+n61 = n73+n85+n97+n109+n121+n133 ...CHalf

If you combine RHalf and CHalf with these first definitions:

n1+n2+n3+n4+n5+n6+n7+n8+n9+n10+n11+n12=C=870; and
 n1+n13+n25+n37+n49+n61+n73+n85+n97+n109+n121+n133=C=870;
 you can say: n1+n2+n3+n4+n5+n6 = n7+n8+n9+n10+n11+n12 =C/2=435; ...Rowhalf
 and n1+n13+n25+n37+n49+n61 = n73+n85+n97+n109+n121+n133 =C/2=435; ...Clmhalf

This implies that our object is basically created as a multiple 6x6 type.

You may well replace the first definitions for Rowhalf and Clmhalf above. It will change nothing about the result, while you can build your object in higher speed.

143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134
11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
23	24	13	14	15	16	17	18	19	20	21	22	23	24	13	14
35	36	25	26	27	28	29	30	31	32	33	34	35	36	25	26
47	48	37	38	39	40	41	42	43	44	45	46	47	48	37	38
59	60	49	50	51	52	53	54	55	56	57	58	59	60	49	50
71	72	61	62	63	64	65	66	67	68	69	70	71	72	61	62
83	84	73	74	75	76	77	78	79	80	81	82	83	84	73	74
95	96	85	86	87	88	89	90	91	92	93	94	95	96	85	86
107	108	97	98	99	100	101	102	103	104	105	106	107	108	97	98
119	120	109	110	111	112	113	114	115	116	117	118	119	120	109	110
131	132	121	122	123	124	125	126	127	128	129	130	131	132	121	122
143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134
11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2

Add both sides of these equations out of Self-complementary Conditions:

n1+n144=n14+n131=n27+n118=n40+n105=n53+n92=n66+n79=CC ... ssc3
 --> n1+n14+n27+n40+n53+n66+n79+n92+n105+n118+n131+n144=6CC=6x145=870 ... pd1
 n12+n133=n23+n122=n34+n111=n45+n100=n56+n89=n67+n78=CC ... ssc4
 --> n12+n23+n34+n45+n56+n67+n78+n89+n100+n111+n122+n133=6CC=870 ... pb12

You can always make these primary diagonals add up to the Magic Constant.

As this is the inherent nature of our 'Composite' object, you may well remove the first definitions of Pandiagonal Conditions from the list. Even if you remove those, nothing will change at all. Of course, you may well take them into the list before all.

Let me demonstrate a few simple algebraic calculations as follows.

n14+n15=n134+n135		n27+n28=n123+n124		n40+n41=n112+n113
n15+n16=n135+n136(-)		n28+n29=n124+n125(-)		n41+n42=n113+n114(-)
-----		-----		-----
n14+n136=n16+n134		n27+n125=n29+n123		n40+n114=n42+n112
n16+n17=n136+n137(+)		n29+n30=n125+n126(+)		n42+n43=n114+n115(+)
-----		-----		-----
n14+n17=n134+n137		n27+n30=n123+n126		n40+n43=n112+n115
n17+n18=n137+n138(-)		n30+n31=n126+n127(-)		n43+n44=n115+n116(-)
-----		-----		-----
n14+n138=n18+n134		n27+n127=n31+n123		n40+n116=n44+n112
n18+n19=n138+n139(+)		n31+n32=n127+n128(+)		n44+n45=n116+n117(+)
-----		-----		-----
n14+n19=n134+n139		n27+n32=n123+n128		n40+n45=n112+n117
n19+n20=n139+n140(-)		n32+n33=n128+n129(-)		n45+n46=n117+n118(-)
-----		-----		-----

n14+n140=n20+n134 n20+n21=n140+n141(+)	n27+n33=n123+n129 n33+n34=n129+n130(+)	n40+118=n46+n112 ...e3
n14+n21=n134+n141 n21+n22=n141+n142(-)	n27+n34=n123+n130 n34+n35=n130+n131(-)	
n14+n142=n22+n134 n22+n23=n142+n143(+)	n27+n131=n35+n123	...e2
n14+n23=n134+n143 n23+n24=n143+n144(-)		
n14+n144=n24+n134	...e1	

In the same way $n53+n105=n57+101$...e4; $n66+n92=n68+n90$...e5;
 $e1+e2+e3+e4+e5$

$$n14+n27+n40+n53+n66+n92+n105+n118+n131+n144 = n134+n123+n112+n101+n90+n68+n57+n46+n35+n24$$

Add $n1+n79$ to both sides of this equation:

$$n1+n14+n27+n40+n53+n66+n79+n92+n105+n118+n131+n144 \dots pd1$$

$$= n1+n24+n35+n46+n57+n68+n79+n90+n101+n112+n123+n134 \dots pb1$$

This explains that two pandiagonals add up to the same Magic Constant: $pd1=pb1=870$

In the same way $n2+n132=n12+n122$; $n15+n119=n23+n111$; $n28+n106=n34+n100$;

$$n41+n93=n45+n89$$
; $n54+n80=n56+n78$; -->

$$n2+n15+n28+n41+n54+n80+n83+n106+n119+n132 = n12+n23+n34+n45+n56+n78+n89+n100+n111+n122$$

Add $n67+n133$ to both sides of this equation:

$$n2+n15+n28+n41+n54+n67+n80+n83+n106+n119+n132+n133 \dots pd2$$

$$= n12+n23+n34+n45+n56+n67+n78+n89+n100+n111+n122+n133 \dots pb12$$

Repeat your Calculations in the same manner, and you can make all pandiagonals add up to the magic constant. Our object possesses these equalities by nature in itself.

1-2. Write our program to make our object: 3-T Simultaneous MS12

Let me show you only the most important part of my program to make our object.

```

/* Begin the Calculations */
/* Level 1: */
/* Set N1 & n144=CSM-N1 & N1<n144 */
void stp01(){
  short a,b;
  for(a=1;a<73;a++){b=CSM-a; //CSM=145; 'b' is for self-complementary pair
    if((uflg[a]==0)&&(uflg[b]==0)){ //Check the flags if they are 'Used' or not
      nm[1]=a; nm[144]=b; //Set the Self-complementary Pairs
      uflg[a]=1; uflg[b]=1; //Set the flags as 'Used'
      stp02();
      uflg[b]=0; uflg[a]=0;} //Reset the flags as 'Un-used'
    }
}
/* Set N12(>n133>N1) & n133=CSM-N12 */
void stp02(){
  short a,b;
  for(a=144;a>72;a--){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)&&(b>nm[1])){
      nm[12]=a; nm[133]=b;
      uflg[a]=1; uflg[b]=1;
      if(nm[1]+nm[12]+nm[133]+nm[144]==QSM){stp03();}
      uflg[b]=0; uflg[a]=0;}
    }
}
/* Set N2 & n143=CSM-N2 */
void stp03(){
  short a,b;
  for(a=144;a>0;a--){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)){

```

```

        nm[2]=a; nm[143]=b;
        uflg[a]=1; uflg[b]=1;
        stp04();
        uflg[b]=0; uflg[a]=0;}
    }
}
/* Set n11=QSM-n12-n143-n144 & n134=CSM-n11 */
void stp04(){
    short a,b;
    a=QSM-nm[12]-nm[143]-nm[144];
    b=QSM-nm[133]-nm[2]-nm[1];
    if((0<a)&&(a<145)&&(a+b==CSM)){
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[11]=a; nm[134]=b;
            uflg[a]=1; uflg[b]=1;
            stp05();
            uflg[b]=0; uflg[a]=0;}}
}
/* Set N3 & n142=CSM-N3 */
void stp05(){
    short a,b;
    for(a=1;a<145;a++){b=CSM-a;
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[3]=a; nm[142]=b;
            uflg[a]=1; uflg[b]=1;
            stp06();
            uflg[b]=0; uflg[a]=0;}
    }
}
/* Set n10=QSM-n11-n142-n143 & n135=CSM-n10 */
void stp06(){
    short a,b;
    a=QSM-nm[11]-nm[142]-nm[143];
    b=QSM-nm[134]-nm[3]-nm[2];
    if((0<a)&&(a<145)&&(a+b==CSM)){
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[10]=a; nm[135]=b;
            uflg[a]=1; uflg[b]=1;
            stp07();
            uflg[b]=0; uflg[a]=0;}}
}
/* Set N4 & n141=CSM-N4 */
void stp07(){
    short a,b;
    for(a=144;a>0;a--){b=CSM-a;
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[4]=a; nm[141]=b;
            uflg[a]=1; uflg[b]=1; cnt2=0;
            stp08();
            uflg[b]=0; uflg[a]=0;}
    }
}
/* Set n9=QSM-n10-n141-n142 & n136=CSM-n9 */
void stp08(){
    short a,b;
    a=QSM-nm[10]-nm[141]-nm[142];
    b=QSM-nm[135]-nm[4]-nm[3];
    if((0<a)&&(a<145)&&(a+b==CSM)){
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[9]=a; nm[136]=b;
            uflg[a]=1; uflg[b]=1;
            stp09();
            uflg[b]=0; uflg[a]=0;}}
}
/* Set N5 & n140=CSM-N5 */

```

```

void stp09(){
short a,b;
for(a=1;a<145;a++){b=CSM-a;
if((uflg[a]==0)&&(uflg[b]==0)){
nm[5]=a; nm[140]=b;
uflg[a]=1; uflg[b]=1;
stp10();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set n8=QSM-n9-n140-n141 & n137=CSM-n8 */
void stp10(){
short a,b;
a=QSM-nm[9]-nm[140]-nm[141];
b=QSM-nm[136]-nm[5]-nm[4];
if((0<a)&&(a<145)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[8]=a; nm[137]=b;
uflg[a]=1; uflg[b]=1;
stp11();
uflg[b]=0; uflg[a]=0;}}}
}
/* Set n6=HSM-n1-n2-n3-n4-n5 & n139=CSM-n6 */
void stp11(){
short a,b;
a=HSM-nm[1]-nm[2]-nm[3]-nm[4]-nm[5]; //Take the 'Half-line' definitions
b=HSM-nm[144]-nm[143]-nm[142]-nm[141]-nm[140];
if((0<a)&&(a<145)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[6]=a; nm[139]=b;
uflg[a]=1; uflg[b]=1;
stp12();
uflg[b]=0; uflg[a]=0;}}}
}
/* Set n7=QSM-n8-n139-n140 & n138=CSM-n7 */
void stp12(){
short a,b,c;
a=QSM-nm[8]-nm[139]-nm[140];
b=QSM-nm[137]-nm[6]-nm[5];
c=L SM-nm[1]-nm[2]-nm[3]-nm[4]-nm[5]-nm[6]-nm[8]-nm[9]-nm[10]-nm[11]-nm[12];
if((0<a)&&(a<145)&&(a+b==CSM)){
if((a==c)&&(uflg[a]==0)&&(uflg[b]==0)){
nm[7]=a; nm[138]=b;
uflg[a]=1; uflg[b]=1;
if(nm[6]+nm[7]+nm[138]+nm[139]==QSM){stp13();}
uflg[b]=0; uflg[a]=0;}}}
}
}
/* Level 2: */
/* Set N13 & n132=CSM-N13 */
void stp13(){
short a,b;
for(a=144;a>0;a--){b=CSM-a;
if((uflg[a]==0)&&(uflg[b]==0)){
nm[13]=a; nm[132]=b;
uflg[a]=1; uflg[b]=1;
stp14();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set n24=QSM-n12-n1-n13 & n121=CSM-n24 */
void stp14(){
short a,b;
a=QSM-nm[12]-nm[1]-nm[13];
b=QSM-nm[133]-nm[144]-nm[132];
if((0<a)&&(a<145)&&(a+b==CSM)){

```

```

        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[24]=a; nm[121]=b;
            uflg[a]=1; uflg[b]=1;
            stp15();
            uflg[b]=0; uflg[a]=0;}}
    }
/* Set N25 & n120=CSM-N25 */
void stp15(){
    short a,b;
    for(a=144;a>0;a--){b=CSM-a;
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[25]=a; nm[120]=b;
            uflg[a]=1; uflg[b]=1;
            stp16();
            uflg[b]=0; uflg[a]=0;}}
    }
}
/* Set n36=QSM-n24-n13-n25 & n109=CSM-n36 */
void stp16(){
    short a,b;
    a=QSM-nm[24]-nm[13]-nm[25];
    b=QSM-nm[121]-nm[132]-nm[120];
    if((0<a)&&(a<145)&&(a+b==CSM)){
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[36]=a; nm[109]=b;
            uflg[a]=1; uflg[b]=1;
            stp17();
            uflg[b]=0; uflg[a]=0;}}
    }
}
/* Set N37 & n108=CSM-N37 */
void stp17(){
    short a,b;
    for(a=1;a<145;a++){b=CSM-a;
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[37]=a; nm[108]=b;
            uflg[a]=1; uflg[b]=1;
            stp18();
            uflg[b]=0; uflg[a]=0;}}
    }
}
/* Set n48=QSM-n36-n25-n37 & n97=CSM-n48 */
void stp18(){
    short a,b;
    a=QSM-nm[36]-nm[25]-nm[37];
    b=QSM-nm[109]-nm[120]-nm[108];
    if((0<a)&&(a<145)&&(a+b==CSM)){
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[48]=a; nm[97]=b;
            uflg[a]=1; uflg[b]=1;
            stp19();
            uflg[b]=0; uflg[a]=0;}}
    }
}
/* Set N49 & n96=CSM-N49 */
void stp19(){
    short a,b;
    for(a=144;a>0;a--){b=CSM-a;
        if((uflg[a]==0)&&(uflg[b]==0)){
            nm[49]=a; nm[96]=b;
            uflg[a]=1; uflg[b]=1;
            stp20();
            uflg[b]=0; uflg[a]=0;}}
    }
}
/* Set n60=QSM-n48-n37-n49 & n85=CSM-n60 */
void stp20(){

```

```

short a,b;
a=QSM-nm[48]-nm[37]-nm[49];
b=QSM-nm[97]-nm[108]-nm[96];
if((0<a)&&(a<145)&&(a+b==CSM)){
    if((uflg[a]==0)&&(uflg[b]==0)){
        nm[60]=a; nm[85]=b;
        uflg[a]=1; uflg[b]=1;
        stp21();
        uflg[b]=0; uflg[a]=0;}}
}
/* Set n61=HSM-n1-n13-n25-n37-n49 & n84=CSM-n61 */
void stp21(){
short a,b;
a=HSM-nm[1]-nm[13]-nm[25]-nm[37]-nm[49];
b=HSM-nm[144]-nm[132]-nm[120]-nm[108]-nm[96];
if((0<a)&&(a<145)&&(a+b==CSM)){
    if((uflg[a]==0)&&(uflg[b]==0)){
        nm[61]=a; nm[84]=b;
        uflg[a]=1; uflg[b]=1;
        stp22();
        uflg[b]=0; uflg[a]=0;}}
}
/* Set n73=QSM-n84-n96-n85 & n72=CSM-n73 */
void stp22(){
short a,b,c;
a=QSM-nm[84]-nm[96]-nm[85];
b=QSM-nm[61]-nm[49]-nm[60];
c=L SM-nm[1]-nm[13]-nm[25]-nm[37]-nm[49]-nm[61]-nm[85]-nm[97]-nm[109]-nm[121]-nm[133];
if((0<a)&&(a<145)&&(a+b==CSM)){
    if((a==c)&&(uflg[a]==0)&&(uflg[b]==0)){
        nm[73]=a; nm[72]=b;
        uflg[a]=1; uflg[b]=1;
        if(nm[72]+nm[61]+nm[84]+nm[73]==QSM){stp23();}
        uflg[b]=0; uflg[a]=0;}}
}
/* Level 3: */
/* Set n14=QSM-n1-n2-n13 & n131=CSM-n14 */
void stp23(){
short a,b;
a=QSM-nm[1]-nm[2]-nm[13];
b=QSM-nm[144]-nm[143]-nm[132];
if((0<a)&&(a<145)&&(a+b==CSM)){
    if((uflg[a]==0)&&(uflg[b]==0)){
        nm[14]=a; nm[131]=b;
        uflg[a]=1; uflg[b]=1;
        stp24();
        uflg[b]=0; uflg[a]=0;}}
}
/* ..(skip).. */

```

1-3. Result of Test-Run for our Program of making 3-T Simultaneous MS12

Let me demonstrate the result list of my first execution here.

Solutions could come out smooth, but would not come to an end very soon. I had to wait for a long time and finally gave it up. Even when I limited to count those with $n1=1$, I could not finish counting. How many solutions does our object have?

**** Three-Type Simultaneous Magic Squares of Order 12: ****

**** 'Composite', Self-complementary and Pan-diagonal ****

											1/ Row\PD	
1	143	3	141	7	140	8	139	9	135	11	133	=870\870
132	14	130	16	126	17	125	18	124	22	122	24	=870\870
97	47	99	45	103	44	104	43	105	39	107	37	=870\870
36	110	34	112	30	113	29	114	28	118	26	120	=870\870

85	59	87	57	91	56	92	55	93	51	95	49	=870\870
84	62	82	64	78	65	77	66	76	70	74	72	=870\870
73	71	75	69	79	68	80	67	81	63	83	61	=870\870
96	50	94	52	90	53	89	54	88	58	86	60	=870\870
25	119	27	117	31	116	32	115	33	111	35	109	=870\870
108	38	106	40	102	41	101	42	100	46	98	48	=870\870
121	23	123	21	127	20	128	19	129	15	131	13	=870\870
12	134	10	136	6	137	5	138	4	142	2	144	=870\870

870 870 870 870 870 870 870 870 870 870 870 870	Column
/870/870/870/870/870/870/870/870/870/870/870/870/	PDSums

241/ Row\PD

1	143	3	140	7	141	9	139	8	135	11	133	=870\870
132	14	130	17	126	16	124	18	125	22	122	24	=870\870
97	47	99	44	103	45	105	43	104	39	107	37	=870\870
36	110	34	113	30	112	28	114	29	118	26	120	=870\870
85	59	87	56	91	57	93	55	92	51	95	49	=870\870
84	62	82	65	78	64	76	66	77	70	74	72	=870\870
73	71	75	68	79	69	81	67	80	63	83	61	=870\870
96	50	94	53	90	52	88	54	89	58	86	60	=870\870
25	119	27	116	31	117	33	115	32	111	35	109	=870\870
108	38	106	41	102	40	100	42	101	46	98	48	=870\870
121	23	123	20	127	21	129	19	128	15	131	13	=870\870
12	134	10	137	6	136	4	138	5	142	2	144	=870\870

870 870 870 870 870 870 870 870 870 870 870 870	Column
/870/870/870/870/870/870/870/870/870/870/870/870/	PDSums

481/ Row\PD

1	143	3	139	8	141	9	140	7	135	11	133	=870\870
132	14	130	18	125	16	124	17	126	22	122	24	=870\870
97	47	99	43	104	45	105	44	103	39	107	37	=870\870
36	110	34	114	29	112	28	113	30	118	26	120	=870\870
85	59	87	55	92	57	93	56	91	51	95	49	=870\870
84	62	82	66	77	64	76	65	78	70	74	72	=870\870
73	71	75	67	80	69	81	68	79	63	83	61	=870\870
96	50	94	54	89	52	88	53	90	58	86	60	=870\870
25	119	27	115	32	117	33	116	31	111	35	109	=870\870
108	38	106	42	101	40	100	41	102	46	98	48	=870\870
121	23	123	19	128	21	129	20	127	15	131	13	=870\870
12	134	10	138	5	136	4	137	6	142	2	144	=870\870

870 870 870 870 870 870 870 870 870 870 870 870	Column
/870/870/870/870/870/870/870/870/870/870/870/870/	PDSums

721/ Row\PD

1	143	7	141	3	140	8	135	9	139	11	133	=870\870
132	14	126	16	130	17	125	22	124	18	122	24	=870\870
97	47	103	45	99	44	104	39	105	43	107	37	=870\870
36	110	30	112	34	113	29	118	28	114	26	120	=870\870
85	59	91	57	87	56	92	51	93	55	95	49	=870\870
84	62	78	64	82	65	77	70	76	66	74	72	=870\870
73	71	79	69	75	68	80	63	81	67	83	61	=870\870
96	50	90	52	94	53	89	58	88	54	86	60	=870\870
25	119	31	117	27	116	32	111	33	115	35	109	=870\870
108	38	102	40	106	41	101	46	100	42	98	48	=870\870
121	23	127	21	123	20	128	15	129	19	131	13	=870\870
12	134	6	136	10	137	5	142	4	138	2	144	=870\870

870 870 870 870 870 870 870 870 870 870 870 870	Column
/870/870/870/870/870/870/870/870/870/870/870/870/	PDSums

```

1441/ Row\PD
1 143 8 141 3 139 7 135 9 140 11 133|=870\870
132 14 125 16 130 18 126 22 124 17 122 24|=870\870
97 47 104 45 99 43 103 39 105 44 107 37|=870\870
36 110 29 112 34 114 30 118 28 113 26 120|=870\870
85 59 92 57 87 55 91 51 93 56 95 49|=870\870
84 62 77 64 82 66 78 70 76 65 74 72|=870\870
73 71 80 69 75 67 79 63 81 68 83 61|=870\870
96 50 89 52 94 54 90 58 88 53 86 60|=870\870
25 119 32 117 27 115 31 111 33 116 35 109|=870\870
108 38 101 40 106 42 102 46 100 41 98 48|=870\870
121 23 128 21 123 19 127 15 129 20 131 13|=870\870
12 134 5 136 10 138 6 142 4 137 2 144|=870\870

```

```

-----+-----
|870|870|870|870|870|870|870|870|870|870|870|870| Column
/870/870/870/870/870/870/870/870/870/870/870/870| PDSums

```

```

2161/ Row\PD
1 143 9 140 3 139 7 135 8 141 11 133|=870\870
132 14 124 17 130 18 126 22 125 16 122 24|=870\870
97 47 105 44 99 43 103 39 104 45 107 37|=870\870
36 110 28 113 34 114 30 118 29 112 26 120|=870\870
85 59 93 56 87 55 91 51 92 57 95 49|=870\870
84 62 76 65 82 66 78 70 77 64 74 72|=870\870
73 71 81 68 75 67 79 63 80 69 83 61|=870\870
96 50 88 53 94 54 90 58 89 52 86 60|=870\870
25 119 33 116 27 115 31 111 32 117 35 109|=870\870
108 38 100 41 106 42 102 46 101 40 98 48|=870\870
121 23 129 20 123 19 127 15 128 21 131 13|=870\870
12 134 4 137 10 138 6 142 5 136 2 144|=870\870

```

```

-----+-----
|870|870|870|870|870|870|870|870|870|870|870|870| Column
/870/870/870/870/870/870/870/870/870/870/870/870| PDSums

```

```

2881/ Row\PD
1 141 3 143 7 140 8 139 11 135 9 133|=870\870
132 16 130 14 126 17 125 18 122 22 124 24|=870\870
97 45 99 47 103 44 104 43 107 39 105 37|=870\870
36 112 34 110 30 113 29 114 26 118 28 120|=870\870
85 57 87 59 91 56 92 55 95 51 93 49|=870\870
84 64 82 62 78 65 77 66 74 70 76 72|=870\870
73 69 75 71 79 68 80 67 83 63 81 61|=870\870
96 52 94 50 90 53 89 54 86 58 88 60|=870\870
25 117 27 119 31 116 32 115 35 111 33 109|=870\870
108 40 106 38 102 41 101 42 98 46 100 48|=870\870
121 21 123 23 127 20 128 19 131 15 129 13|=870\870
12 136 10 134 6 137 5 138 2 142 4 144|=870\870

```

```

-----+-----
|870|870|870|870|870|870|870|870|870|870|870|870| Column
/870/870/870/870/870/870/870/870/870/870/870/870| PDSums

```

. . . .

** Calculated by Kanji Setsuda on January 15, 2010 with MacOSX & Xcode3.1.2 **

#2. Challenge to Count all the Standard Solutions with n1=1

2-1. Improve our present Program for some better one with a good speed

I just wanted to know how many solutions I could count even when n1=1. I had to improve my present program to a quick type, and began to try to make it so.

I tried to remove a few independent variables to make them into dependent ones. Next I rearranged the program modules for a better order and location. I also tried to

put the limitations to the value ranges which every critical variable should take. I had to study our object again with my new algebraic analysis as follows.

Find all complementary pairs whose sums are equal among 48 below:

$n1+n133=n3+n135=n5+n137=n7+n139=n9+n141=n11+n143$;
 Select $n1+n133=n3+n135$; --> $n3=n1+n133-n135$; and try to eliminate $n135$ by the next inequality conditions: $0<n135<145$; --> $(n1+n133-145)<n3<(n1+n133-0)$;
 In the same way $n1+n133=n5+n137$; --> $n5=n1+n133-n137$; but $0<n137<145$;
 Therefore $(n1+n133-145)<n5<(n1+n133-0)$;
 In the same way you can say all: $(n1+n133-145)<n7<(n1+n133)$;
 $(n1+n133-145)<n9<(n1+n133)$; and $(n1+n133-145)<n11<(n1+n133)$;
 But $0<\{n3, n5, n7, n9, n11\}<145$;
 When you define $LV1=n1+n133-145$; then you should also put: $\text{if}(LV1<0)\text{then}\{LV1=0;\}$
 When you define $HV1=n1+n133$; then you should also put: $\text{if}(HV1>145)\text{then}\{HV1=145;\}$
 It consequently means: $LV1<\{n3, n5, n7, n9, n11\}<HV1$
 You can also say: $LV1<\{n135, n137, n139, n141, n143\}<HV1$
 On the other hand,
 $n12+n144=n2+n134=n4+n136=n6+n138=n8+n140=n10+n142$;
 $n2=n12+n144-n134$; $0<n134<145$; --> $(n12+n144-145)<n2<(n12+n144)$;
 In the same way $(n12+n144-145)<n4<(n12+n144)$; $(n12+n144-145)<n6<(n12+n144)$;
 $(n12+n144-145)<n8<(n12+n144)$; $(n12+n144-145)<n10<(n12+n144)$;
 But $0<\{n2, n4, n6, n8, n10\}<145$;
 When you define $LV2=n12+n144-145$; you should also put: $\text{if}(LV2<0)\text{then}\{LV2=0;\}$
 When you define $HV2=n12+n144$; you should also put: $\text{if}(HV2>145)\text{then}\{HV2=145;\}$
 It consequently means: $LV2<\{n2, n4, n6, n8, n10\}<HV2$
 You can also say: $LV1<\{n134, n136, n138, n140, n142\}<HV1$

143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134
11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
23	24	13	14	15	16	17	18	19	20	21	22	23	24	13	14
35	36	25	26	27	28	29	30	31	32	33	34	35	36	25	26
47	48	37	38	39	40	41	42	43	44	45	46	47	48	37	38
59	60	49	50	51	52	53	54	55	56	57	58	59	60	49	50
71	72	61	62	63	64	65	66	67	68	69	70	71	72	61	62
83	84	73	74	75	76	77	78	79	80	81	82	83	84	73	74
95	96	85	86	87	88	89	90	91	92	93	94	95	96	85	86
107	108	97	98	99	100	101	102	103	104	105	106	107	108	97	98
119	120	109	110	111	112	113	114	115	116	117	118	119	120	109	110
131	132	121	122	123	124	125	126	127	128	129	130	131	132	121	122
143	144	133	134	135	136	137	138	139	140	141	142	143	144	133	134
11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2

For both columns on the two edges above,
 $n1+n12=n25+n36=n49+n60=n73+n87=n97+n108=n121+n132$;
 $n25=n1+n12-n36$; $0<n36<145$; --> $(n1+n12-145)<n25<(n1+n12)$;
 In the same way $(n1+n12-145)<n49<(n1+n12)$; $(n1+n12-145)<n73<(n1+n12)$;
 $(n1+n12-145)<n97<(n1+n12)$; $(n1+n12-145)<n121<(n1+n12)$;
 But $0<\{n25, n49, n73, n97, n121\}<145$
 If you define $LV3=n1+n12-145$; then put at the same time: $\text{if}(LV3<0)\text{then}\{LV3=0;\}$
 If you define $HV3=n1+n12$; then put at the same time: $\text{if}(HV3>145)\text{then}\{HV3=145;\}$
 It consequently means $LV3<\{n25, n49, n73, n97, n121\}<HV3$

You can also say: $LV3 < \{n36, n60, n87, n108, n132\} < HV3$

On the other hand,

$n133+n144=n13+n24=n37+n48=n61+n72=n85+n96=n109+n120$;

You can say: $(n133+n144-145) < n13 < (n133+n144)$; $(n133+n144-145) < n37 < (n133+n144)$;

$(n133+n144-145) < n61 < (n133+n144)$; $(n133+n144-145) < n85 < (n133+n144)$; ...

If you define $LV4=n133+n144-145$; then put at the same time: $\text{if}(LV4 < 0)\text{then}\{LV4=0;\}$

If you define $HV4=n133+n144$; then put at the same time: $\text{if}(HV4 > 145)\text{then}\{HV4=145;\}$

It means $LV4 < \{n13, n37, n61, n85, n109\} < HV4$

You can also say: $LV4 < \{n24, n48, n72, n96, n120\} < HV4$

2-2. New Program List for our 3-T Simultaneous Magic Squares 12x12

Let me show you my another Program List here, but only the most important part.

It positively uses the above limitations to the value range every critical variable should take. I am sure you can save your time and energy by these limitations.

```
/* Begin the Calculations */
/* Level 1: */
/* Set N1<n144 & n144=CSM-N1 */
void stp01(){
  short a,b;
  for(a=1;a<2;a++){b=CSM-a;          //Calculate only when N1==1
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[1]=a; nm[144]=b;
      uflg[a]=1; uflg[b]=1;
      stp02();
      uflg[b]=0; uflg[a]=0;}
  }
}
/* Set N12 & n133=CSM-N12 & N12>n133>N1 */
void stp02(){
  short a,b;
  for(a=144;a>72;a--){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)&&(b>nm[1])){
      nm[12]=a; nm[133]=b;
      uflg[a]=1; uflg[b]=1;
      if(nm[1]+nm[12]+nm[133]+nm[144]==QSM){stp03();}
      uflg[b]=0; uflg[a]=0;}
  }
}
/* Set both the Lowest Values and Highest ones for Critical Variables */
/* Set N2 & n143=CSM-N2 */
void stp03(){
  short a,b;
  LV1=nm[1]+nm[133]-145;  if(LV1<0){LV1=0;}
  HV1=nm[1]+nm[133];     if(HV1>145){HV1=145;}
  LV2=nm[12]+nm[144]-145; if(LV2<0){LV2=0;}
  HV2=nm[12]+nm[144];    if(HV2>145){HV2=145;}
  LV3=nm[1]+nm[12]-145;  if(LV3<0){LV3=0;}
  HV3=nm[1]+nm[12];      if(HV3>145){HV3=145;}
  LV4=nm[133]+nm[144]-145; if(LV4<0){LV4=0;}
  HV4=nm[133]+nm[144];   if(HV4>145){HV4=145;}
  /**/
  for(a=HV2-1;a>LV2;a--){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[2]=a; nm[143]=b;
      uflg[a]=1; uflg[b]=1;
      stp04();
      uflg[b]=0; uflg[a]=0;}
  }
}
```

```

}
/* Set n11=QSM-n12-n143-n144 & n134=CSM-n11 */
void stp04(){
short a,b;
a=QSM-nm[12]-nm[143]-nm[144];
b=QSM-nm[133]-nm[2]-nm[1];
if((LV1<a)&&(a<HV1)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[11]=a; nm[134]=b;
uflg[a]=1; uflg[b]=1;
stp05();
uflg[b]=0; uflg[a]=0;}}
}
/* Set N3 & n142=CSM-N3 */
void stp05(){
short a,b;
for(a=LV1+1;a<HV1;a++){b=CSM-a;
if((uflg[a]==0)&&(uflg[b]==0)){
nm[3]=a; nm[142]=b;
uflg[a]=1; uflg[b]=1;
stp06();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set n10=QSM-n11-n142-n143 & n135=CSM-n10 */
void stp06(){
short a,b;
a=QSM-nm[11]-nm[142]-nm[143];
b=QSM-nm[134]-nm[3]-nm[2];
if((LV2<a)&&(a<HV2)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[10]=a; nm[135]=b;
uflg[a]=1; uflg[b]=1;
stp07();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set N4 & n141=CSM-N4 */
void stp07(){
short a,b;
for(a=HV2-1;a>LV2;a--){b=CSM-a;
if((uflg[a]==0)&&(uflg[b]==0)){
nm[4]=a; nm[141]=b;
uflg[a]=1; uflg[b]=1;
stp08();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set n9=QSM-n10-n141-n142 & n136=CSM-n9 */
void stp08(){
short a,b;
a=QSM-nm[10]-nm[141]-nm[142];
b=QSM-nm[135]-nm[4]-nm[3];
if((LV1<a)&&(a<HV1)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[9]=a; nm[136]=b;
uflg[a]=1; uflg[b]=1;
stp09();
uflg[b]=0; uflg[a]=0;}}
}
}
/* Set N5 & n140=CSM-N5 */

```

```

void stp09(){
  short a,b;
  for(a=LV1+1;a<HV1;a++){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[5]=a; nm[140]=b;
      uflg[a]=1; uflg[b]=1;
      stp10();
      uflg[b]=0; uflg[a]=0;}
  }
}
/* Set n8=QSM-n9-n140-n141 & n137=CSM-n8 */
void stp10(){
  short a,b;
  a=QSM-nm[9]-nm[140]-nm[141];
  b=QSM-nm[136]-nm[5]-nm[4];
  if((LV2<a)&&(a<HV2)&&(a+b==CSM)){
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[8]=a; nm[137]=b;
      uflg[a]=1; uflg[b]=1;
      stp11();
      uflg[b]=0; uflg[a]=0;}}
}
/* Set n6=HSM-n1-n2-n3-n4-n5 & n139=CSM-n6 */
void stp11(){
  short a,b;
  a=HSM-nm[1]-nm[2]-nm[3]-nm[4]-nm[5];
  b=HSM-nm[144]-nm[143]-nm[142]-nm[141]-nm[140];
  if((LV2<a)&&(a<HV2)&&(a+b==CSM)){
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[6]=a; nm[139]=b;
      uflg[a]=1; uflg[b]=1;
      stp12();
      uflg[b]=0; uflg[a]=0;}}
}
/* Set n7=QSM-n8-n139-n140 & n138=CSM-n7 */
void stp12(){
  short a,b,c;
  a=QSM-nm[8]-nm[139]-nm[140];
  b=QSM-nm[137]-nm[6]-nm[5];
  c=LSM-nm[1]-nm[2]-nm[3]-nm[4]-nm[5]-nm[6]-nm[8]-nm[9]-nm[10]-nm[11]-nm[12];
  if((LV1<a)&&(a<HV1)&&(a+b==CSM)){
    if((a==c)&&(uflg[a]==0)&&(uflg[b]==0)){
      nm[7]=a; nm[138]=b;
      uflg[a]=1; uflg[b]=1;
      if(nm[6]+nm[7]+nm[138]+nm[139]==QSM){stp13();}
      uflg[b]=0; uflg[a]=0;}}
}
/* Level 2: */
/* Set N13 & n132=CSM-N13 */
void stp13(){
  short a,b;
  for(a=HV4-1;a>LV4;a--){b=CSM-a;
    if((uflg[a]==0)&&(uflg[b]==0)){
      nm[13]=a; nm[132]=b;
      uflg[a]=1; uflg[b]=1;
      stp14();
      uflg[b]=0; uflg[a]=0;}
  }
}
/* Set n14=QSM-n1-n2-n13 & n131=CSM-n14 */

```

```

void stp14(){
short a,b;
a=QSM-nm[1]-nm[2]-nm[13];
b=QSM-nm[144]-nm[143]-nm[132];
if((0<a)&&(a<145)&&(a+b==CSM)){
if((uflg[a]==0)&&(uflg[b]==0)){
nm[14]=a; nm[131]=b;
uflg[a]=1; uflg[b]=1;
stp15();
uflg[b]=0; uflg[a]=0;}}
}
/* ..(skip).. */

```

2-3. Result List of my recent Calculations

I am glad I can give you my final report of building our object solutions.
I could count all the Standard Solutions as many as 100800 when n1=1.
Let me show you the list of my recent calculations as follows, but only a part.

```

** Three-Type Simultaneous Magic Squares of Order 12: **
** 'Composite', Self-complementary and Pan-diagonal **
** Standard Set of Solutions with n1=1 (Part) **

```

```

0/ (n1, n12)=(1, 143):    0/ (n1, n12)=(1, 142):    0/ (n1, n12)=(1, 141):
0/ (n1, n12)=(1, 140):    0/ (n1, n12)=(1, 139):    0/ (n1, n12)=(1, 138):
0/ (n1, n12)=(1, 137):    0/ (n1, n12)=(1, 136):    0/ (n1, n12)=(1, 135):
0/ (n1, n12)=(1, 134):    0/ (n1, n12)=(1, 133):

      1/
1 143  3 141  7 140  8 139  9 135  11 133  1 143  7 141  3 140  8 135  9 139  11 133
132 14 130 16 126 17 125 18 124 22 122 24 132 14 126 16 130 17 125 22 124 18 122 24
97 47 99 45 103 44 104 43 105 39 107 37 97 47 103 45 99 44 104 39 105 43 107 37
36 110 34 112 30 113 29 114 28 118 26 120 36 110 30 112 34 113 29 118 28 114 26 120
85 59 87 57 91 56 92 55 93 51 95 49 85 59 91 57 87 56 92 51 93 55 95 49
84 62 82 64 78 65 77 66 76 70 74 72 84 62 78 64 82 65 77 70 76 66 74 72
73 71 75 69 79 68 80 67 81 63 83 61 73 71 79 69 75 68 80 63 81 67 83 61
96 50 94 52 90 53 89 54 88 58 86 60 96 50 90 52 94 53 89 58 88 54 86 60
25 119 27 117 31 116 32 115 33 111 35 109 25 119 31 117 27 116 32 111 33 115 35 109
108 38 106 40 102 41 101 42 100 46 98 48 108 38 102 40 106 41 101 46 100 42 98 48
121 23 123 21 127 20 128 19 129 15 131 13 121 23 127 21 123 20 128 15 129 19 131 13
12 134 10 136 6 137 5 138 4 142 2 144 12 134 6 136 10 137 5 142 4 138 2 144

      1441/
1 143  8 141  3 139  7 135  9 140  11 133  1 143  9 140  3 139  7 135  8 141  11 133
132 14 125 16 130 18 126 22 124 17 122 24 132 14 124 17 130 18 126 22 125 16 122 24
97 47 104 45 99 43 103 39 105 44 107 37 97 47 105 44 99 43 103 39 104 45 107 37
36 110 29 112 34 114 30 118 28 113 26 120 36 110 28 113 34 114 30 118 29 112 26 120
85 59 92 57 87 55 91 51 93 56 95 49 85 59 93 56 87 55 91 51 92 57 95 49
84 62 77 64 82 66 78 70 76 65 74 72 84 62 76 65 82 66 78 70 77 64 74 72
73 71 80 69 75 67 79 63 81 68 83 61 73 71 81 68 75 67 79 63 80 69 83 61
96 50 89 52 94 54 90 58 88 53 86 60 96 50 88 53 94 54 90 58 89 52 86 60
25 119 32 117 27 115 31 111 33 116 35 109 25 119 33 116 27 115 31 111 32 117 35 109
108 38 101 40 106 42 102 46 100 41 98 48 108 38 100 41 106 42 102 46 101 40 98 48
121 23 128 21 123 19 127 15 129 20 131 13 121 23 129 20 123 19 127 15 128 21 131 13
12 134 5 136 10 138 6 142 4 137 2 144 12 134 4 137 10 138 6 142 5 136 2 144

      2881/
1 141  3 143  7 140  8 139  11 135  9 133  1 141  7 143  3 140  8 135  11 139  9 133
132 16 130 14 126 17 125 18 122 22 124 24 132 16 126 14 130 17 125 22 122 18 124 24
97 45 99 47 103 44 104 43 107 39 105 37 97 45 103 47 99 44 104 39 107 43 105 37
36 112 34 110 30 113 29 114 26 118 28 120 36 112 30 110 34 113 29 118 26 114 28 120
85 57 87 59 91 56 92 55 95 51 93 49 85 57 91 59 87 56 92 51 95 55 93 49
84 64 82 62 78 65 77 66 74 70 76 72 84 64 78 62 82 65 77 70 74 66 76 72
73 69 75 71 79 68 80 67 83 63 81 61 73 69 79 71 75 68 80 63 83 67 81 61
96 52 94 50 90 53 89 54 86 58 88 60 96 52 90 50 94 53 89 58 86 54 88 60
25 117 27 119 31 116 32 115 35 111 33 109 25 117 31 119 27 116 32 111 35 115 33 109
108 40 106 38 102 41 101 42 98 46 100 48 108 40 102 38 106 41 101 46 98 42 100 48
121 21 123 23 127 20 128 19 131 15 129 13 121 21 127 23 123 20 128 15 131 19 129 13
12 136 10 134 6 137 5 138 2 142 4 144 12 136 6 134 10 137 5 142 2 138 4 144

```

4321/ 5041/

1 141 8 143 3 139 7 135 11 140 9 133	1 141 11 140 3 139 7 135 8 143 9 133
132 16 125 14 130 18 126 22 122 17 124 24	132 16 122 17 130 18 126 22 125 14 124 24
97 45 104 47 99 43 103 39 107 44 105 37	97 45 107 44 99 43 103 39 104 47 105 37
36 112 29 110 34 114 30 118 26 113 28 120	36 112 26 113 34 114 30 118 29 110 28 120
85 57 92 59 87 55 91 51 95 56 93 49	85 57 95 56 87 55 91 51 92 59 93 49
84 64 77 62 82 66 78 70 74 65 76 72	84 64 74 65 82 66 78 70 77 62 76 72
73 69 80 71 75 67 79 63 83 68 81 61	73 69 83 68 75 67 79 63 80 71 81 61
96 52 89 50 94 54 90 58 86 53 88 60	96 52 86 53 94 54 90 58 89 50 88 60
25 117 32 119 27 115 31 111 35 116 33 109	25 117 35 116 27 115 31 111 32 119 33 109
108 40 101 38 106 42 102 46 98 41 100 48	108 40 98 41 106 42 102 46 101 38 100 48
121 21 128 23 123 19 127 15 131 20 129 13	121 21 131 20 123 19 127 15 128 23 129 13
12 136 5 134 10 138 6 142 2 137 4 144	12 136 2 137 10 138 6 142 5 134 4 144

5761/ 8641/

1 140 3 143 7 141 9 139 11 135 8 133	1 139 3 143 8 141 9 140 11 135 7 133
132 17 130 14 126 16 124 18 122 22 125 24	132 18 130 14 125 16 124 17 122 22 126 24
97 44 99 47 103 45 105 43 107 39 104 37	97 43 99 47 104 45 105 44 107 39 103 37
36 113 34 110 30 112 28 114 26 118 29 120	36 114 34 110 29 112 28 113 26 118 30 120
85 56 87 59 91 57 93 55 95 51 92 49	85 55 87 59 92 57 93 56 95 51 91 49
84 65 82 62 78 64 76 66 74 70 77 72	84 66 82 62 77 64 76 65 74 70 78 72
73 68 75 71 79 69 81 67 83 63 80 61	73 67 75 71 80 69 81 68 83 63 79 61
96 53 94 50 90 52 88 54 86 58 89 60	96 54 94 50 89 52 88 53 86 58 90 60
25 116 27 119 31 117 33 115 35 111 32 109	25 115 27 119 32 117 33 116 35 111 31 109
108 41 106 38 102 40 100 42 98 46 101 48	108 42 106 38 101 40 100 41 98 46 102 48
121 20 123 23 127 21 129 19 131 15 128 13	121 19 123 23 128 21 129 20 131 15 127 13
12 137 10 134 6 136 4 138 2 142 5 144	12 138 10 134 5 136 4 137 2 142 6 144

11521/

1 135 7 143 8 141 9 140 11 139 3 133
132 22 126 14 125 16 124 17 122 18 130 24
97 39 103 47 104 45 105 44 107 43 99 37
36 118 30 110 29 112 28 113 26 114 34 120
85 51 91 59 92 57 93 56 95 55 87 49
84 70 78 62 77 64 76 65 74 66 82 72
73 63 79 71 80 69 81 68 83 67 75 61
96 58 90 50 89 52 88 53 86 54 94 60
25 111 31 119 32 117 33 116 35 115 27 109
108 46 102 38 101 40 100 41 98 42 106 48
121 15 127 23 128 21 129 20 131 19 123 13
12 142 6 134 5 136 4 137 2 138 10 144

14400/ (n1, n12)=(1, 132):	14400/ (n1, n12)=(1, 131):	14400/ (n1, n12)=(1, 130):
14400/ (n1, n12)=(1, 129):	14400/ (n1, n12)=(1, 128):	14400/ (n1, n12)=(1, 127):
14400/ (n1, n12)=(1, 126):	14400/ (n1, n12)=(1, 125):	14400/ (n1, n12)=(1, 124):
14400/ (n1, n12)=(1, 123):	14400/ (n1, n12)=(1, 122):	14400/ (n1, n12)=(1, 121):
14400/ (n1, n12)=(1, 120):	14400/ (n1, n12)=(1, 119):	14400/ (n1, n12)=(1, 118):
14400/ (n1, n12)=(1, 117):		

14401/ 17281/

1 143 3 141 15 132 16 131 25 119 27 117	1 141 3 143 15 132 16 131 27 119 25 117
140 6 138 8 126 17 125 18 116 30 114 32	140 8 138 6 126 17 125 18 114 30 116 32
81 63 83 61 95 52 96 51 105 39 107 37	81 61 83 63 95 52 96 51 107 39 105 37
36 110 34 112 22 121 21 122 12 134 10 136	36 112 34 110 22 121 21 122 10 134 12 136
77 67 79 65 91 56 92 55 101 43 103 41	77 65 79 67 91 56 92 55 103 43 101 41
100 46 98 48 86 57 85 58 76 70 74 72	100 48 98 46 86 57 85 58 74 70 76 72
73 71 75 69 87 60 88 59 97 47 99 45	73 69 75 71 87 60 88 59 99 47 97 45
104 42 102 44 90 53 89 54 80 66 78 68	104 44 102 42 90 53 89 54 78 66 80 68
9 135 11 133 23 124 24 123 33 111 35 109	9 133 11 135 23 124 24 123 35 111 33 109
108 38 106 40 94 49 93 50 84 62 82 64	108 40 106 38 94 49 93 50 82 62 84 64
113 31 115 29 127 20 128 19 137 7 139 5	113 29 115 31 127 20 128 19 139 7 137 5
28 118 26 120 14 129 13 130 4 142 2 144	28 120 26 118 14 129 13 130 2 142 4 144

20161/ 23041/

1 132 3 143 15 141 25 131 27 119 16 117	1 131 3 143 16 141 25 132 27 119 15 117
140 17 138 6 126 8 116 18 114 30 125 32	140 18 138 6 125 8 116 17 114 30 126 32
81 52 83 63 95 61 105 51 107 39 96 37	81 51 83 63 96 61 105 52 107 39 95 37
36 121 34 110 22 112 12 122 10 134 21 136	36 122 34 110 21 112 12 121 10 134 22 136
77 56 79 67 91 65 101 55 103 43 92 41	77 55 79 67 92 65 101 56 103 43 91 41
100 57 98 46 86 48 76 58 74 70 85 72	100 58 98 46 85 48 76 57 74 70 86 72
73 60 75 71 87 69 97 59 99 47 88 45	73 59 75 71 88 69 97 60 99 47 87 45
104 53 102 42 90 44 80 54 78 66 89 68	104 54 102 42 89 44 80 53 78 66 90 68
9 124 11 135 23 133 33 123 35 111 24 109	9 123 11 135 24 133 33 124 35 111 23 109
108 49 106 38 94 40 84 50 82 62 93 64	108 50 106 38 93 40 84 49 82 62 94 64

113 20 115 31 127 29 137 19 139 7 128 5 113 19 115 31 128 29 137 20 139 7 127 5
28 129 26 118 14 120 4 130 2 142 13 144 28 130 26 118 13 120 4 129 2 142 14 144

25921/
1 119 15 143 16 141 25 132 27 131 3 117
140 30 126 6 125 8 116 17 114 18 138 32
81 39 95 63 96 61 105 52 107 51 83 37
36 134 22 110 21 112 12 121 10 122 34 136
77 43 91 67 92 65 101 56 103 55 79 41
100 70 86 46 85 48 76 57 74 58 98 72
73 47 87 71 88 69 97 60 99 59 75 45
104 66 90 42 89 44 80 53 78 54 102 68
9 111 23 135 24 133 33 124 35 123 11 109
108 62 94 38 93 40 84 49 82 50 106 64
113 7 127 31 128 29 137 20 139 19 115 5
28 142 14 118 13 120 4 129 2 130 26 144

28800/ (n1, n12)=(1, 116): 28800/ (n1, n12)=(1, 115):

28801/ 31681/
1 143 3 135 19 134 20 133 21 117 29 115 1 135 3 143 19 134 20 133 29 117 21 115
141 5 139 13 123 14 122 15 121 31 113 33 141 13 139 5 123 14 122 15 113 31 121 33
79 65 81 57 97 56 98 55 99 39 107 37 79 57 81 65 97 56 98 55 107 39 99 37
36 110 34 118 18 119 17 120 16 136 8 138 36 118 34 110 18 119 17 120 8 136 16 138
76 68 78 60 94 59 95 58 96 42 104 40 76 60 78 68 94 59 95 58 104 42 96 40
102 44 100 52 84 53 83 54 82 70 74 72 102 52 100 44 84 53 83 54 74 70 82 72
73 71 75 63 91 62 92 61 93 45 101 43 73 63 75 71 91 62 92 61 101 45 93 43
105 41 103 49 87 50 86 51 85 67 77 69 105 49 103 41 87 50 86 51 77 67 85 69
7 137 9 129 25 128 26 127 27 111 35 109 7 129 9 137 25 128 26 127 35 111 27 109
108 38 106 46 90 47 89 48 88 64 80 66 108 46 106 38 90 47 89 48 80 64 88 66
112 32 114 24 130 23 131 22 132 6 140 4 112 24 114 32 130 23 131 22 140 6 132 4
30 116 28 124 12 125 11 126 10 142 2 144 30 124 28 116 12 125 11 126 2 142 10 144

34561/ 37441/
1 134 3 143 19 135 21 133 29 117 20 115 1 133 3 143 20 135 21 134 29 117 19 115
141 14 139 5 123 13 121 15 113 31 122 33 141 15 139 5 122 13 121 14 113 31 123 33
79 56 81 65 97 57 99 55 107 39 98 37 79 55 81 65 98 57 99 56 107 39 97 37
36 119 34 110 18 118 16 120 8 136 17 138 36 120 34 110 17 118 16 119 8 136 18 138
76 59 78 68 94 60 96 58 104 42 95 40 76 58 78 68 95 60 96 59 104 42 94 40
102 53 100 44 84 52 82 54 74 70 83 72 102 54 100 44 83 52 82 53 74 70 84 72
73 62 75 71 91 63 93 61 101 45 92 43 73 61 75 71 92 63 93 62 101 45 91 43
105 50 103 41 87 49 85 51 77 67 86 69 105 51 103 41 86 49 85 50 77 67 87 69
7 128 9 137 25 129 27 127 35 111 26 109 7 127 9 137 26 129 27 128 35 111 25 109
108 47 106 38 90 46 88 48 80 64 89 66 108 48 106 38 89 46 88 47 80 64 90 66
112 23 114 32 130 24 132 22 140 6 131 4 112 22 114 32 131 24 132 23 140 6 130 4
30 125 28 116 12 124 10 126 2 142 11 144 30 126 28 116 11 124 10 125 2 142 12 144

40321/
1 117 19 143 20 135 21 134 29 133 3 115
141 31 123 5 122 13 121 14 113 15 139 33
79 39 97 65 98 57 99 56 107 55 81 37
36 136 18 110 17 118 16 119 8 120 34 138
76 42 94 68 95 60 96 59 104 58 78 40
102 70 84 44 83 52 82 53 74 54 100 72
73 45 91 71 92 63 93 62 101 61 75 43
105 67 87 41 86 49 85 50 77 51 103 69
7 111 25 137 26 129 27 128 35 127 9 109
108 64 90 38 89 46 88 47 80 48 106 66
112 6 130 32 131 24 132 23 140 22 114 4
30 142 12 116 11 124 10 125 2 126 28 144

43200/ (n1, n12)=(1, 114): 43200/ (n1, n12)=(1, 113): 43200/ (n1, n12)=(1, 112):
43200/ (n1, n12)=(1, 111):

43201/ 46081/
1 141 7 135 19 132 22 129 25 117 31 111 1 135 7 141 19 132 22 129 31 117 25 111
143 5 137 11 125 14 122 17 119 29 113 35 143 11 137 5 125 14 122 17 113 29 119 35
75 67 81 61 93 58 96 55 99 43 105 37 75 61 81 67 93 58 96 55 105 43 99 37
36 112 30 118 18 121 15 124 12 136 6 142 36 118 30 112 18 121 15 124 6 136 12 142
74 68 80 62 92 59 95 56 98 44 104 38 74 62 80 68 92 59 95 56 104 44 98 38
106 42 100 48 88 51 85 54 82 66 76 72 106 48 100 42 88 51 85 54 76 66 82 72
73 69 79 63 91 60 94 57 97 45 103 39 73 63 79 69 91 60 94 57 103 45 97 39
107 41 101 47 89 50 86 53 83 65 77 71 107 47 101 41 89 50 86 53 77 65 83 71
3 139 9 133 21 130 24 127 27 115 33 109 3 133 9 139 21 130 24 127 33 115 27 109
108 40 102 46 90 49 87 52 84 64 78 70 108 46 102 40 90 49 87 52 78 64 84 70

110 32 116 26 128 23 131 20 134 8 140 2 110 26 116 32 128 23 131 20 140 8 134 2
 34 114 28 120 16 123 13 126 10 138 4 144 34 120 28 114 16 123 13 126 4 138 10 144

48961/

51841/

1 132 7 141 19 135 25 129 31 117 22 111 1 129 7 141 22 135 25 132 31 117 19 111
 143 14 137 5 125 11 119 17 113 29 122 35 143 17 137 5 122 11 119 14 113 29 125 35
 75 58 81 67 93 61 99 55 105 43 96 37 75 55 81 67 96 61 99 58 105 43 93 37
 36 121 30 112 18 118 12 124 6 136 15 142 36 124 30 112 15 118 12 121 6 136 18 142
 74 59 80 68 92 62 98 56 104 44 95 38 74 56 80 68 95 62 98 59 104 44 92 38
 106 51 100 42 88 48 82 54 76 66 85 72 106 54 100 42 85 48 82 51 76 66 88 72
 73 60 79 69 91 63 97 57 103 45 94 39 73 57 79 69 94 63 97 60 103 45 91 39
 107 50 101 41 89 47 87 53 77 65 86 71 107 53 101 41 86 47 83 50 77 65 89 71
 3 130 9 139 21 133 27 127 33 115 24 109 3 127 9 139 24 133 27 130 33 115 21 109
 108 49 102 40 90 46 84 52 78 64 87 70 108 52 102 40 87 46 84 49 78 64 90 70
 110 23 116 32 128 26 134 20 140 8 131 2 110 20 116 32 131 26 134 23 140 8 128 2
 34 123 28 114 16 120 10 126 4 138 13 144 34 126 28 114 13 120 10 123 4 138 16 144

54721/

1 117 19 141 22 135 25 132 31 129 7 111
 143 29 125 5 122 11 119 14 113 17 137 35
 75 43 93 67 96 61 99 58 105 55 81 37
 36 136 18 112 15 118 12 121 6 124 30 142
 74 44 92 68 95 62 98 59 104 56 80 38
 106 66 88 42 85 48 82 51 76 54 100 72
 73 45 91 69 94 63 97 60 103 57 79 39
 107 65 89 41 86 47 83 50 77 53 101 71
 3 115 21 139 24 133 27 130 33 127 9 109
 108 64 90 40 87 46 84 49 78 52 102 70
 110 8 128 32 131 26 134 23 140 20 116 2
 34 138 16 114 13 120 10 123 4 126 28 144

57600/ (n1, n12)=(1, 110): 57600/ (n1, n12)=(1, 109):

57601/

60481/

1 143 3 141 19 128 20 127 33 111 35 109 1 141 3 143 19 128 20 127 35 111 33 109
 140 6 138 8 122 21 121 22 108 38 106 40 140 8 138 6 122 21 121 22 106 38 108 40
 97 47 99 45 115 32 116 31 129 15 131 13 97 45 99 47 115 32 116 31 131 15 129 13
 44 102 42 104 26 117 25 118 12 134 10 136 44 104 42 102 26 117 25 118 10 134 12 136
 61 83 63 81 79 68 80 67 93 51 95 49 61 81 63 83 79 68 80 67 95 51 93 49
 92 54 90 56 74 69 73 70 60 86 58 88 92 56 90 54 74 69 73 70 58 86 60 88
 57 87 59 85 75 72 76 71 89 55 91 53 57 85 59 87 75 72 76 71 91 55 89 53
 96 50 94 52 78 65 77 66 64 82 62 84 96 52 94 50 78 65 77 66 62 82 64 84
 9 135 11 133 27 120 28 119 41 103 43 101 9 133 11 135 27 120 28 119 43 103 41 101
 132 14 130 16 114 29 113 30 100 46 98 48 132 16 130 14 114 29 113 30 98 46 100 48
 105 39 107 37 123 24 124 23 137 7 139 5 105 37 107 39 123 24 124 23 139 7 137 5
 36 110 34 112 18 125 17 126 4 142 2 144 36 112 34 110 18 125 17 126 2 142 4 144

63361/

66241/

1 128 3 143 19 141 33 127 35 111 20 109 1 127 3 143 20 141 33 128 35 111 19 109
 140 21 138 6 122 8 108 22 106 38 121 40 140 22 138 6 121 8 108 21 106 38 122 40
 97 32 99 47 115 45 129 31 131 15 116 13 97 31 99 47 116 45 129 32 131 15 115 13
 44 117 42 102 26 104 12 118 10 134 25 136 44 118 42 102 25 104 12 117 10 134 26 136
 61 68 63 83 79 81 93 67 95 51 80 49 61 67 63 83 80 81 93 68 95 51 79 49
 92 69 90 54 74 56 60 70 58 86 73 88 92 70 90 54 73 56 60 69 58 86 74 88
 57 72 59 87 75 85 89 71 91 55 76 53 57 71 59 87 76 85 89 72 91 55 75 53
 96 65 94 50 78 52 64 66 62 82 77 84 96 66 94 50 77 52 64 65 62 82 78 84
 9 120 11 135 27 133 41 119 43 103 28 101 9 119 11 135 28 133 41 120 43 103 27 101
 132 29 130 14 114 16 100 30 98 46 113 48 132 30 130 14 113 16 100 29 98 46 114 48
 105 24 107 39 123 37 137 23 139 7 124 5 105 23 107 39 124 37 137 24 139 7 123 5
 36 125 34 110 18 112 4 126 2 142 17 144 36 126 34 110 17 112 4 125 2 142 18 144

69121/

1 111 19 143 20 141 33 128 35 127 3 109
 140 38 122 6 121 8 108 21 106 22 138 40
 97 15 115 47 116 45 129 32 131 31 99 13
 44 134 26 102 25 104 12 117 10 118 42 136
 61 51 79 83 80 81 93 68 95 67 63 49
 92 86 74 54 73 56 60 69 58 70 90 88
 57 55 75 87 76 85 89 72 91 71 59 53
 96 82 78 50 77 52 64 65 62 66 94 84
 9 103 27 135 28 133 41 120 43 119 11 101
 132 46 114 14 113 16 100 29 98 30 130 48
 105 7 123 39 124 37 137 24 139 23 107 5
 36 142 18 110 17 112 4 125 2 126 34 144

72000/ (n1, n12)=(1, 108): 72000/ (n1, n12)=(1, 107): 72000/ (n1, n12)=(1, 106):

72001/ 74881/

1 143 3 132 25 131 26 130 27 108 38 106	1 132 3 143 25 131 26 130 38 108 27 106
141 5 139 16 117 17 116 18 115 40 104 42	141 16 139 5 117 17 116 18 104 40 115 42
97 47 99 36 121 35 122 34 123 12 134 10	97 36 99 47 121 35 122 34 134 12 123 10
45 101 43 112 21 113 20 114 19 136 8 138	45 112 43 101 21 113 20 114 8 136 19 138
58 86 60 75 82 74 83 73 84 51 95 49	58 75 60 86 82 74 83 73 95 51 84 49
93 53 91 64 69 65 68 66 67 88 56 90	93 64 91 53 69 65 68 66 56 88 67 90
55 89 57 78 79 77 80 76 81 54 92 52	55 78 57 89 79 77 80 76 92 54 81 52
96 50 94 61 72 62 71 63 70 85 59 87	96 61 94 50 72 62 71 63 59 85 70 87
7 137 9 126 31 125 32 124 33 102 44 100	7 126 9 137 31 125 32 124 44 102 33 100
135 11 133 22 111 23 110 24 109 46 98 48	135 22 133 11 111 23 110 24 98 46 109 48
103 41 105 30 127 29 128 28 129 6 140 4	103 30 105 41 127 29 128 28 140 6 129 4
39 107 37 118 15 119 14 120 13 142 2 144	39 118 37 107 15 119 14 120 2 142 13 144

77761/ 80641/

1 131 3 143 25 132 27 130 38 108 26 106	1 130 3 143 26 132 27 131 38 108 25 106
141 17 139 5 117 16 115 18 104 40 116 42	141 18 139 5 116 16 115 17 104 40 117 42
97 35 99 47 121 36 123 34 134 12 122 10	97 34 99 47 122 36 123 35 134 12 121 10
45 113 43 101 21 112 19 114 8 136 20 138	45 114 43 101 20 112 19 113 8 136 21 138
58 74 60 86 82 75 84 73 95 51 83 49	58 73 60 86 83 75 84 74 95 51 82 49
93 65 91 53 69 64 67 66 56 88 68 90	93 66 91 53 68 64 67 65 56 88 69 90
55 77 57 89 79 78 81 76 92 54 80 52	55 76 57 89 80 78 81 77 92 54 79 52
96 62 94 50 72 61 70 63 59 85 71 87	96 63 94 50 71 61 70 62 59 85 72 87
7 125 9 137 31 126 33 124 44 102 32 100	7 124 9 137 32 126 33 125 44 102 31 100
135 23 133 11 111 22 109 24 98 46 110 48	135 24 133 11 110 22 109 23 98 46 111 48
103 29 105 41 127 30 129 28 140 6 128 4	103 28 105 41 128 30 129 29 140 6 127 4
39 119 37 107 15 118 13 120 2 142 14 144	39 120 37 107 14 118 13 119 2 142 15 144

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1 108 25 143 26 132 27 131 38 130 3 106
141 40 117 5 116 16 115 17 104 18 139 42
97 12 121 47 122 36 123 35 134 34 99 10
45 136 21 101 20 112 19 113 8 114 43 138
58 51 82 86 83 75 84 74 95 73 60 49
93 88 69 53 68 64 67 65 56 66 91 90
55 54 79 89 80 78 81 77 92 76 57 52
96 85 72 50 71 61 70 62 59 63 94 87
7 102 31 137 32 126 33 125 44 124 9 100
135 46 111 11 110 22 109 23 98 24 133 48
103 6 127 41 128 30 129 29 140 28 105 4
39 142 15 107 14 118 13 119 2 120 37 144

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86400/ (n1, n12)=(1, 102): 86400/ (n1, n12)=(1, 101): 86400/ (n1, n12)=(1, 100):

86401/ 89281/

1 140 9 132 25 128 29 124 33 108 41 100	1 132 9 140 25 128 29 124 41 108 33 100
143 6 135 14 119 18 115 22 111 38 103 46	143 14 135 6 119 18 115 22 103 38 111 46
97 44 105 36 121 32 125 28 129 12 137 4	97 36 105 44 121 32 125 28 137 12 129 4
47 102 39 110 23 114 19 118 15 134 7 142	47 110 39 102 23 114 19 118 7 134 15 142
52 89 60 81 76 77 80 73 84 57 92 49	52 81 60 89 76 77 80 73 92 57 84 49
95 54 87 62 71 66 67 70 63 86 55 94	95 62 87 54 71 66 67 70 55 86 63 94
51 90 59 82 75 78 79 74 83 58 91 50	51 82 59 90 75 78 79 74 91 58 83 50
96 53 88 61 72 65 68 69 64 85 56 93	96 61 88 53 72 65 68 69 56 85 64 93
3 138 11 130 27 126 31 122 35 106 43 98	3 130 11 138 27 126 31 122 43 106 35 98
141 8 133 16 117 20 113 24 109 40 101 48	141 16 133 8 117 20 113 24 101 40 109 48
99 42 107 34 123 30 127 26 131 10 139 2	99 34 107 42 123 30 127 26 139 10 131 2
45 104 37 112 21 116 17 120 13 136 5 144	45 112 37 104 21 116 17 120 5 136 13 144

92161/ 95041/

1 128 9 140 25 132 33 124 41 108 29 100	1 124 9 140 29 132 33 128 41 108 25 100
143 18 135 6 119 14 111 22 103 38 115 46	143 22 135 6 115 14 111 18 103 38 119 46
97 32 105 44 121 36 129 28 137 12 125 4	97 28 105 44 125 36 129 32 137 12 121 4
47 114 39 102 23 110 15 118 7 134 19 142	47 118 39 102 19 110 15 114 7 134 23 142
52 77 60 89 76 81 84 73 92 57 80 49	52 73 60 89 80 81 84 77 92 57 76 49
95 66 87 54 71 62 63 70 55 86 67 94	95 70 87 54 67 62 63 66 55 86 71 94
51 78 59 90 75 82 83 74 91 58 79 50	51 74 59 90 79 82 83 78 91 58 75 50
96 65 88 53 72 61 64 69 56 85 68 93	96 69 88 53 68 61 64 65 56 85 72 93
3 126 11 138 27 130 35 122 43 106 31 98	3 122 11 138 31 130 35 126 43 106 27 98
141 20 133 8 117 16 109 24 101 40 113 48	141 24 133 8 113 16 109 20 101 40 117 48
99 30 107 42 123 34 131 26 139 10 127 2	99 26 107 42 127 34 131 30 139 10 123 2
45 116 37 104 21 112 13 120 5 136 17 144	45 120 37 104 17 112 13 116 5 136 21 144

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1 108 25 140 29 132 33 128 41 124 9 100
143 38 119 6 115 14 111 18 103 22 135 46
97 12 121 44 125 36 129 32 137 28 105 4
47 134 23 102 19 110 15 114 7 118 39 142
52 57 76 89 80 81 84 77 92 73 60 49
95 86 71 54 67 62 63 66 55 70 87 94
51 58 75 90 79 82 83 78 91 74 59 50
96 85 72 53 68 61 64 65 56 69 88 93
3 106 27 138 31 130 35 126 43 122 11 98
141 40 117 8 113 16 109 20 101 24 133 48
99 10 123 42 127 34 131 30 139 26 107 2
45 136 21 104 17 112 13 116 5 120 37 144

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100800/ (n1, n12)=(1, 99): 100800/ (n1, n12)=(1, 98): 100800/ (n1, n12)=(1, 97):
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100800/ (n1, n12)=(1, 93): 100800/ (n1, n12)=(1, 92): 100800/ (n1, n12)=(1, 91):
100800/ (n1, n12)=(1, 90): 100800/ (n1, n12)=(1, 89): 100800/ (n1, n12)=(1, 88):
100800/ (n1, n12)=(1, 87): 100800/ (n1, n12)=(1, 86): 100800/ (n1, n12)=(1, 85):
100800/ (n1, n12)=(1, 84): 100800/ (n1, n12)=(1, 83): 100800/ (n1, n12)=(1, 82):
100800/ (n1, n12)=(1, 81): 100800/ (n1, n12)=(1, 80): 100800/ (n1, n12)=(1, 79):
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100800/ (n1, n12)=(1, 75): 100800/ (n1, n12)=(1, 74): 100800/ (n1, n12)=(1, 73):

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[Count of Solutions with n1=1: 100800]

100801/												103681/											
2 144	4 142	5 138	6 137	10 136	12 134	2 142	4 144	5 138	6 137	12 136	10 134												
131 13 129	15 128	19 127	20 123	21 121	23	131 15 129	13 128	19 127	20 121	21 123	23												
26 120	28 118	29 114	30 113	34 112	36 110	26 118	28 120	29 114	30 113	36 112	34 110												
107 37 105	39 104	43 103	44 99	45 97	47	107 39 105	37 104	43 103	44 97	45 99	47												
74 72 76	70 77	66 78	65 82	64 84	62	74 70 76	72 77	66 78	65 84	64 82	62												
95 49 93	51 92	55 91	56 87	57 85	59	95 51 93	49 92	55 91	56 85	57 87	59												
86 60 88	58 89	54 90	53 94	52 96	50	86 58 88	60 89	54 90	53 96	52 94	50												
83 61 81	63 80	67 79	68 75	69 73	71	83 63 81	61 80	67 79	68 73	69 75	71												
98 48 100	46 101	42 102	41 106	40 108	38	98 46 100	48 101	42 102	41 108	40 106	38												
35 109 33	111 32	115 31	116 27	117 25	119	35 111 33	109 32	115 31	116 25	117 27	119												
122 24 124	22 125	18 126	17 130	16 132	14	122 22 124	24 125	18 126	17 132	16 130	14												
11 133 9	135 8	139 7	140 3	141 1	143	11 135 9	133 8	139 7	140 1	141 3	143												
.																							

** Calculated and listed by Kanji Setsuda on January 31, 2010 **

List-forming Inequality Conditions are $n1=1$ and $n1 < n133 < n12$.

It took about several hours for me to print out those solutions.

Total Count of Standard Solutions including $n1 \geq 1$ should be 3628800. You can calculate it by the next equation: $100800 \times 2 \times 12 \times 12 / 8 = 3628800$.

No matter how big it might look, it must be really the rarest set of solutions.

#3. Conclusion

I am deeply impressed with the very compact structure of our object.

There are only 7 values possible for n12 to take: {133, 117, 115, 111, 109, 106 and 100} and 14400 solutions existing for each value for n12. You can divide 14400 into 2880×5 or $20 \times 12 \times 12 \times 5$. You can find the similar structures among the divided units.

But I do not yet know why they are made that way.

Anyhow I am very happy to have counted through and I can report about the total counts of standard solutions when $n1=1$.

For the last word, I must thank especially to Mr. Miguel Angel Amela in La Pampa, Argentine, who gave me nice e-mails many times to encourage me to my challenge. He also told me of his success in making the same type of Order 16 by himself.

(English Version written on March 6, 2010 by Kanji Setsuda with MacOSX & Xcode3.1.2)

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