

Chapter 5: Advanced Study of 'Prototype' Cubes: Kanji Setsuda

Section 2: Prototype Cubes of Order 4 and 'Composite' Pan-Magic Cubes of Order 4 Recomposed by 'DAMT'

#1. Prototype Cubes of Order 4 and 'Do-it-After-the-Model Transformation'

Let's study more about 'Prototype' cubes and 'Do-it-After-the-Model Transformation' by applying it actually to the various cases of magic cubes.

Let me take the 'Composite' type of Pan-magic Cubes of order 4 for our objects now and study about it in an entirely different style from the past.

* 'Composite' Pan-Magic Cube 4x4x4 *

<pre> 1-----17-----33-----49 2 18 34 50 5 3 21 19 37 35 53 51 6 4---22---20---38---36---54---52 9 7 25 23 41 39 57 55 10 8 26 24 42 40 58 56 13--11- --29--27- --45--43- --61 59 14 12 30 28 46 44 62 60 15 31 47 63 16-----32-----48-----64 n34+n35+n38+n39=K; n34+n35+n50+n51=K; n34+n38+n50+n54=K; n35+n39+n51+n55=K; n38+n39+n54+n55=K; n50+n51+n54+n55=K;</pre>	<pre> n1+n2+n5+n6=K; n1+n2+n17+n18=K; n1+n5+n17+n18=K; n2+n6+n18+n22=K; n5+n6+n21+n22=K; n17+n18+n21+n22=K; n7+n8+n11+n12=K; n7+n8+n23+n24=K; n7+n11+n23+n27=K; n8+n12+n24+n28=K; n11+n12+n27+n28=K; n23+n24+n27+n28=K;</pre>
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You may probably know well about this object, but let me explain a little here. Suppose any pan-triagonal cube has such imaginary small blocks in it as every 2x2 adjacent entries on each surface add up to the same sum, 'magic constant.'

Any 2x2 adjacent entries everywhere in this cube should always add up to 130. We would like to call "Composite" for this type of objects.

Although they are well known as "Compact" or "Most-perfect", especially in Europe, but I like the name 'Composite' best of all, for it was given by Prof. Mutsumi Suzuki long ago in his page with his beautiful picture of Japanese royal flower.

Of course, it is also a pan-magic cube, all of whose rows, columns, pillars and pan-triagonals should add up to the 'magic constant' 130 at the same time.

We know there are as many standard solutions as 6720 for these 'Composite' pan-magic cubes of order 4. The next list shows some example solutions of them.

Let's take those 6720 solutions for our objects at first and try to reconstruct them by our application 'Do-it-After-the-Model Transformation' and Prototype cubes.

* List of Example Solutions of 'Composite' Pan-magic Cubes of Order 4 *

<pre> 1/64 1-----48-----49-----32 63 18 15 34 60 4 21 45 12 52 37 29 6 62---43---19---54---14---27---35 13 57 36 24 61 9 20 40 51 7 30 42 3 55 46 26 56--16- --25--33--- 8--64---41 17 10 50 39 31 58 2 23 47 53 28 5 44 11-----38-----59-----22</pre>	<pre> 2/64 1-----56-----41-----32 63 10 23 34 60 4 13 53 20 44 37 29 6 62---51---11---46---22---27---35 21 57 36 16 61 17 12 40 43 7 30 50 3 47 54 26 48--24- --25--33--- 8--64---49 9 18 42 39 31 58 2 15 55 45 28 5 52 19-----38-----59-----14</pre>
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1-----48-----49-----32
|64      17      16      |33
60  3  21  46  12  51  37  30
| 5  62---44---19---53---14---28---35
13  58 | 36  23  61  10  20  39 |
|52  7  29  42  4  55  |45  26
56--15-|25--34--- 8--63---41  18 |
  9  50  40  31  57  2  24  47
    54 |    27      6      43 |
    11-----38-----59-----22

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1-----56-----41-----32
|64      9      24      |33
60  3  13  54  20  43  37  30
| 5  62---52---11---45---22---28---35
21  58 | 36  15  61  18  12  39 |
|44  7  29  50  4  47  |53  26
48--23-|25--34--- 8--63---49  10 |
  17  42  40  31  57  2  16  55
    46 |    27      6      51 |
    19-----38-----59-----14

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1-----48-----49-----32
|64      17      16      |33
60  2  21  47  12  50  37  31
| 5  63---44---18---53---15---28---34
13  59 | 36  22  61  11  20  38 |
|52  6  29  43  4  54  |45  27
56--14-|25--35--- 8--62---41  19 |
  9  51  40  30  57  3  24  46
    55 |    26      7      42 |
    10-----39-----58-----23

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1-----56-----41-----32
|64      9      24      |33
60  2  13  55  20  42  37  31
| 5  63---52---10---45---23---28---34
21  59 | 36  14  61  19  12  38 |
|44  6  29  51  4  46  |53  27
48--22-|25--35--- 8--62---49  11 |
  17  43  40  30  57  3  16  54
    47 |    26      7      50 |
    18-----39-----58-----15

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1-----56-----25-----48
|64      9      40      |17
62  2  11  55  38  26  19  47
| 3  63---54---10---27---39---46---18
  7  61 | 50  12  31  37  42  20 |
|58  4  15  53  34  28  |23  45
60-- 8-|13--49---36--32---21  41 |
  5  57  52  16  29  33  44  24
    59 |    14      35      22 |
    6-----51-----30-----43

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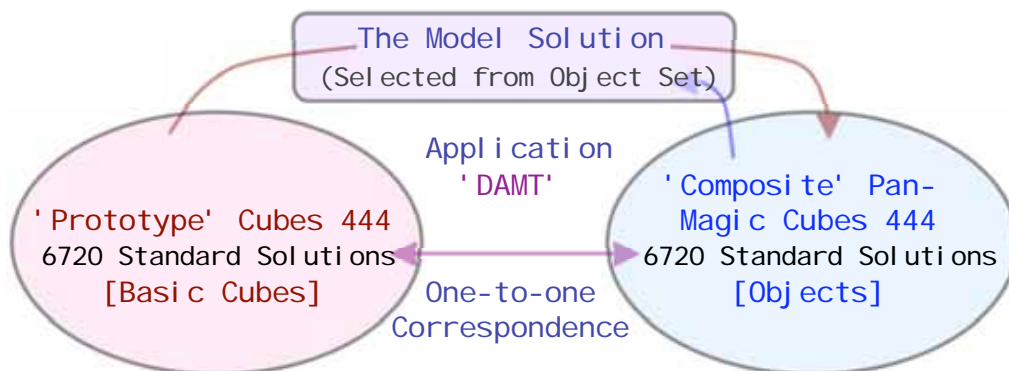
14/32

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1-----60-----21-----48
|64      5      44      |17
62  2  7  59  42  22  19  47
| 3  63---58--- 6---23---43---46---18
  11  61 | 50  8  31  41  38  20 |
|54  4  15  57  34  24  |27  45
56--12-|13--49---36--32---25  37 |
  9  53  52  16  29  33  40  28
    55 |    14      35      26 |
    10-----51-----30-----39

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* Conceptual Diagram for 'Do-it-After-the-Model Transformation' *



#2. 'Model' solution and the rules of 'DAM' Transformation

Let me pick up the next representative solution out of objects, assume it for our 'Model' and write the rules of 'Do-it- After-the-Model Transformation' as follows.

ProtoT/	/Model
1-----17-----33-----49	1-----48-----49-----32
2 18 34 50	63 18 15 34
5 3 21 19 37 35 53 51	60 4 21 45 12 52 37 29
6 4---22--20---38--36---54--52	6 62---43--19---54--14---27--35
9 7 25 23 41 39 57 55	13 57 36 24 61 9 20 40
10 8 26 24 42 40 58 56	51 7 30 42 3 55 46 26
13--11- -29--27---45--43---61 59	56--16- -25--33--- 8--64---41 17
14 12 30 28 46 44 62 60	10 50 39 31 58 2 23 47
15 31 47 63	53 28 5 44
16-----32-----48-----64	11-----38-----59-----22

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/**/
/* Rules of the 'Do-it-After-the-Model Transformation' */
void damt(){
    tnm[1]=nm[1];    tnm[2]=nm[63];    tnm[3]=nm[4];    tnm[4]=nm[62];
    tnm[5]=nm[60];   tnm[6]=nm[6];    tnm[7]=nm[57];   tnm[8]=nm[7];
    tnm[9]=nm[13];   tnm[10]=nm[51];  tnm[11]=nm[16];  tnm[12]=nm[50];
    tnm[13]=nm[56];  tnm[14]=nm[10];  tnm[15]=nm[53];  tnm[16]=nm[11];
    tnm[17]=nm[48];  tnm[18]=nm[18];  tnm[19]=nm[45];  tnm[20]=nm[19];
    tnm[21]=nm[21];  tnm[22]=nm[43];  tnm[23]=nm[24];  tnm[24]=nm[42];
    tnm[25]=nm[36];  tnm[26]=nm[30];  tnm[27]=nm[33];  tnm[28]=nm[31];
    tnm[29]=nm[25];  tnm[30]=nm[39];  tnm[31]=nm[28];  tnm[32]=nm[38];
    tnm[33]=nm[49];  tnm[34]=nm[15];  tnm[35]=nm[52];  tnm[36]=nm[14];
    tnm[37]=nm[12];  tnm[38]=nm[54];  tnm[39]=nm[9];   tnm[40]=nm[55];
    tnm[41]=nm[61];  tnm[42]=nm[3];   tnm[43]=nm[64];  tnm[44]=nm[2];
    tnm[45]=nm[8];   tnm[46]=nm[58];  tnm[47]=nm[5];   tnm[48]=nm[59];
    tnm[49]=nm[32];  tnm[50]=nm[34];  tnm[51]=nm[29];  tnm[52]=nm[35];
    tnm[53]=nm[37];  tnm[54]=nm[27];  tnm[55]=nm[40];  tnm[56]=nm[26];
    tnm[57]=nm[20];  tnm[58]=nm[46];  tnm[59]=nm[17];  tnm[60]=nm[47];
    tnm[61]=nm[41];  tnm[62]=nm[23];  tnm[63]=nm[44];  tnm[64]=nm[22];}
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#3. How do we design the 'Inverse Function' of DAMT to make Prototype Cubes?

We are going to make the solution set of 6720 Prototype cubes and then remake them into 6720 standard solutions of 'Composite' pan-magic cubes of order 4 by our 'DAM Transformation' applied to each Prototype one after another. We want to find the one-to-one correspondence between the two sets of solutions in the end.

But how can we make those Prototype cubes, then?

We want to try that 'inverse function' of DAMT here again, and examine it to find if it is universally applicable. We have to be taught by our teacher, the Model solution.

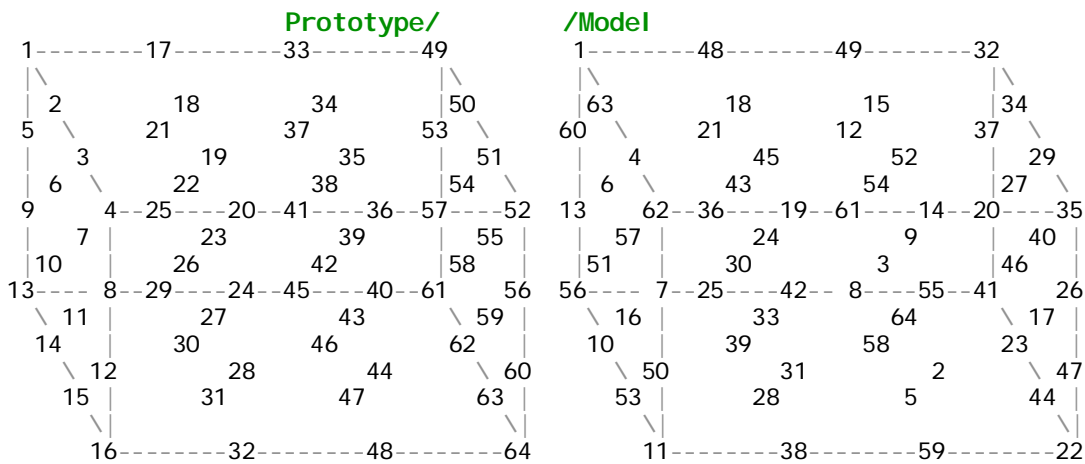
* Basic Conditions for Prototype Cubes *

$n1+n63+n4+n62=C \dots b1;$ $n1+n60+n13+n56=C \dots b2;$
 $n1+n48+n49+n32=C \dots b3;$
 $n1+n43+n64+n22=C \dots p1;$ $n1+n42+n64+n23=C \dots p2;$
 $n1+n39+n64+n26=C \dots p3;$ $n1+n38+n64+n27=C \dots p4;$

* Composite Conditions: *

$n1+n63+n60+n6=C \dots c1a;$ $n1+n63+n48+n18=C \dots c1b;$ $n1+n60+n48+n21=C \dots c1c;$
 $n63+n4+n6+n57=C \dots c2a;$ $n63+n4+n18+n45=C \dots c2b;$ $n63+n6+n18+n43=C \dots c2c;$
 $n4+n62+n57+n7=C \dots c3a;$ $n4+n62+n45+n19=C \dots c3b;$ $n4+n57+n45+n24=C \dots c3c;$
 $n62+n1+n7+n60=C \dots c4a;$ $n62+n1+n19+n48=C \dots c4b;$ $n62+n7+n19+n42=C \dots c4c;$
 $n60+n6+n13+n51=C \dots c5a;$ $n60+n6+n21+n43=C \dots c5b;$ $n60+n13+n21+n36=C \dots c5c;$
 $n6+n57+n51+n16=C \dots c6a;$ $n6+n57+n43+n24=C \dots c6b;$ $n6+n51+n43+n30=C \dots c6c;$
 $n57+n7+n16+n50=C \dots c7a;$ $n57+n7+n24+n42=C \dots c7b;$ $n57+n16+n24+n33=C \dots c7c;$
 $n7+n60+n50+n13=C \dots c8a;$ $n7+n60+n42+n21=C \dots c8b;$ $n7+n50+n42+n31=C \dots c8c;$
 $n13+n51+n56+n10=C \dots c9a;$ $n13+n51+n36+n30=C \dots c9b;$ $n13+n56+n36+n25=C \dots c9c;$

$n_{51}+n_{16}+n_{10}+n_{53}=C \dots c_{10a}$; $n_{51}+n_{16}+n_{30}+n_{33}=C \dots c_{10b}$; $n_{51}+n_{10}+n_{30}+n_{39}=C \dots c_{10c}$;
 $n_{16}+n_{50}+n_{53}+n_{11}=C \dots c_{11a}$; $n_{16}+n_{50}+n_{33}+n_{31}=C \dots c_{11b}$; $n_{16}+n_{53}+n_{33}+n_{28}=C \dots c_{11c}$;
 $n_{50}+n_{13}+n_{11}+n_{56}=C \dots c_{12a}$; $n_{50}+n_{13}+n_{31}+n_{36}=C \dots c_{12b}$; $n_{50}+n_{11}+n_{31}+n_{38}=C \dots c_{12c}$;
 $n_{56}+n_{10}+n_{1}+n_{63}=C \dots c_{13a}$; $n_{56}+n_{10}+n_{25}+n_{39}=C \dots c_{13b}$; $n_{56}+n_{1}+n_{25}+n_{48}=C \dots c_{13c}$;
 $n_{10}+n_{53}+n_{63}+n_{4}=C \dots c_{14a}$; $n_{10}+n_{53}+n_{39}+n_{28}=C \dots c_{14b}$; $n_{10}+n_{63}+n_{39}+n_{18}=C \dots c_{14c}$;
 $n_{53}+n_{11}+n_{4}+n_{62}=C \dots c_{15a}$; $n_{53}+n_{11}+n_{28}+n_{38}=C \dots c_{15b}$; $n_{53}+n_{4}+n_{28}+n_{45}=C \dots c_{15c}$;
 $n_{11}+n_{56}+n_{62}+n_{1}=C \dots c_{16a}$; $n_{11}+n_{56}+n_{38}+n_{25}=C \dots c_{16b}$; $n_{11}+n_{62}+n_{38}+n_{19}=C \dots c_{16c}$;
 $n_{48}+n_{18}+n_{21}+n_{43}=C \dots c_{17a}$; $n_{48}+n_{18}+n_{49}+n_{15}=C \dots c_{17b}$; $n_{48}+n_{21}+n_{49}+n_{12}=C \dots c_{17c}$;
 $n_{18}+n_{45}+n_{43}+n_{24}=C \dots c_{18a}$; $n_{18}+n_{45}+n_{15}+n_{52}=C \dots c_{18b}$; $n_{18}+n_{43}+n_{15}+n_{54}=C \dots c_{18c}$;
 $n_{45}+n_{19}+n_{24}+n_{42}=C \dots c_{19a}$; $n_{45}+n_{19}+n_{52}+n_{14}=C \dots c_{19b}$; $n_{45}+n_{24}+n_{52}+n_{9}=C \dots c_{19c}$;
 $n_{19}+n_{48}+n_{42}+n_{21}=C \dots c_{20a}$; $n_{19}+n_{48}+n_{14}+n_{49}=C \dots c_{20b}$; $n_{19}+n_{42}+n_{14}+n_{55}=C \dots c_{20c}$;
 $n_{21}+n_{43}+n_{36}+n_{30}=C \dots c_{21a}$; $n_{21}+n_{43}+n_{12}+n_{54}=C \dots c_{21b}$; $n_{21}+n_{36}+n_{12}+n_{61}=C \dots c_{21c}$;
 $n_{43}+n_{24}+n_{30}+n_{33}=C \dots c_{22a}$; $n_{43}+n_{24}+n_{54}+n_{9}=C \dots c_{22b}$; $n_{43}+n_{30}+n_{54}+n_{3}=C \dots c_{22c}$;
 $n_{24}+n_{42}+n_{33}+n_{31}=C \dots c_{23a}$; $n_{24}+n_{42}+n_{9}+n_{55}=C \dots c_{23b}$; $n_{24}+n_{33}+n_{9}+n_{64}=C \dots c_{23c}$;
 $n_{42}+n_{21}+n_{31}+n_{36}=C \dots c_{24a}$; $n_{42}+n_{21}+n_{55}+n_{12}=C \dots c_{24b}$; $n_{42}+n_{31}+n_{55}+n_{2}=C \dots c_{24c}$;
 $n_{36}+n_{30}+n_{25}+n_{39}=C \dots c_{25a}$; $n_{36}+n_{30}+n_{61}+n_{3}=C \dots c_{25b}$; $n_{36}+n_{25}+n_{61}+n_{8}=C \dots c_{25c}$;
 $n_{30}+n_{33}+n_{39}+n_{28}=C \dots c_{26a}$; $n_{30}+n_{33}+n_{3}+n_{64}=C \dots c_{26b}$; $n_{30}+n_{39}+n_{3}+n_{58}=C \dots c_{26c}$;
 $n_{33}+n_{31}+n_{28}+n_{38}=C \dots c_{27a}$; $n_{33}+n_{31}+n_{64}+n_{2}=C \dots c_{27b}$; $n_{33}+n_{28}+n_{64}+n_{5}=C \dots c_{27c}$;
 $n_{31}+n_{36}+n_{38}+n_{25}=C \dots c_{28a}$; $n_{31}+n_{36}+n_{2}+n_{61}=C \dots c_{28b}$; $n_{31}+n_{38}+n_{2}+n_{59}=C \dots c_{28c}$;
 $n_{25}+n_{39}+n_{48}+n_{18}=C \dots c_{29a}$; $n_{25}+n_{39}+n_{8}+n_{58}=C \dots c_{29b}$; $n_{25}+n_{48}+n_{8}+n_{49}=C \dots c_{29c}$;
 $n_{39}+n_{28}+n_{18}+n_{45}=C \dots c_{30a}$; $n_{39}+n_{28}+n_{58}+n_{5}=C \dots c_{30b}$; $n_{39}+n_{18}+n_{58}+n_{15}=C \dots c_{30c}$;
 $n_{28}+n_{38}+n_{45}+n_{19}=C \dots c_{31a}$; $n_{28}+n_{38}+n_{5}+n_{59}=C \dots c_{31b}$; $n_{28}+n_{45}+n_{5}+n_{52}=C \dots c_{31c}$;
 $n_{38}+n_{25}+n_{19}+n_{48}=C \dots c_{32a}$; $n_{38}+n_{25}+n_{59}+n_{8}=C \dots c_{32b}$; $n_{38}+n_{19}+n_{59}+n_{14}=C \dots c_{32c}$;



$n_{49}+n_{15}+n_{12}+n_{54}=C \dots c_{33a}$; $n_{49}+n_{15}+n_{32}+n_{34}=C \dots c_{33b}$; $n_{49}+n_{12}+n_{32}+n_{37}=C \dots c_{33c}$;
 $n_{15}+n_{52}+n_{54}+n_{9}=C \dots c_{34a}$; $n_{15}+n_{52}+n_{34}+n_{29}=C \dots c_{34b}$; $n_{15}+n_{54}+n_{34}+n_{27}=C \dots c_{34c}$;
 $n_{52}+n_{14}+n_{9}+n_{55}=C \dots c_{35a}$; $n_{52}+n_{14}+n_{29}+n_{35}=C \dots c_{35b}$; $n_{52}+n_{9}+n_{29}+n_{40}=C \dots c_{35c}$;
 $n_{14}+n_{49}+n_{55}+n_{12}=C \dots c_{36a}$; $n_{14}+n_{49}+n_{35}+n_{32}=C \dots c_{36b}$; $n_{14}+n_{55}+n_{35}+n_{26}=C \dots c_{36c}$;
 $n_{12}+n_{54}+n_{61}+n_{3}=C \dots c_{37a}$; $n_{12}+n_{54}+n_{37}+n_{27}=C \dots c_{37b}$; $n_{12}+n_{61}+n_{37}+n_{20}=C \dots c_{37c}$;
 $n_{54}+n_{9}+n_{3}+n_{64}=C \dots c_{38a}$; $n_{54}+n_{9}+n_{27}+n_{40}=C \dots c_{38b}$; $n_{54}+n_{3}+n_{27}+n_{46}=C \dots c_{38c}$;
 $n_{9}+n_{55}+n_{64}+n_{2}=C \dots c_{39a}$; $n_{9}+n_{55}+n_{40}+n_{26}=C \dots c_{39b}$; $n_{9}+n_{64}+n_{40}+n_{17}=C \dots c_{39c}$;
 $n_{55}+n_{12}+n_{2}+n_{61}=C \dots c_{40a}$; $n_{55}+n_{12}+n_{26}+n_{37}=C \dots c_{40b}$; $n_{55}+n_{2}+n_{26}+n_{47}=C \dots c_{40c}$;
 $n_{61}+n_{3}+n_{8}+n_{58}=C \dots c_{41a}$; $n_{61}+n_{3}+n_{20}+n_{46}=C \dots c_{41b}$; $n_{61}+n_{8}+n_{20}+n_{41}=C \dots c_{41c}$;
 $n_{3}+n_{64}+n_{58}+n_{5}=C \dots c_{42a}$; $n_{3}+n_{64}+n_{46}+n_{17}=C \dots c_{42b}$; $n_{3}+n_{58}+n_{46}+n_{23}=C \dots c_{42c}$;
 $n_{64}+n_{2}+n_{5}+n_{59}=C \dots c_{43a}$; $n_{64}+n_{2}+n_{17}+n_{47}=C \dots c_{43b}$; $n_{64}+n_{5}+n_{17}+n_{44}=C \dots c_{43c}$;
 $n_{2}+n_{61}+n_{59}+n_{8}=C \dots c_{44a}$; $n_{2}+n_{61}+n_{47}+n_{20}=C \dots c_{44b}$; $n_{2}+n_{59}+n_{47}+n_{22}=C \dots c_{44c}$;
 $n_{8}+n_{58}+n_{49}+n_{15}=C \dots c_{45a}$; $n_{8}+n_{58}+n_{41}+n_{23}=C \dots c_{45b}$; $n_{8}+n_{49}+n_{41}+n_{32}=C \dots c_{45c}$;
 $n_{58}+n_{5}+n_{15}+n_{52}=C \dots c_{46a}$; $n_{58}+n_{5}+n_{23}+n_{44}=C \dots c_{46b}$; $n_{58}+n_{15}+n_{23}+n_{34}=C \dots c_{46c}$;
 $n_{5}+n_{59}+n_{52}+n_{14}=C \dots c_{47a}$; $n_{5}+n_{59}+n_{44}+n_{22}=C \dots c_{47b}$; $n_{5}+n_{52}+n_{44}+n_{29}=C \dots c_{47c}$;
 $n_{59}+n_{8}+n_{14}+n_{49}=C \dots c_{48a}$; $n_{59}+n_{8}+n_{22}+n_{41}=C \dots c_{48b}$; $n_{59}+n_{14}+n_{22}+n_{35}=C \dots c_{48c}$;
 $n_{32}+n_{34}+n_{37}+n_{27}=C \dots c_{49a}$; $n_{32}+n_{34}+n_{1}+n_{63}=C \dots c_{49b}$; $n_{32}+n_{37}+n_{1}+n_{60}=C \dots c_{49c}$;
 $n_{34}+n_{29}+n_{27}+n_{40}=C \dots c_{50a}$; $n_{34}+n_{29}+n_{63}+n_{4}=C \dots c_{50b}$; $n_{34}+n_{27}+n_{63}+n_{6}=C \dots c_{50c}$;
 $n_{29}+n_{35}+n_{40}+n_{26}=C \dots c_{51a}$; $n_{29}+n_{35}+n_{4}+n_{62}=C \dots c_{51b}$; $n_{29}+n_{40}+n_{4}+n_{57}=C \dots c_{51c}$;
 $n_{35}+n_{32}+n_{26}+n_{37}=C \dots c_{52a}$; $n_{35}+n_{32}+n_{62}+n_{1}=C \dots c_{52b}$; $n_{35}+n_{26}+n_{62}+n_{7}=C \dots c_{52c}$;
 $n_{37}+n_{27}+n_{20}+n_{46}=C \dots c_{53a}$; $n_{37}+n_{27}+n_{60}+n_{6}=C \dots c_{53b}$; $n_{37}+n_{20}+n_{60}+n_{13}=C \dots c_{53c}$;
 $n_{27}+n_{40}+n_{46}+n_{17}=C \dots c_{54a}$; $n_{27}+n_{40}+n_{6}+n_{57}=C \dots c_{54b}$; $n_{27}+n_{46}+n_{6}+n_{51}=C \dots c_{54c}$;
 $n_{40}+n_{26}+n_{17}+n_{47}=C \dots c_{55a}$; $n_{40}+n_{26}+n_{57}+n_{7}=C \dots c_{55b}$; $n_{40}+n_{17}+n_{57}+n_{16}=C \dots c_{55c}$;
 $n_{26}+n_{37}+n_{47}+n_{20}=C \dots c_{56a}$; $n_{26}+n_{37}+n_{7}+n_{60}=C \dots c_{56b}$; $n_{26}+n_{47}+n_{7}+n_{50}=C \dots c_{56c}$;

n20+n46+n41+n23=C ... c57a; n20+n46+n13+n51=C ... c57b; n20+n41+n13+n56=C ... c57c;
n46+n17+n23+n44=C ... c58a; n46+n17+n51+n16=C ... c58b; n46+n23+n51+n10=C ... c58c;
n17+n47+n44+n22=C ... c59a; n17+n47+n16+n50=C ... c59b; n17+n44+n16+n53=C ... c59c;
n47+n20+n22+n41=C ... c60a; n47+n20+n50+n13=C ... c60b; n47+n22+n50+n11=C ... c60c;
n41+n23+n32+n34=C ... c61a; n41+n23+n56+n10=C ... c61b; n41+n32+n56+n1=C ... c61c;
n23+n44+n34+n29=C ... c62a; n23+n44+n10+n53=C ... c62b; n23+n34+n10+n63=C ... c62c;
n44+n22+n29+n35=C ... c63a; n44+n22+n53+n11=C ... c63b; n44+n29+n53+n4=C ... c63c;
n22+n41+n35+n32=C ... c64a; n22+n41+n11+n56=C ... c64b; n22+n35+n11+n62=C ... c64c;

*** List Forming Inequality Conditions for Standard Solutions ***

n1<n62; n1<n56; n1<n11; n1<n32; n1<n35; n1<n41; n1<n22; and n63>n60>n48;

This 'inverse function' is designed and defined with a lot of simultaneous equations just as listed above. They are dictated only by tracing after the Model precisely.

You might be surprised to see a long list of 'Composite Conditions', but it is natural for any 3-dimensional cubes to have so many of them. You might possibly be afraid of a short list of a few 'Basic Conditions', but it is all right for Composite types, since lots of Composite Conditions take care of the rest and complete them well.

We have to find every possible value that satisfies all those simultaneous equations, solve them and make all the solutions of Prototype cubes now. We can fortunately use our assistant PC to make it calculate hard and fast and solve them perfectly.

I have to report of our success in making all those 6720 Prototype solutions by this method we have just designed and prepared carefully.

#4. Apply DAMT to Prototype Cubes and Recompose our Object Cubes

The next job is to apply our DAM Transformation one after another to each of those 6720 Prototypes we have just made and to remake our goal objects, 6720 standard solutions of Composite pan-magic cubes of order 4.

Since I have no rich pages for the full-size list, I want to show you a compact list for the most beautiful part of our result, demonstrating only the solutions with n1=1.

**** Solution Counts according to the Values of n1 ****

```
[ 1: 840] [ 2: 720] [ 3: 624] [ 4: 528] [ 5: 528] [ 6: 432] [ 7: 360] [ 8: 288]
[ 9: 408] [10: 312] [11: 240] [12: 168] [13: 168] [14: 96] [15: 48] [16: 0]
[17: 240] [18: 168] [19: 120] [20: 72] [21: 96] [22: 48] [23: 24] [24: 0]
[25: 96] [26: 48] [27: 24] [28: 0] [29: 24] [30: 0] [31: 0] [32: 0]
[33: 0] [34: 0] [35: 0] [36: 0] [37: 0] [38: 0] [39: 0] [40: 0]
[41: 0] [42: 0] [43: 0] [44: 0] [45: 0] [46: 0] [47: 0] [48: 0]
[49: 0] [50: 0] [51: 0] [52: 0] [53: 0] [54: 0] [55: 0] [56: 0]
[57: 0] [58: 0] [59: 0] [60: 0] [61: 0] [62: 0] [63: 0] [64: 0]
```

[Count = 6720] OK!

**** 'Prototype' Cubes of Order 4 and 'Composite & Pan-triagonal' ****

**** Magic Cubes of Order 4 Reconstructed by 'DAM Transformation' ****

**** Part List of Standard Solutions with n1=1 ****

				1/ProtoT					/CP										
1	-----	17	-----	33	-----	49		1	-----	48	-----	49	-----	32					
	2		18		34			50		63		18		15			34		
5	3	21	19	37	35	53	51	60	4	21	45	12	52	37	29				
	6	4	--	22	--	20	--	38	--	36	--	54	--	52					
9	7		25	23	41	39	57	55		13	57		36	24	61	9	20	40	
	10	8	26	24	42	40		58	56		51	7	30	42	3	55		46	26
13	--	11		--	29	--	27	--	45	--	43	--	61	59					
	14	12	30	28	46	44	62	60		10	50	39	31	58	2	23	47		
		15			31		47	63			53			28		5	44		
			16	-----	32	-----	48	-----	64				11	-----	38	-----	59	-----	22

13/ProtoT /CP

1-----18-----34-----49
 | 2 17 33 |50
 6 4 21 19 37 35 54 52
 | 5 3---22--20---38--36---53--51
 10 7 | 25 24 41 40 58 55 |
 | 9 8 26 23 42 39 |57 56
 13--11-|-30--28---46--44---61 59 |
 14 12 29 27 45 43 62 60
 16 | 31 47 64 |
 15-----32-----48-----63

1-----48-----49-----32
 |64 17 16 |33
 60 3 21 46 12 51 37 30
 | 5 62---44--19---53--14---28--35
 13 58 | 36 23 61 10 20 39 |
 |52 7 29 42 4 55 |45 26
 56--15-|-25--34--- 8--63---41 18 |
 9 50 40 31 57 2 24 47
 54 | 27 6 43 |
 11-----38-----59-----22

25/ProtoT /CP

1-----17-----33-----49
 | 2 18 34 |50
 3 5 19 21 35 37 51 53
 | 4 6---20--22---36--38---52--54
 9 7 | 25 23 41 39 57 55 |
 |10 8 26 24 42 40 |58 56
 11--13-|-27--29---43--45---59 61 |
 12 14 28 30 44 46 60 62
 15 | 31 47 63 |
 16-----32-----48-----64

1-----48-----49-----32
 |63 18 15 |34
 62 6 19 43 14 54 35 27
 | 4 60---45--21---52--12---29--37
 11 57 | 38 24 59 9 22 40 |
 |53 7 28 42 5 55 |44 26
 56--16-|-25--33--- 8--64---41 17 |
 10 50 39 31 58 2 23 47
 51 | 30 3 46 |
 13-----36-----61-----20

37/ProtoT /CP

1-----18-----34-----49
 | 2 17 33 |50
 4 6 19 21 35 37 52 54
 | 3 5---20--22---36--38---51--53
 10 7 | 25 24 41 40 58 55 |
 | 9 8 26 23 42 39 |57 56
 11--13-|-28--30---44--46---59 61 |
 12 14 27 29 43 45 60 62
 16 | 31 47 64 |
 15-----32-----48-----63

1-----48-----49-----32
 |64 17 16 |33
 62 5 19 44 14 53 35 28
 | 3 60---46--21---51--12---30--37
 11 58 | 38 23 59 10 22 39 |
 |54 7 27 42 6 55 |43 26
 56--15-|-25--34--- 8--63---41 18 |
 9 50 40 31 57 2 24 47
 52 | 29 4 45 |
 13-----36-----61-----20

49/ProtoT /CP

1-----17-----33-----49
 | 2 18 34 |50
 3 9 19 25 35 41 51 57
 | 4 10---20--26---36--42---52--58
 5 11 | 21 27 37 43 53 59 |
 | 6 12 22 28 38 44 |54 60
 7--13-|-23--29---39--45---55 61 |
 8 14 24 30 40 46 56 62
 15 | 31 47 63 |
 16-----32-----48-----64

1-----48-----49-----32
 |63 18 15 |34
 62 10 19 39 14 58 35 23
 | 4 56---45--25---52-- 8---29--41
 7 53 | 42 28 55 5 26 44 |
 |57 11 24 38 9 59 |40 22
 60--16-|-21--33---12--64---37 17 |
 6 50 43 31 54 2 27 47
 51 | 30 3 46 |
 13-----36-----61-----20

61/ProtoT /CP

1-----18-----34-----49
 | 2 17 33 |50
 4 10 19 25 35 41 52 58
 | 3 9---20--26---36--42---51--57
 6 11 | 21 28 37 44 54 59 |
 | 5 12 22 27 38 43 |53 60
 7--13-|-24--30---40--46---55 61 |
 8 14 23 29 39 45 56 62
 16 | 31 47 64 |
 15-----32-----48-----63

1-----48-----49-----32
 |64 17 16 |33
 62 9 19 40 14 57 35 24
 | 3 56---46--25---51-- 8---30--41
 7 54 | 42 27 55 6 26 43 |
 |58 11 23 38 10 59 |39 22
 60--15-|-21--34---12--63---37 18 |
 5 50 44 31 53 2 28 47
 52 | 29 4 45 |
 13-----36-----61-----20

73/ProtoT /CP

1-----9-----33-----41
 | 2 10 34 |42
 3 17 11 25 35 49 43 57
 | 4 18--12--26--36--50--44--58
 5 19 | 13 27 37 51 45 59 |
 | 6 20 14 28 38 52 |46 60
 7--21-|-15--29--39--53--47 61 |
 8 22 16 30 40 54 48 62
 23 | 31 55 63 |
 24-----32-----56-----64

1-----56-----41-----32
 |63 10 23 |34
 62 18 11 39 22 58 35 15
 | 4 48--53--25--44-- 8--29--49
 7 45 | 50 28 47 5 26 52 |
 |57 19 16 38 17 59 |40 14
 60--24-|-13--33--20--64--37 9 |
 6 42 51 31 46 2 27 55
 43 | 30 3 54 |
 21-----36-----61-----12

85/ProtoT /CP

1-----10-----34-----41
 | 2 9 33 |42
 4 18 11 25 35 49 44 58
 | 3 17--12--26--36--50--43--57
 6 19 | 13 28 37 52 46 59 |
 | 5 20 14 27 38 51 |45 60
 7--21-|-16--30--40--54--47 61 |
 8 22 15 29 39 53 48 62
 24 | 31 55 64 |
 23-----32-----56-----63

1-----56-----41-----32
 |64 9 24 |33
 62 17 11 40 22 57 35 16
 | 3 48--54--25--43-- 8--30--49
 7 46 | 50 27 47 6 26 51 |
 |58 19 15 38 18 59 |39 14
 60--23-|-13--34--20--63--37 10 |
 5 42 52 31 45 2 28 55
 44 | 29 4 53 |
 21-----36-----61-----12

97/ProtoT /CP

1-----9-----17-----25
 | 2 10 18 |26
 3 33 11 41 19 49 27 57
 | 4 34--12--42--20--50--28--58
 5 35 | 13 43 21 51 29 59 |
 | 6 36 14 44 22 52 |30 60
 7--37-|-15--45--23--53--31 61 |
 8 38 16 46 24 54 32 62
 39 | 47 55 63 |
 40-----48-----56-----64

1-----56-----25-----48
 |63 10 39 |18
 62 34 11 23 38 58 19 15
 | 4 32--53--41--28-- 8--45--49
 7 29 | 50 44 31 5 42 52 |
 |57 35 16 22 33 59 |24 14
 60--40-|-13--17--36--64--21 9 |
 6 26 51 47 30 2 43 55
 27 | 46 3 54 |
 37-----20-----61-----12

109/ProtoT /CP

1-----10-----18-----25
 | 2 9 17 |26
 4 34 11 41 19 49 28 58
 | 3 33--12--42--20--50--27--57
 6 35 | 13 44 21 52 30 59 |
 | 5 36 14 43 22 51 |29 60
 7--37-|-16--46--24--54--31 61 |
 8 38 15 45 23 53 32 62
 40 | 47 55 64 |
 39-----48-----56-----63

1-----56-----25-----48
 |64 9 40 |17
 62 33 11 24 38 57 19 16
 | 3 32--54--41--27-- 8--46--49
 7 30 | 50 43 31 6 42 51 |
 |58 35 15 22 34 59 |23 14
 60--39-|-13--18--36--63--21 10 |
 5 26 52 47 29 2 44 55
 28 | 45 4 53 |
 37-----20-----61-----12

121/ProtoT /CP

1-----17-----33-----49
 | 3 19 35 |51
 5 2 21 18 37 34 53 50
 | 7 4--23--20--39--36--55--52
 9 6 | 25 22 41 38 57 54 |
 |11 8 27 24 43 40 |59 56
 13--10-|-29--26--45--42--61 58 |
 15 12 31 28 47 44 63 60
 14 | 30 46 62 |
 16-----32-----48-----64

1-----48-----49-----32
 |62 19 14 |35
 60 4 21 45 12 52 37 29
 | 7 63--42--18--55--15--26--34
 13 57 | 36 24 61 9 20 40 |
 |50 6 31 43 2 54 |47 27
 56--16-|-25--33-- 8--64--41 17 |
 11 51 38 30 59 3 22 46
 53 | 28 5 44 |
 10-----39-----58-----23

217/ProtoT /CP

1-----18-----34-----49
 | 4 19 35 |52
 6 2 21 17 37 33 54 50
 | 7 3--24--20--40--36--55--51
 10 5 | 25 22 41 38 58 53 |
 |11 8 28 23 44 39 |59 56
 13--9-|-30--26--46--42--61 57 |
 16 12 31 27 47 43 64 60
 14 | 29 45 62 |
 15-----32-----48-----63

1-----48-----49-----32
 |62 19 14 |35
 60 3 21 46 12 51 37 30
 | 7 64--42--17--55--16--26--33
 13 58 | 36 23 61 10 20 39 |
 |50 5 31 44 2 53 |47 28
 56--15-|-25--34--8--63--41 18 |
 11 52 38 29 59 4 22 45
 54 | 27 6 43 |
 9-----40-----57-----24

289/ProtoT /CP

1-----17-----33-----49
 | 5 21 37 |53
 9 2 25 18 41 34 57 50
 |13 6--29--22--45--38--61--54
 3 10 | 19 26 35 42 51 58 |
 | 7 14 23 30 39 46 |55 62
 11--4-|-27--20--43--36--59 52 |
 15 8 31 24 47 40 63 56
 12 | 28 44 60 |
 16-----32-----48-----64

1-----48-----49-----32
 |60 21 12 |37
 56 6 25 43 8 54 41 27
 |13 63--36--18--61--15--20--34
 11 51 | 38 30 59 3 22 46 |
 |50 10 31 39 2 58 |47 23
 62--16-|-19--33--14--64--35 17 |
 7 53 42 28 55 5 26 44
 57 | 24 9 40 |
 4-----45-----52-----29

367/ProtoT /CP

1-----18-----34-----49
 | 6 21 37 |54
 10 2 25 17 41 33 58 50
 |13 5--30--22--46--38--61--53
 4 9 | 19 26 35 42 52 57 |
 | 7 14 24 29 40 45 |55 62
 11--3-|-28--20--44--36--59 51 |
 16 8 31 23 47 39 64 56
 12 | 27 43 60 |
 15-----32-----48-----63

1-----48-----49-----32
 |60 21 12 |37
 56 5 25 44 8 53 41 28
 |13 64--36--17--61--16--20--33
 11 52 | 38 29 59 4 22 45 |
 |50 9 31 40 2 57 |47 24
 62--15-|-19--34--14--63--35 18 |
 7 54 42 27 55 6 26 43
 58 | 23 10 39 |
 3-----46-----51-----30

421/ProtoT /CP

1-----19-----35-----49
 | 7 21 37 |55
 11 3 25 17 41 33 59 51
 |13 5--31--23--47--39--61--53
 4 9 | 18 27 34 43 52 57 |
 | 6 15 24 29 40 45 |54 63
 10--2-|-28--20--44--36--58 50 |
 16 8 30 22 46 38 64 56
 12 | 26 42 60 |
 14-----32-----48-----62

1-----48-----49-----32
 |60 21 12 |37
 56 5 25 44 8 53 41 28
 |13 64--36--17--61--16--20--33
 10 52 | 39 29 58 4 23 45 |
 |51 9 30 40 3 57 |46 24
 63--14-|-18--35--15--62--34 19 |
 6 55 43 26 54 7 27 42
 59 | 22 11 38 |
 2-----47-----50-----31

457/ProtoT /CP

1-----33-----5-----37
 | 9 41 13 |45
 17 2 49 34 21 6 53 38
 |25 10--57--42--29--14--61--46
 3 18 | 35 50 7 22 39 54 |
 |11 26 43 58 15 30 |47 62
 19--4-|-51--36--23--8--55 40 |
 27 12 59 44 31 16 63 48
 20 | 52 24 56 |
 28-----60-----32-----64

1-----32-----37-----60
 |56 41 20 |13
 48 10 49 23 12 46 21 51
 |25 63--8--34--61--27--36--6
 19 39 | 14 58 55 3 42 30 |
 |38 18 59 15 2 54 |31 43
 62--28-|-35--5--26--64--7 33 |
 11 45 22 52 47 9 50 24
 53 | 44 17 16 |
 4-----29-----40-----57

523/ProtoT /CP

1-----34-----6-----37
 |10 41 13 |46
 18 2 49 33 21 5 54 38
 |25 9--58--42--30--14--61--45
 4 17 |35 50 7 22 40 53 |
 |11 26 44 57 16 29 |47 62
 19-- 3-|-52--36--24-- 8--55 39 |
 28 12 59 43 31 15 64 48
 20 | 51 23 56 |
 27-----60-----32-----63

1-----32-----37-----60
 |56 41 20 |13
 48 9 49 24 12 45 21 52
 |25 64-- 8--33--61--28--36-- 5
 19 40 |14 57 55 4 42 29 |
 |38 17 59 16 2 53 |31 44
 62--27-|-35-- 6--26--63-- 7 34 |
 11 46 22 51 47 10 50 23
 54 | 43 18 15 |
 3-----30-----39-----58

565/ProtoT /CP

1-----35-----7-----37
 |11 41 13 |47
 19 3 49 33 21 5 55 39
 |25 9--59--43--31--15--61--45
 4 17 |34 51 6 23 40 53 |
 |10 27 44 57 16 29 |46 63
 18-- 2-|-52--36--24-- 8--54 38 |
 28 12 58 42 30 14 64 48
 20 | 50 22 56 |
 26-----60-----32-----62

1-----32-----37-----60
 |56 41 20 |13
 48 9 49 24 12 45 21 52
 |25 64-- 8--33--61--28--36-- 5
 18 40 |15 57 54 4 43 29 |
 |39 17 58 16 3 53 |30 44
 63--26-|-34-- 7--27--62-- 6 35 |
 10 47 23 50 46 11 51 22
 55 | 42 19 14 |
 2-----31-----38-----59

589/ProtoT /CP

1-----37-----7-----35
 |13 41 11 |47
 21 5 49 33 19 3 55 39
 |25 9--61--45--31--15--59--43
 6 17 |34 53 4 23 40 51 |
 |10 29 46 57 16 27 |44 63
 18-- 2-|-54--38--24-- 8--52 36 |
 30 14 58 42 28 12 64 48
 22 | 50 20 56 |
 26-----62-----32-----60

1-----32-----35-----62
 |56 41 22 |11
 48 9 49 24 14 43 19 54
 |25 64-- 8--33--59--30--38-- 3
 18 40 |15 57 52 6 45 27 |
 |39 17 58 16 5 51 |28 46
 63--26-|-34-- 7--29--60-- 4 37 |
 10 47 23 50 44 13 53 20
 55 | 42 21 12 |
 2-----31-----36-----61

601/ProtoT /CP

1-----25-----49-----41
 |17 9 33 |57
 19 18 11 10 35 34 59 58
 | 3 2--27--26--51--50--43--42
 21 4 |13 28 37 52 61 44 |
 | 5 20 29 12 53 36 |45 60
 7-- 6-|-31--30--55--54--47 46 |
 23 22 15 14 39 38 63 62
 24 | 16 40 64 |
 8-----32-----56-----48

1-----56-----41-----32
 |64 9 24 |33
 62 2 11 55 22 42 35 31
 | 3 63--54--10--43--23--30--34
 7 61 |50 12 47 21 26 36 |
 |58 4 15 53 18 44 |39 29
 60-- 8-|-13--49--20--48--37 25 |
 5 57 52 16 45 17 28 40
 59 | 14 19 38 |
 6-----51-----46-----27

661/ProtoT /CP

1-----25-----49-----41
 |18 10 34 |58
 19 17 11 9 35 33 59 57
 | 4 2--28--26--52--50--44--42
 21 3 |13 27 37 51 61 43 |
 | 6 20 30 12 54 36 |46 60
 7-- 5-|-31--29--55--53--47 45 |
 24 22 16 14 40 38 64 62
 23 | 15 39 63 |
 8-----32-----56-----48

1-----56-----41-----32
 |63 10 23 |34
 62 2 11 55 22 42 35 31
 | 4 64--53-- 9--44--24--29--33
 7 61 |50 12 47 21 26 36 |
 |57 3 16 54 17 43 |40 30
 60-- 8-|-13--49--20--48--37 25 |
 6 58 51 15 46 18 27 39
 59 | 14 19 38 |
 5-----52-----45-----28

697/ProtoT /CP

1-----25-----49-----41
 |19 11 35 |59
 21 17 13 9 37 33 61 57
 | 7 3--31--27--55--51--47--43
 18 5 | 10 29 34 53 58 45 |
 | 4 23 28 15 52 39 |44 63
 6-- 2-|-30--26--54--50--46 42 |
 24 20 16 12 40 36 64 60
 22 | 14 38 62 |
 8-----32-----56-----48

1-----56-----41-----32
 |62 11 22 |35
 60 3 13 54 20 43 37 30
 | 7 64--50-- 9--47--24--26--33
 6 58 | 51 15 46 18 27 39 |
 |57 5 16 52 17 45 |40 28
 63-- 8-|-10--49--23--48--34 25 |
 4 59 53 14 44 19 29 38
 61 | 12 21 36 |
 2-----55-----42-----31

715/ProtoT /CP

1-----49-----19-----35
 |21 37 7 |55
 25 17 41 33 11 3 59 51
 |13 5--61--53--31--23--47--39
 18 9 | 34 57 4 27 52 43 |
 | 6 29 54 45 24 15 |40 63
 10-- 2-|-58--50--28--20--44 36 |
 30 22 46 38 16 8 64 56
 26 | 42 12 60 |
 14-----62-----32-----48

1-----32-----35-----62
 |60 37 26 | 7
 56 5 41 28 22 39 11 58
 |13 64--20--33--47--30--50-- 3
 10 52 | 23 45 44 18 53 15 |
 |51 9 46 24 17 43 |16 54
 63--14-|-34--19--29--48-- 4 49 |
 6 55 27 42 40 21 57 12
 59 | 38 25 8 |
 2-----31-----36-----61

721/ProtoT /CP

1-----41-----49-----25
 |33 9 17 |57
 35 34 11 10 19 18 59 58
 | 3 2--43--42--51--50--27--26
 37 4 | 13 44 21 52 61 28 |
 | 5 36 45 12 53 20 |29 60
 7-- 6-|-47--46--55--54--31 30 |
 39 38 15 14 23 22 63 62
 40 | 16 24 64 |
 8-----48-----56-----32

1-----56-----25-----48
 |64 9 40 |17
 62 2 11 55 38 26 19 47
 | 3 63--54--10--27--39--46--18
 7 61 | 50 12 31 37 42 20 |
 |58 4 15 53 34 28 |23 45
 60-- 8-|-13--49--36--32--21 41 |
 5 57 52 16 29 33 44 24
 59 | 14 35 22 |
 6-----51-----30-----43

781/ProtoT /CP

1-----41-----49-----25
 |34 10 18 |58
 35 33 11 9 19 17 59 57
 | 4 2--44--42--52--50--28--26
 37 3 | 13 43 21 51 61 27 |
 | 6 36 46 12 54 20 |30 60
 7-- 5-|-47--45--55--53--31 29 |
 40 38 16 14 24 22 64 62
 39 | 15 23 63 |
 8-----48-----56-----32

1-----56-----25-----48
 |63 10 39 |18
 62 2 11 55 38 26 19 47
 | 4 64--53-- 9--28--40--45--17
 7 61 | 50 12 31 37 42 20 |
 |57 3 16 54 33 27 |24 46
 60-- 8-|-13--49--36--32--21 41 |
 6 58 51 15 30 34 43 23
 59 | 14 35 22 |
 5-----52-----29-----44

817/ProtoT /CP

1-----41-----49-----25
 |35 11 19 |59
 37 33 13 9 21 17 61 57
 | 7 3--47--43--55--51--31--27
 34 5 | 10 45 18 53 58 29 |
 | 4 39 44 15 52 23 |28 63
 6-- 2-|-46--42--54--50--30 26 |
 40 36 16 12 24 20 64 60
 38 | 14 22 62 |
 8-----48-----56-----32

1-----56-----25-----48
 |62 11 38 |19
 60 3 13 54 36 27 21 46
 | 7 64--50-- 9--31--40--42--17
 6 58 | 51 15 30 34 43 23 |
 |57 5 16 52 33 29 |24 44
 63-- 8-|-10--49--39--32--18 41 |
 4 59 53 14 28 35 45 22
 61 | 12 37 20 |
 2-----55-----26-----47

835/ProtoT										/CP																		
1	-----	49	-----	35	-----	19	-----	1	-----	48	-----	19	-----	62														
	37		21		7			55		60		21		42			7											
41	33	25	17	11	3	59	51	56	5	25	44	38	23	11	58													
	13	5	-----	61	-----	53	-----	47	-----	39	-----	31	-----	23			13	64	-----									
34	9		18	57		4	43	52	27		10	52		39	29	28	34	53	15									
	6	45	54	29	40	15		24	63		51	9	30	40	33	27		16	54									
10	-----	2	-----	58	-----	50	-----	44	-----	36	-----	28	20	63	-----	14	-----	18	-----	35	-----	45	-----	32	-----	4	49	
	46	38	30	22	16	8	64	56	6	55	43	26	24	37	57	12												
	42		26		12		60		59		22		41		8													
	14	-----	62	-----	48	-----	32		2	-----	47	-----	20	-----	61													

**** Solution Counts according to the Values of n43 ****

[1: 0]	[2: 0]	[3: 0]	[4: 0]	[5: 0]	[6: 0]	[7: 0]	[8: 0]
[9: 0]	[10: 0]	[11: 0]	[12: 0]	[13: 0]	[14: 0]	[15: 0]	[16: 0]
[17: 0]	[18: 0]	[19: 0]	[20: 0]	[21: 0]	[22: 0]	[23: 0]	[24: 0]
[25: 0]	[26: 0]	[27: 0]	[28: 0]	[29: 0]	[30: 0]	[31: 0]	[32: 120]
[33: 0]	[34: 0]	[35: 0]	[36: 0]	[37: 0]	[38: 0]	[39: 0]	[40: 0]
[41: 0]	[42: 0]	[43: 0]	[44: 0]	[45: 0]	[46: 0]	[47: 0]	[48: 120]
[49: 0]	[50: 0]	[51: 0]	[52: 0]	[53: 0]	[54: 0]	[55: 0]	[56: 120]
[57: 0]	[58: 0]	[59: 0]	[60: 120]	[61: 0]	[62: 120]	[63: 120]	[64: 120]

[Count = 840] OK!

#5. What does the Result tell us?

What do you think of the meaning of those Prototype cubes?

They surely look like the set of Basic Forms including various variations of the first form made by tracking after the 3-dimensional regular array 4x4x4.

Watch the last monitor list, and you will find what we have recomposed for object solutions with n1=1 could be classified into 7 groups according to the values of n43. Value pairs of (n1, n43) should be limited only to the 7 patterns: (1, 64), (1, 63), (1, 62), (1, 60), (1, 56), (1, 48) or (1, 32). They could be nothing else.

We know this is one of the essential properties of pan-magic cubes of order 4. It certifies that we could have recomposed nothing other than pan-magic cubes.

It is also one of the inherent properties of Composite pan-magic cubes of order 4 that each solution count 120 is equal to the other 6 according to the values of n43.

It is sure we have succeeded in recomposing what we have wanted and finding the beautiful correspondence between the two solution sets of Prototypes and objects.

#6. Recompose those Fundamental 105 Solutions of Composite PMC444

We once composed the fundamental 105 solutions of Composite pan-magic cubes of order 4. I remember they are one of the most beautiful solution sets of all.

Can we recompose those objects only by our 'DAMT' and Prototype cubes?

Yes, we can. We don't have to change any conditions for DAMT and Prototypes.

We only have to add the next two sets of conditions as follows, and select the fundamental solutions out of the standard ones.

- (1) n1==1;
- (2) n1<n62; n1<n56; n1<n11; n1<n32; n1<n35; n1<n41; n1<n22; n63>n60>n48; and n63>n62; n60>n56; n48>n32;

Let me show you the result of my recent computation now. I am sorry I can show you only a part of 105 solutions in the next list.

** Prototype Cubes and Composite Pan-magic Cubes of Order 4 **
 ** Part List: Pairs of Fundamental Solutions of Both Types **

1/ProtoT				/CP					
1-----17-----33-----49	2	18	34	50	1-----48-----49-----32	63	18	15	34
5 3 21 19 37 35 53 51	6	4--22--20--38--36--54--52			60 4 21 45 12 52 37 29	6	62--43--19--54--14--27--35		
9 7 25 23 41 39 57 55	10	8 26 24 42 40 58 56			13 57 36 24 61 9 20 40	51	7 30 42 3 55 46 26		
13--11- -29--27--45--43--61 59	14	12 30 28 46 44 62 60			56--16- -25--33--8--64--41 17	10	50 39 31 58 2 23 47		
15 31 47 63	16-----32-----48-----64				53 28 5 44				

2/ProtoT				/CP					
1-----9-----33-----41	2	10	34	42	1-----56-----41-----32	63	10	23	34
5 3 13 11 37 35 45 43	6	4--14--12--38--36--46--44			60 4 13 53 20 44 37 29	6	62--51--11--46--22--27--35		
17 7 25 15 49 39 57 47	18	8 26 16 50 40 58 48			21 57 36 16 61 17 12 40	43	7 30 50 3 47 54 26		
21--19- -29--27--53--51--61 59	22	20 30 28 54 52 62 60			48--24- -25--33--8--64--49 9	18	42 39 31 58 2 15 55		
23 31 55 63	24-----32-----56-----64				45 28 5 52				

3/ProtoT				/CP					
1-----9-----17-----25	2	10	18	26	1-----56-----25-----48	63	10	39	18
5 3 13 11 21 19 29 27	6	4--14--12--22--20--30--28			60 4 13 53 36 28 21 45	6	62--51--11--30--38--43--19		
33 7 41 15 49 23 57 31	34	8 42 16 50 24 58 32			37 57 20 16 61 33 12 24	27	7 46 50 3 31 54 42		
37--35- -45--43--53--51--61 59	38	36 46 44 54 52 62 60			32--40- -41--17--8--64--49 9	34	26 23 47 58 2 15 55		
39 47 55 63	40-----48-----56-----64				29 44 5 52				

4/ProtoT				/CP					
1-----18-----34-----49	2	17	33	50	1-----48-----49-----32	64	17	16	33
6 4 21 19 37 35 54 52	5	3--22--20--38--36--53--51			60 3 21 46 12 51 37 30	5	62--44--19--53--14--28--35		
10 7 25 24 41 40 58 55	9	8 26 23 42 39 57 56			13 58 36 23 61 10 20 39	52	7 29 42 4 55 45 26		
13--11- -30--28--46--44--61 59	14	12 29 27 45 43 62 60			56--15- -25--34--8--63--41 18	9	50 40 31 57 2 24 47		
16 31 47 64	15-----32-----48-----63				54 27 6 43				

5/ProtoT				/CP					
1-----10-----34-----41	2	9	33	42	1-----56-----41-----32	64	9	24	33
6 4 13 11 37 35 46 44	5	3--14--12--38--36--45--43			60 3 13 54 20 43 37 30	5	62--52--11--45--22--28--35		
18 7 25 16 49 40 58 47	17	8 26 15 50 39 57 48			21 58 36 15 61 18 12 39	44	7 29 50 4 47 53 26		
21--19- -30--28--54--52--61 59	22	20 29 27 53 51 62 60			48--23- -25--34--8--63--49 10	17	42 40 31 57 2 16 55		
24 31 55 64	23-----32-----56-----63				46 27 6 51				

6/ProtoT /CP
 1-----10-----18-----25
 | 2 9 17 |26
 6 4 13 11 21 19 30 28
 | 5 3---14---12---22---20---29---27
 34 7 | 41 16 49 24 58 31 |
 |33 8 42 15 50 23 |57 32
 37--35-|-46--44--54-52--61 59 |
 38 36 45 43 53 51 62 60
 40 | 47 55 64 |
 39-----48-----56-----63

/CP
 1-----56-----25-----48
 |64 9 40 |17
 60 3 13 54 36 27 21 46
 | 5 62---52---11---29---38---44---19
 37 58 | 20 15 61 34 12 23 |
 |28 7 45 50 4 31 |53 42
 32--39-|-41--18-- 8--63---49 10 |
 33 26 24 47 57 2 16 55
 30 | 43 6 51 |
 35-----22-----59-----14

7/ProtoT /CP
 1-----17-----33-----49
 | 2 18 34 |50
 3 5 19 21 35 37 51 53
 | 4 6---20---22---36---38---52---54
 9 7 | 25 23 41 39 57 55 |
 |10 8 26 24 42 40 |58 56
 11--13-|-27--29--43-45--59 61 |
 12 14 28 30 44 46 60 62
 15 | 31 47 63 |
 16-----32-----48-----64

/CP
 1-----48-----49-----32
 |63 18 15 |34
 62 6 19 43 14 54 35 27
 | 4 60---45---21---52---12---29---37
 11 57 | 38 24 59 9 22 40 |
 |53 7 28 42 5 55 |44 26
 56--16-|-25--33-- 8--64---41 17 |
 10 50 39 31 58 2 23 47
 51 | 30 3 46 |
 13-----36-----61-----20

8/ProtoT /CP
 1----- 9-----33-----41
 | 2 10 34 |42
 3 5 11 13 35 37 43 45
 | 4 6---12---14---36---38---44---46
 17 7 | 25 15 49 39 57 47 |
 |18 8 26 16 50 40 |58 48
 19--21-|-27--29--51-53--59 61 |
 20 22 28 30 52 54 60 62
 23 | 31 55 63 |
 24-----32-----56-----64

/CP
 1-----56-----41-----32
 |63 10 23 |34
 62 6 11 51 22 46 35 27
 | 4 60---53---13---44---20---29---37
 19 57 | 38 16 59 17 14 40 |
 |45 7 28 50 5 47 |52 26
 48--24-|-25--33-- 8--64---49 9 |
 18 42 39 31 58 2 15 55
 43 | 30 3 54 |
 21-----36-----61-----12

9/ProtoT /CP
 1----- 9-----17-----25
 | 2 10 18 |26
 3 5 11 13 19 21 27 29
 | 4 6---12---14---20---22---28---30
 33 7 | 41 15 49 23 57 31 |
 |34 8 42 16 50 24 |58 32
 35--37-|-43--45--51-53--59 61 |
 36 38 44 46 52 54 60 62
 39 | 47 55 63 |
 40-----48-----56-----64

/CP
 1-----56-----25-----48
 |63 10 39 |18
 62 6 11 51 38 30 19 43
 | 4 60---53---13---28---36---45---21
 35 57 | 22 16 59 33 14 24 |
 |29 7 44 50 5 31 |52 42
 32--40-|-41--17-- 8--64---49 9 |
 34 26 23 47 58 2 15 55
 27 | 46 3 54 |
 37-----20-----61-----12

10/ProtoT /CP
 1-----18-----34-----49
 | 2 17 33 |50
 4 6 19 21 35 37 52 54
 | 3 5---20---22---36---38---51---53
 10 7 | 25 24 41 40 58 55 |
 | 9 8 26 23 42 39 |57 56
 11--13-|-28--30--44-46--59 61 |
 12 14 27 29 43 45 60 62
 16 | 31 47 64 |
 15-----32-----48-----63

/CP
 1-----48-----49-----32
 |64 17 16 |33
 62 5 19 44 14 53 35 28
 | 3 60---46---21---51---12---30---37
 11 58 | 38 23 59 10 22 39 |
 |54 7 27 42 6 55 |43 26
 56--15-|-25--34-- 8--63---41 18 |
 9 50 40 31 57 2 24 47
 52 | 29 4 45 |
 13-----36-----61-----20

11/ProtoT /CP

1-----10-----34-----41	1-----56-----41-----32
2 9 33 42	64 9 24 33
4 6 11 13 35 37 44 46	62 5 11 52 22 45 35 28
3 5---12---14---36---38---43---45	3 60---54---13---43---20---30---37
18 7 25 16 49 40 58 47	19 58 38 15 59 18 14 39
17 8 26 15 50 39 57 48	46 7 27 50 6 47 51 26
19--21- -28--30---52--54---59 61	48--23- -25--34---8--63---49 10
20 22 27 29 51 53 60 62	17 42 40 31 57 2 16 55
24 31 55 64	44 29 4 53
23-----32-----56-----63	21-----36-----61-----12

12/ProtoT /CP

1-----10-----18-----25	1-----56-----25-----48
2 9 17 26	64 9 40 17
4 6 11 13 19 21 28 30	62 5 11 52 38 29 19 44
3 5---12---14---20---22---27---29	3 60---54---13---27---36---46---21
34 7 41 16 49 24 58 31	35 58 22 15 59 34 14 23
33 8 42 15 50 23 57 32	30 7 43 50 6 31 51 42
35--37- -44--46---52--54---59 61	32--39- -41--18---8--63---49 10
36 38 43 45 51 53 60 62	33 26 24 47 57 2 16 55
40 47 55 64	28 45 4 53
39-----48-----56-----63	37-----20-----61-----12

13/ProtoT /CP

1-----17-----33-----49	1-----48-----49-----32
2 18 34 50	63 18 15 34
3 9 19 25 35 41 51 57	62 10 19 39 14 58 35 23
4 10---20---26---36---42---52---58	4 56---45---25---52---8---29---41
5 11 21 27 37 43 53 59	7 53 42 28 55 5 26 44
6 12 22 28 38 44 54 60	57 11 24 38 9 59 40 22
7--13- -23--29---39--45---55 61	60--16- -21--33---12--64---37 17
8 14 24 30 40 46 56 62	6 50 43 31 54 2 27 47
15 31 47 63	51 30 3 46
16-----32-----48-----64	13-----36-----61-----20

14/ProtoT /CP

1-----5-----33-----37	1-----60-----37-----32
2 6 34 38	63 6 27 34
3 9 7 13 35 41 39 45	62 10 7 51 26 46 35 23
4 10---8---14---36---42---40---46	4 56---57---13---40---20---29---41
17 11 21 15 49 43 53 47	19 53 42 16 55 17 14 44
18 12 22 16 50 44 54 48	45 11 24 50 9 47 52 22
19--25- -23--29---51--57---55 61	48--28- -21--33---12--64---49 5
20 26 24 30 52 58 56 62	18 38 43 31 54 2 15 59
27 31 59 63	39 30 3 58
28-----32-----60-----64	25-----36-----61-----8

15/ProtoT /CP

1-----5-----17-----21	1-----60-----21-----48
2 6 18 22	63 6 43 18
3 9 7 13 19 25 23 29	62 10 7 51 42 30 19 39
4 10---8---14---20---26---24---30	4 56---57---13---24---36---45---25
33 11 37 15 49 27 53 31	35 53 26 16 55 33 14 28
34 12 38 16 50 28 54 32	29 11 40 50 9 31 52 38
35--41- -39--45---51--57---55 61	32--44- -37--17---12--64---49 5
36 42 40 46 52 58 56 62	34 22 27 47 54 2 15 59
43 47 59 63	23 46 3 58
44-----48-----60-----64	41-----20-----61-----8

16/ProtoT /CP
 1-----18-----34-----49
 | 2 17 33 |50
 4 10 19 25 35 41 52 58
 | 3 9---20--26---36--42---51--57
 6 11 | 21 28 37 44 54 59 |
 | 5 12 22 27 38 43 |53 60
 7--13-|-24--30---40--46---55 61 |
 8 14 | 23 29 39 45 56 62
 16 | 31 47 | 64 |
 15-----32-----48-----63

/CP
 1-----48-----49-----32
 | 64 17 16 |33
 62 9 19 40 14 57 35 24
 | 3 56---46--25---51-- 8---30--41
 7 54 | 42 27 55 6 26 43 |
 | 58 11 23 38 10 59 |39 22
 60--15-|-21--34---12--63---37 18 |
 5 50 | 44 31 53 2 28 47
 52 | 29 4 | 45 |
 13-----36-----61-----20

19/ProtoT /CP
 1----- 9-----33-----41
 | 2 10 34 |42
 3 17 11 25 35 49 43 57
 | 4 18---12--26---36--50---44--58
 5 19 | 13 27 37 51 45 59 |
 | 6 20 14 28 38 52 |46 60
 7--21-|-15--29---39--53---47 61 |
 8 22 16 30 40 54 48 62
 23 | 31 55 | 63 |
 24-----32-----56-----64

/CP
 1-----56-----41-----32
 | 63 10 23 |34
 62 18 11 39 22 58 35 15
 | 4 48---53--25---44-- 8---29--49
 7 45 | 50 28 47 5 26 52 |
 | 57 19 16 38 17 59 |40 14
 60--24-|-13--33---20--64---37 9 |
 6 42 51 31 46 2 27 55
 43 | 30 3 | 54 |
 21-----36-----61-----12

22/ProtoT /CP
 1-----10-----34-----41
 | 2 9 33 |42
 4 18 11 25 35 49 44 58
 | 3 17---12--26---36--50---43--57
 6 19 | 13 28 37 52 46 59 |
 | 5 20 14 27 38 51 |45 60
 7--21-|-16--30---40--54---47 61 |
 8 22 15 29 39 53 48 62
 24 | 31 55 | 64 |
 23-----32-----56-----63

/CP
 1-----56-----41-----32
 | 64 9 24 |33
 62 17 11 40 22 57 35 16
 | 3 48---54--25---43-- 8---30--49
 7 46 | 50 27 47 6 26 51 |
 | 58 19 15 38 18 59 |39 14
 60--23-|-13--34---20--63---37 10 |
 5 42 52 31 45 2 28 55
 44 | 29 4 | 53 |
 21-----36-----61-----12

25/ProtoT /CP
 1----- 9-----17-----25
 | 2 10 18 |26
 3 33 11 41 19 49 27 57
 | 4 34---12--42---20--50---28--58
 5 35 | 13 43 21 51 29 59 |
 | 6 36 14 44 22 52 |30 60
 7--37-|-15--45---23--53---31 61 |
 8 38 16 46 24 54 32 62
 39 | 47 55 | 63 |
 40-----48-----56-----64

/CP
 1-----56-----25-----48
 | 63 10 39 |18
 62 34 11 23 38 58 19 15
 | 4 32---53--41---28-- 8---45--49
 7 29 | 50 44 31 5 42 52 |
 | 57 35 16 22 33 59 |24 14
 60--40-|-13--17---36--64---21 9 |
 6 26 51 47 30 2 43 55
 27 | 46 3 | 54 |
 37-----20-----61-----12

28/ProtoT /CP
 1-----10-----18-----25
 | 2 9 17 |26
 4 34 11 41 19 49 28 58
 | 3 33---12--42---20--50---27--57
 6 35 | 13 44 21 52 30 59 |
 | 5 36 14 43 22 51 |29 60
 7--37-|-16--46---24--54---31 61 |
 8 38 15 45 23 53 32 62
 40 | 47 55 | 64 |
 39-----48-----56-----63

/CP
 1-----56-----25-----48
 | 64 9 40 |17
 62 33 11 24 38 57 19 16
 | 3 32---54--41---27-- 8---46--49
 7 30 | 50 43 31 6 42 51 |
 | 58 35 15 22 34 59 |23 14
 60--39-|-13--18---36--63---21 10 |
 5 26 52 47 29 2 44 55
 28 | 45 4 | 53 |
 37-----20-----61-----12

31/ProtoT /CP

1-----19-----35-----49
 | 3 17 33 |51
 7 4 21 18 37 34 55 52
 | 5 2---23--20---39--36---53--50
 11 6 | 25 24 41 40 59 54 |
 | 9 8 27 22 43 38 |57 56
 13--10-|-31--28---47--44---61 58 |
 15 12 29 26 45 42 63 60
 16 | 30 46 64 |
 14-----32-----48-----62

1-----48-----49-----32
 |64 17 16 |33
 60 2 21 47 12 50 37 31
 | 5 63---44--18---53--15---28--34
 13 59 | 36 22 61 11 20 38 |
 |52 6 29 43 4 54 |45 27
 56--14-|-25--35---8--62---41 19 |
 9 51 40 30 57 3 24 46
 55 | 26 7 42 |
 10-----39-----58-----23

46/ProtoT /CP

1-----21-----37-----49
 | 5 17 33 |53
 7 6 19 18 35 34 55 54
 | 3 2---23--22---39--38---51--50
 13 4 | 25 24 41 40 61 52 |
 | 9 8 29 20 45 36 |57 56
 11--10-|-31--30---47--46---59 58 |
 15 14 27 26 43 42 63 62
 16 | 28 44 64 |
 12-----32-----48-----60

1-----48-----49-----32
 |64 17 16 |33
 62 2 19 47 14 50 35 31
 | 3 63---46--18---51--15---30--34
 11 61 | 38 20 59 13 22 36 |
 |54 4 27 45 6 52 |43 29
 56--12-|-25--37---8--60---41 21 |
 9 53 40 28 57 5 24 44
 55 | 26 7 42 |
 10-----39-----58-----23

61/ProtoT /CP

1-----25-----41-----49
 | 9 17 33 |57
 11 10 19 18 35 34 59 58
 | 3 2---27--26---43--42---51--50
 13 4 | 21 28 37 44 61 52 |
 | 5 12 29 20 45 36 |53 60
 7--6-|-31--30---47--46---55 54 |
 15 14 23 22 39 38 63 62
 16 | 24 40 64 |
 8-----32-----48-----56

1-----48-----49-----32
 |64 17 16 |33
 62 2 19 47 14 50 35 31
 | 3 63---46--18---51--15---30--34
 7 61 | 42 20 55 13 26 36 |
 |58 4 23 45 10 52 |39 29
 60--8-|-21--41---12--56---37 25 |
 5 57 44 24 53 9 28 40
 59 | 22 11 38 |
 6-----43-----54-----27

76/ProtoT /CP

1-----25-----49-----41
 |17 9 33 |57
 19 18 11 10 35 34 59 58
 | 3 2---27--26---51--50---43--42
 21 4 | 13 28 37 52 61 44 |
 | 5 20 29 12 53 36 |45 60
 7--6-|-31--30---55--54---47 46 |
 23 22 15 14 39 38 63 62
 24 | 16 40 64 |
 8-----32-----56-----48

1-----56-----41-----32
 |64 9 24 |33
 62 2 11 55 22 42 35 31
 | 3 63---54--10---43--23---30--34
 7 61 | 50 12 47 21 26 36 |
 |58 4 15 53 18 44 |39 29
 60--8-|-13--49---20--48---37 25 |
 5 57 52 16 45 17 28 40
 59 | 14 19 38 |
 6-----51-----46-----27

91/ProtoT /CP

1-----41-----49-----25
 |33 9 17 |57
 35 34 11 10 19 18 59 58
 | 3 2---43--42---51--50---27--26
 37 4 | 13 44 21 52 61 28 |
 | 5 36 45 12 53 20 |29 60
 7--6-|-47--46---55--54---31 30 |
 39 38 15 14 23 22 63 62
 40 | 16 24 64 |
 8-----48-----56-----32

1-----56-----25-----48
 |64 9 40 |17
 62 2 11 55 38 26 19 47
 | 3 63---54--10---27--39---46--18
 7 61 | 50 12 31 37 42 20 |
 |58 4 15 53 34 28 |23 45
 60--8-|-13--49---36--32---21 41 |
 5 57 52 16 29 33 44 24
 59 | 14 35 22 |
 6-----51-----30-----43

** Monitor List of Solution Counts according to the value of n43 **
 [32: 15], [48: 15], [56: 15], [60: 15], [62: 15], [63: 15], [64: 15]
 [Total Count = 105] OK!

#7. Prototype Cubes and 'Composite & Complete' Pan-magic Cubes of Order 4

For the next step I want to recompose all the 960 standard solutions of 'Composite & Complete' pan-magic cubes of order 4, by applying the single 'DAM Transformation' 960 times one after another to every of 960 Prototype cubes.

As you know, new object 'C&C' PMC444 is usually designed and composed under lots of 'Composite Conditions' and also with the 'Complete Conditions', defining all complementary pairs of 65 situated only on its pan-triagonals. It is a special type of Composite PMC444 and makes a subset of 960 solutions among the 6720 ones.

** Sample List of 'Composite & Complete' Pan-Magic Cubes 4x4x4 **

```

1#
1-----48-----49-----32
|63      18      15      |34
60  4   21  45   12  52   37  29
| 6  62---43--19---54--14---27--35
13 57 | 36  24   61  9   20  40 |
|51  7   30  42   3  55   |46  26
56--16-|--25--33--- 8--64---41 17 |
 10 50   39  31   58  2   23  47
    53 |    28      5      44 |
    11-----38-----59-----22

9#
1-----48-----49-----32
|63      18      15      |34
62  6   19  43   14  54   35  27
| 4  60---45--21---52--12---29--37
11 57 | 38  24   59  9   22  40 |
|53  7   28  42   5  55   |44  26
56--16-|--25--33--- 8--64---41 17 |
 10 50   39  31   58  2   23  47
    51 |    30      3      46 |
    13-----36-----61-----20

17#
1-----48-----49-----32
|60      21      12      |37
62  6   19  43   14  54   35  27
| 7  63---42--18---55--15---26--34
11 57 | 38  24   59  9   22  40 |
|50  4   31  45   2  52   |47  29
56--16-|--25--33--- 8--64---41 17 |
 13 53   36  28   61  5   20  44
    51 |    30      3      46 |
    10-----39-----58-----23

25#
5-----44-----53-----28
|64      17      16      |33
58  2   23  47   10  50   39  31
| 3  59---46--22---51--11---30--38
15 61 | 34  20   63  13   18  36 |
|54  8   27  41   6  56   |43  25
52--12-|--29--37--- 4--60---45 21 |
  9 49   40  32   57  1   24  48
    55 |    26      7      42 |
    14-----35-----62-----19

33#
5-----44-----53-----28
|59      22      11      |38
58  2   23  47   10  50   39  31
| 8  64---41--17---56--16---25--33
15 61 | 34  20   63  13   18  36 |
|49  3   32  46   1  51   |48  30
52--12-|--29--37--- 4--60---45 21 |
 14 54   35  27   62  6   19  43
    55 |    26      7      42 |
    9-----40-----57-----24

41#
5-----44-----53-----28
|59      22      11      |38
64  8   17  41   16  56   33  25
| 2  58---47--23---50--10---31--39
 9 61 | 40  20   57  13   24  36 |
|55  3   26  46   7  51   |42  30
52--12-|--29--37--- 4--60---45 21 |
 14 54   35  27   62  6   19  43
    49 |    32      1      48 |
    15-----34-----63-----18

```

But what do we have to do and prepare for our new job?

First of all, we usually have to pick up one representative solution out of our object cubes, assume it for the 'Model' and write the rules of 'DAM Transformation' after it.

But we may well choose the same Model and dictate the same rules with the last case of 'C&P' MC444, because the Model already belongs to the set of 'C&C' PMC444. We now don't have to change anything but the following "Complete Conditions".

**** Complete Conditions for Prototype Cubes: CC=65 ****

n1+n64=CC; n2+n63=CC; n3+n62=CC; n4+n61=CC;
 n5+n60=CC; n6+n59=CC; n7+n58=CC; n8+n57=CC;
 n9+n56=CC; n10+n55=CC; n11+n54=CC; n12+n53=CC;
 n13+n52=CC; n14+n51=CC; n15+n50=CC; n16+n49=CC;
 n17+n48=CC; n18+n47=CC; n19+n46=CC; n20+n45=CC;
 n21+n44=CC; n22+n43=CC; n23+n42=CC; n24+n41=CC;
 n25+n40=CC; n26+n39=CC; n27+n38=CC; n28+n37=CC;
 n29+n36=CC; n30+n35=CC; n31+n34=CC; n32+n33=CC;
 n33+n32=CC;

**** Three Basic Conditions for Prototype Cubes: C=130 ****

n1+n63+n4+n62=C ... b1; n1+n60+n13+n56=C ... b2; n1+n48+n49+n32=C ... b3;

Prototype/								/Model											
1	-----	17	-----	33	-----	49		1	-----	48	-----	49	-----	32					
	2		18		34		50		63		18		15		34				
5	3	21	19	37	35	53	51	60	4	21	45	12	52	37	29				
	6	4	---22	---20	---38	---36	---54	---52		6	62	---43	---19	---54	---14	---27	---35		
9	7		25	23	41	39	57	55		13	57		36	24	61	9	20	40	
	10	8	26	24	42	40	58	56		51	7	30	42	3	55	46	26		
13	---11	---	---29	---27	---45	---43	---61	59		56	---16	---	---25	---33	---8	---64	---41	17	
	14	12	30	28	46	44	62	60		10	50	39	31	58	2	23	47		
		15		31		47	63				53		28		5	44			
		16	-----	32	-----	48	-----	64			11	-----	38	-----	59	-----	22		

Let me skip listing out those many 'Composite Conditions' again, and come to our conclusion soon.

I solved our new 'inverse function' of DAMT with my assistant PC, composed 960 Prototype cubes, applied DAMT one after another to each Prototype, and finally recomposed our object cubes, 960 standard solutions of 'C&C' PMC444.

The next list shows a part of my recent result.

**** Prototype Cubes and 'Composite & Complete' Pan-magic Cubes 444 ****

1/ProtoT								/CC											
1	-----	17	-----	33	-----	49		1	-----	48	-----	49	-----	32					
	2		18		34		50		63		18		15		34				
5	3	21	19	37	35	53	51	60	4	21	45	12	52	37	29				
	6	4	---22	---20	---38	---36	---54	---52		6	62	---43	---19	---54	---14	---27	---35		
9	7		25	23	41	39	57	55		13	57		36	24	61	9	20	40	
	10	8	26	24	42	40	58	56		51	7	30	42	3	55	46	26		
13	---11	---	---29	---27	---45	---43	---61	59		56	---16	---	---25	---33	---8	---64	---41	17	
	14	12	30	28	46	44	62	60		10	50	39	31	58	2	23	47		
		15		31		47	63				53		28		5	44			
		16	-----	32	-----	48	-----	64			11	-----	38	-----	59	-----	22		

7/ProtoT								/CC											
1	-----	17	-----	33	-----	49		1	-----	48	-----	49	-----	32					
	2		18		34		50		63		18		15		34				
9	3	25	19	41	35	57	51	56	4	25	45	8	52	41	29				
	10	4	---26	---20	---42	---36	---58	---52		10	62	---39	---19	---58	---14	---23	---35		
5	11		21	27	37	43	53	59		13	53		36	28	61	5	20	44	
	6	12	22	28	38	44	54	60		51	11	30	38	3	59	46	22		
13	---7	---	---29	---23	---45	---39	---61	55		60	---16	---	---21	---33	---12	---64	---37	17	
	14	8	30	24	46	40	62	56		6	50	43	31	54	2	27	47		
		15		31		47	63				57		24		9	40			
		16	-----	32	-----	48	-----	64			7	-----	42	-----	55	-----	26		

11/ProtoT /CC

1-----33-----9-----41	1-----32-----41-----56
2 34 10 42	63 34 23 10
17 3 49 35 25 11 57 43	48 4 49 29 8 44 25 53
18 4--50--36--26--12--58--44	18 62--15--35--58--22--39--11
5 19 37 51 13 27 45 59	21 45 12 52 61 5 36 28
6 20 38 52 14 28 46 60	43 19 54 14 3 59 30 38
21--7- -53--39--29--15--61 47	60--24- -37--9--20--64---13 33
22 8 54 40 30 16 62 48	6 42 27 55 46 2 51 31
23 55 31 63	57 40 17 16
24-----56-----32-----64	7-----26-----47-----50

13/ProtoT /CC

1-----17-----33-----49	1-----48-----49-----32
2 18 34 50	63 18 15 34
3 5 19 21 35 37 51 53	62 6 19 43 14 54 35 27
4 6--20--22--36--38--52--54	4 60--45--21--52--12--29--37
9 7 25 23 41 39 57 55	11 57 38 24 59 9 22 40
10 8 26 24 42 40 58 56	53 7 28 42 5 55 44 26
11--13- -27--29--43--45--59 61	56--16- -25--33--8--64---41 17
12 14 28 30 44 46 60 62	10 50 39 31 58 2 23 47
15 31 47 63	51 30 3 46
16-----32-----48-----64	13-----36-----61-----20

25/ProtoT /CC

1-----17-----33-----49	1-----48-----49-----32
2 18 34 50	63 18 15 34
3 9 19 25 35 41 51 57	62 10 19 39 14 58 35 23
4 10--20--26--36--42--52--58	4 56--45--25--52--8--29--41
5 11 21 27 37 43 53 59	7 53 42 28 55 5 26 44
6 12 22 28 38 44 54 60	57 11 24 38 9 59 40 22
7--13- -23--29--39--45--55 61	60--16- -21--33--12--64---37 17
8 14 24 30 40 46 56 62	6 50 43 31 54 2 27 47
15 31 47 63	51 30 3 46
16-----32-----48-----64	13-----36-----61-----20

37/ProtoT /CC

1-----9-----33-----41	1-----56-----41-----32
2 10 34 42	63 10 23 34
3 17 11 25 35 49 43 57	62 18 11 39 22 58 35 15
4 18--12--26--36--50--44--58	4 48--53--25--44--8--29--49
5 19 13 27 37 51 45 59	7 45 50 28 47 5 26 52
6 20 14 28 38 52 46 60	57 19 16 38 17 59 40 14
7--21- -15--29--39--53--47 61	60--24- -13--33--20--64---37 9
8 22 16 30 40 54 48 62	6 42 51 31 46 2 27 55
23 31 55 63	43 30 3 54
24-----32-----56-----64	21-----36-----61-----12

49/ProtoT /CC

1-----9-----17-----25	1-----56-----25-----48
2 10 18 26	63 10 39 18
3 33 11 41 19 49 27 57	62 34 11 23 38 58 19 15
4 34--12--42--20--50--28--58	4 32--53--41--28--8--45--49
5 35 13 43 21 51 29 59	7 29 50 44 31 5 42 52
6 36 14 44 22 52 30 60	57 35 16 22 33 59 24 14
7--37- -15--45--23--53--31 61	60--40- -13--17--36--64---21 9
8 38 16 46 24 54 32 62	6 26 51 47 30 2 43 55
39 47 55 63	27 46 3 54
40-----48-----56-----64	37-----20-----61-----12

61/ProtoT /CC

1-----17-----33-----49
 | 3 19 35 |51
 5 2 21 18 37 34 53 50
 | 7 4--23--20--39--36--55--52
 9 6 | 25 22 41 38 57 54 |
 |11 8 27 24 43 40 |59 56
 13--10-|-29--26--45--42--61 58 |
 15 12 31 28 47 44 63 60
 14 | 30 46 62 |
 16-----32-----48-----64

1-----48-----49-----32
 |62 19 14 |35
 60 4 21 45 12 52 37 29
 | 7 63--42--18--55--15--26--34
 13 57 | 36 24 61 9 20 40 |
 |50 6 31 43 2 54 |47 27
 56--16-|-25--33-- 8--64--41 17 |
 11 51 38 30 59 3 22 46
 53 | 28 5 44 |
 10-----39-----58-----23

97/ProtoT /CC

1-----17-----33-----49
 | 5 21 37 |53
 9 2 25 18 41 34 57 50
 |13 6--29--22--45--38--61--54
 3 10 | 19 26 35 42 51 58 |
 | 7 14 23 30 39 46 |55 62
 11-- 4-|-27--20--43--36--59 52 |
 15 8 31 24 47 40 63 56
 12 | 28 44 60 |
 16-----32-----48-----64

1-----48-----49-----32
 |60 21 12 |37
 56 6 25 43 8 54 41 27
 |13 63--36--18--61--15--20--34
 11 51 | 38 30 59 3 22 46 |
 |50 10 31 39 2 58 |47 23
 62--16-|-19--33--14--64--35 17 |
 7 53 42 28 55 5 26 44
 57 | 24 9 40 |
 4-----45-----52-----29

115/ProtoT /CC

1-----33----- 5-----37
 | 9 41 13 |45
 17 2 49 34 21 6 53 38
 |25 10--57--42--29--14--61--46
 3 18 | 35 50 7 22 39 54 |
 |11 26 43 58 15 30 |47 62
 19-- 4-|-51--36--23-- 8--55 40 |
 27 12 59 44 31 16 63 48
 20 | 52 24 56 |
 28-----60-----32-----64

1-----32-----37-----60
 |56 41 20 |13
 48 10 49 23 12 46 21 51
 |25 63-- 8--34--61--27--36-- 6
 19 39 | 14 58 55 3 42 30 |
 |38 18 59 15 2 54 |31 43
 62--28-|-35-- 5--26--64-- 7 33 |
 11 45 22 52 47 9 50 24
 53 | 44 17 16 |
 4-----29-----40-----57

121/ProtoT /CC

2-----18-----34-----50
 | 1 17 33 |49
 6 4 22 20 38 36 54 52
 | 5 3--21--19--37--35--53--51
 10 8 | 26 24 42 40 58 56 |
 | 9 7 25 23 41 39 |57 55
 14--12-|-30--28--46--44--62 60 |
 13 11 29 27 45 43 61 59
 16 | 32 48 64 |
 15-----31-----47-----63

2-----47-----50-----31
 |64 17 16 |33
 59 3 22 46 11 51 38 30
 | 5 61--44--20--53--13--28--36
 14 58 | 35 23 62 10 19 39 |
 |52 8 29 41 4 56 |45 25
 55--15-|-26--34-- 7--63--42 18 |
 9 49 40 32 57 1 24 48
 54 | 27 6 43 |
 12-----37-----60-----21

241/ProtoT /CC

3-----19-----35-----51
 | 1 17 33 |49
 7 4 23 20 39 36 55 52
 | 5 2--21--18--37--34--53--50
 11 8 | 27 24 43 40 59 56 |
 | 9 6 25 22 41 38 |57 54
 15--12-|-31--28--47--44--63 60 |
 13 10 29 26 45 42 61 58
 16 | 32 48 64 |
 14-----30-----46-----62

3-----46-----51-----30
 |64 17 16 |33
 58 2 23 47 10 50 39 31
 | 5 61--44--20--53--13--28--36
 15 59 | 34 22 63 11 18 38 |
 |52 8 29 41 4 56 |45 25
 54--14-|-27--35-- 6--62--43 19 |
 9 49 40 32 57 1 24 48
 55 | 26 7 42 |
 12-----37-----60-----21

337/ProtoT /CC

4-----20-----36-----52
 | 2 18 34 |50
 8 3 24 19 40 35 56 51
 | 6 1---22--17---38--33---54--49
 12 7 | 28 23 44 39 60 55 |
 |10 5 26 21 42 37 |58 53
 16--11-|-32--27---48--43---64 59 |
 14 9 30 25 46 41 62 57
 15 | 31 47 |63 |
 13-----29-----45-----61

4-----45-----52-----29
 |63 18 15 |34
 57 1 24 48 9 49 40 32
 | 6 62---43--19---54--14---27--35
 16 60 | 33 21 64 12 17 37 |
 |51 7 30 42 3 55 |46 26
 53--13-|-28--36--- 5--61---44 20 |
 10 50 39 31 58 2 23 47
 56 | 25 8 |41 |
 11-----38-----59-----22

433/ProtoT /CC

5-----21-----37-----53
 | 1 17 33 |49
 7 6 23 22 39 38 55 54
 | 3 2---19--18---35--34---51--50
 13 8 | 29 24 45 40 61 56 |
 | 9 4 25 20 41 36 |57 52
 15--14-|-31--30---47--46---63 62 |
 11 10 27 26 43 42 59 58
 16 | 32 48 |64 |
 12-----28-----44-----60

5-----44-----53-----28
 |64 17 16 |33
 58 2 23 47 10 50 39 31
 | 3 59---46--22---51--11---30--38
 15 61 | 34 20 63 13 18 36 |
 |54 8 27 41 6 56 |43 25
 52--12-|-29--37--- 4--60---45 21 |
 9 49 40 32 57 1 24 48
 55 | 26 7 |42 |
 14-----35-----62-----19

505/ProtoT /CC

6-----22-----38-----54
 | 2 18 34 |50
 8 5 24 21 40 37 56 53
 | 4 1---20--17---36--33---52--49
 14 7 | 30 23 46 39 62 55 |
 |10 3 26 19 42 35 |58 51
 16--13-|-32--29---48--45---64 61 |
 12 9 28 25 44 41 60 57
 15 | 31 47 |63 |
 11-----27-----43-----59

6-----43-----54-----27
 |63 18 15 |34
 57 1 24 48 9 49 40 32
 | 4 60---45--21---52--12---29--37
 16 62 | 33 19 64 14 17 35 |
 |53 7 28 42 5 55 |44 26
 51--11-|-30--38--- 3--59---46 22 |
 10 50 39 31 58 2 23 47
 56 | 25 8 |41 |
 13-----36-----61-----20

577/ProtoT /CC

7-----23-----39-----55
 | 3 19 35 |51
 8 5 24 21 40 37 56 53
 | 4 1---20--17---36--33---52--49
 15 6 | 31 22 47 38 63 54 |
 |11 2 27 18 43 34 |59 50
 16--13-|-32--29---48--45---64 61 |
 12 9 28 25 44 41 60 57
 14 | 30 46 |62 |
 10-----26-----42-----58

7-----42-----55-----26
 |62 19 14 |35
 57 1 24 48 9 49 40 32
 | 4 60---45--21---52--12---29--37
 16 63 | 33 18 64 15 17 34 |
 |53 6 28 43 5 54 |44 27
 50--10-|-31--39--- 2--58---47 23 |
 11 51 38 30 59 3 22 46
 56 | 25 8 |41 |
 13-----36-----61-----20

631/ProtoT /CC

8-----24-----40-----56
 | 4 20 36 |52
 7 6 23 22 39 38 55 54
 | 3 2---19--18---35--34---51--50
 16 5 | 32 21 48 37 64 53 |
 |12 1 28 17 44 33 |60 49
 15--14-|-31--30---47--46---63 62 |
 11 10 27 26 43 42 59 58
 13 | 29 45 |61 |
 9-----25-----41-----57

8-----41-----56-----25
 |61 20 13 |36
 58 2 23 47 10 50 39 31
 | 3 59---46--22---51--11---30--38
 15 64 | 34 17 63 16 18 33 |
 |54 5 27 44 6 53 |43 28
 49-- 9-|-32--40--- 1--57---48 24 |
 12 52 37 29 60 4 21 45
 55 | 26 7 |42 |
 14-----35-----62-----19

685/ProtoT /CC

9-----25-----41-----57
 | 1 17 33 |49
 11 10 27 26 43 42 59 58
 | 3 2---19--18---35--34---51--50
 13 12 | 29 28 45 44 61 60 |
 | 5 4 21 20 37 36 |53 52
 15--14-|-31--30---47--46---63 62 |
 7 6 23 22 39 38 55 54
 16 | 32 48 64 |
 8-----24-----40-----56

9-----40-----57-----24
 |64 17 16 |33
 54 2 27 47 6 50 43 31
 | 3 55---46--26---51-- 7---30--42
 15 61 | 34 20 63 13 18 36 |
 |58 12 23 37 10 60 |39 21
 52-- 8-|-29--41--- 4--56---45 25 |
 5 49 44 32 53 1 28 48
 59 | 22 11 38 |
 14-----35-----62-----19

733/ProtoT /CC

10-----26-----42-----58
 | 2 18 34 |50
 12 9 28 25 44 41 60 57
 | 4 1---20--17---36--33---52--49
 14 11 | 30 27 46 43 62 59 |
 | 6 3 22 19 38 35 |54 51
 16--13-|-32--29---48--45---64 61 |
 8 5 24 21 40 37 56 53
 15 | 31 47 63 |
 7-----23-----39-----55

10-----39-----58-----23
 |63 18 15 |34
 53 1 28 48 5 49 44 32
 | 4 56---45--25---52-- 8---29--41
 16 62 | 33 19 64 14 17 35 |
 |57 11 24 38 9 59 |40 22
 51-- 7-|-30--42--- 3--55---46 26 |
 6 50 43 31 54 2 27 47
 60 | 21 12 37 |
 13-----36-----61-----20

781/ProtoT /CC

11-----27-----43-----59
 | 3 19 35 |51
 12 9 28 25 44 41 60 57
 | 4 1---20--17---36--33---52--49
 15 10 | 31 26 47 42 63 58 |
 | 7 2 23 18 39 34 |55 50
 16--13-|-32--29---48--45---64 61 |
 8 5 24 21 40 37 56 53
 14 | 30 46 62 |
 6-----22-----38-----54

11-----38-----59-----22
 |62 19 14 |35
 53 1 28 48 5 49 44 32
 | 4 56---45--25---52-- 8---29--41
 16 63 | 33 18 64 15 17 34 |
 |57 10 24 39 9 58 |40 23
 50-- 6-|-31--43--- 2--54---47 27 |
 7 51 42 30 55 3 26 46
 60 | 21 12 37 |
 13-----36-----61-----20

811/ProtoT /CC

12-----28-----44-----60
 | 4 20 36 |52
 11 10 27 26 43 42 59 58
 | 3 2---19--18---35--34---51--50
 16 9 | 32 25 48 41 64 57 |
 | 8 1 24 17 40 33 |56 49
 15--14-|-31--30---47--46---63 62 |
 7 6 23 22 39 38 55 54
 13 | 29 45 61 |
 5-----21-----37-----53

12-----37-----60-----21
 |61 20 13 |36
 54 2 27 47 6 50 43 31
 | 3 55---46--26---51-- 7---30--42
 15 64 | 34 17 63 16 18 33 |
 |58 9 23 40 10 57 |39 24
 49-- 5-|-32--44--- 1--53---48 28 |
 8 52 41 29 56 4 25 45
 59 | 22 11 38 |
 14-----35-----62-----19

841/ProtoT /CC

13-----29-----45-----61
 | 5 21 37 |53
 9 14 25 30 41 46 57 62
 | 1 6---17--22---33--38---49--54
 15 10 | 31 26 47 42 63 58 |
 | 7 2 23 18 39 34 |55 50
 11--16-|-27--32---43--48---59 64 |
 3 8 19 24 35 40 51 56
 12 | 28 44 60 |
 4-----20-----36-----52

13-----36-----61-----20
 |60 21 12 |37
 56 6 25 43 8 54 41 27
 | 1 51---48--30---49-- 3---32--46
 11 63 | 38 18 59 15 22 34 |
 |62 10 19 39 14 58 |35 23
 50-- 4-|-31--45--- 2--52---47 29 |
 7 53 42 28 55 5 26 44
 57 | 24 9 40 |
 16-----33-----64-----17

853/ProtoT /CC

14-----30-----46-----62
 | 6 22 38 |54
 10 13 26 29 42 45 58 61
 | 2 5--18--21--34--37--50--53
 16 9 | 32 25 48 41 64 57 |
 | 8 1 24 17 40 33 |56 49
 12--15-|-28--31---44--47---60 63 |
 4 7 20 23 36 39 52 55
 11 | 27 43 59 |
 3-----19-----35-----51

14-----35-----62-----19
 |59 22 11 |38
 55 5 26 44 7 53 42 28
 | 2 52--47--29--50-- 4--31--45
 12 64 | 37 17 60 16 21 33 |
 |61 9 20 40 13 57 |36 24
 49-- 3-|-32--46--- 1--51---48 30 |
 8 54 41 27 56 6 25 43
 58 | 23 10 39 |
 15-----34-----63-----18

865/ProtoT /CC

17-----49-----25-----57
 | 1 33 9 |41
 19 18 51 50 27 26 59 58
 | 3 2--35--34--11--10--43--42
 21 20 | 53 52 29 28 61 60 |
 | 5 4 37 36 13 12 |45 44
 23--22-|-55--54---31--30---63 62 |
 7 6 39 38 15 14 47 46
 24 | 56 32 64 |
 8-----40-----16-----48

17-----16-----57-----40
 |64 33 24 | 9
 46 2 51 31 6 42 27 55
 | 3 47--30--50--43-- 7--54--26
 23 61 | 10 36 63 21 34 12 |
 |58 20 39 13 18 60 |15 37
 44-- 8-|-53--25--- 4--48---29 49 |
 5 41 28 56 45 1 52 32
 59 | 38 19 14 |
 22-----11-----62-----35

889/ProtoT /CC

18-----50-----26-----58
 | 2 34 10 |42
 20 17 52 49 28 25 60 57
 | 4 1--36--33--12-- 9--44--41
 22 19 | 54 51 30 27 62 59 |
 | 6 3 38 35 14 11 |46 43
 24--21-|-56--53---32--29---64 61 |
 8 5 40 37 16 13 48 45
 23 | 55 31 63 |
 7-----39-----15-----47

18-----15-----58-----39
 |63 34 23 |10
 45 1 52 32 5 41 28 56
 | 4 48--29--49--44-- 8--53--25
 24 62 | 9 35 64 22 33 11 |
 |57 19 40 14 17 59 |16 38
 43-- 7-|-54--26--- 3--47---30 50 |
 6 42 27 55 46 2 51 31
 60 | 37 20 13 |
 21-----12-----61-----36

913/ProtoT /CC

19-----51-----27-----59
 | 3 35 11 |43
 20 17 52 49 28 25 60 57
 | 4 1--36--33--12-- 9--44--41
 23 18 | 55 50 31 26 63 58 |
 | 7 2 39 34 15 10 |47 42
 24--21-|-56--53---32--29---64 61 |
 8 5 40 37 16 13 48 45
 22 | 54 30 62 |
 6-----38-----14-----46

19-----14-----59-----38
 |62 35 22 |11
 45 1 52 32 5 41 28 56
 | 4 48--29--49--44-- 8--53--25
 24 63 | 9 34 64 23 33 10 |
 |57 18 40 15 17 58 |16 39
 42-- 6-|-55--27--- 2--46---31 51 |
 7 43 26 54 47 3 50 30
 60 | 37 20 13 |
 21-----12-----61-----36

925/ProtoT /CC

20-----52-----28-----60
 | 4 36 12 |44
 19 18 51 50 27 26 59 58
 | 3 2--35--34--11--10--43--42
 24 17 | 56 49 32 25 64 57 |
 | 8 1 40 33 16 9 |48 41
 23--22-|-55--54---31--30---63 62 |
 7 6 39 38 15 14 47 46
 21 | 53 29 61 |
 5-----37-----13-----45

20-----13-----60-----37
 |61 36 21 |12
 46 2 51 31 6 42 27 55
 | 3 47--30--50--43-- 7--54--26
 23 64 | 10 33 63 24 34 9 |
 |58 17 39 16 18 57 |15 40
 41-- 5-|-56--28--- 1--45---32 52 |
 8 44 25 53 48 4 49 29
 59 | 38 19 14 |
 22-----11-----62-----35

937/ProtoT	/CC
21-----53-----29-----61	21-----12-----61-----36
5 37 13 45	60 37 20 13
17 22 49 54 25 30 57 62	48 6 49 27 8 46 25 51
1 6---33---38--- 9--14---41--46	1 43---32---54---41-- 3---56--30
23 18 55 50 31 26 63 58	19 63 14 34 59 23 38 10
7 2 39 34 15 10 47 42	62 18 35 15 22 58 11 39
19--24- -51--56---27--32---59 64	42-- 4- -55--29--- 2--44---31 53
3 8 35 40 11 16 43 48	7 45 26 52 47 5 50 28
20 52 28 60	57 40 17 16
4-----36-----12-----44	24----- 9-----64-----33

943/ProtoT	/CC
22-----54-----30-----62	22-----11-----62-----35
6 38 14 46	59 38 19 14
18 21 50 53 26 29 58 61	47 5 50 28 7 45 26 52
2 5---34---37---10--13---42--45	2 44---31---53---42-- 4---55--29
24 17 56 49 32 25 64 57	20 64 13 33 60 24 37 9
8 1 40 33 16 9 48 41	61 17 36 16 21 57 12 40
20--23- -52--55---28--31---60 63	41-- 3- -56--30--- 1--43---32 54
4 7 36 39 12 15 44 47	8 46 25 51 48 6 49 27
19 51 27 59	58 39 18 15
3-----35-----11-----43	23-----10-----63-----34

949/ProtoT	/CC
25-----57-----29-----61	25----- 8-----61-----36
9 41 13 45	56 41 20 13
17 26 49 58 21 30 53 62	48 10 49 23 12 46 21 51
1 10---33---42--- 5--14---37--46	1 39---32---58---37-- 3---60--30
27 18 59 50 31 22 63 54	19 63 14 34 55 27 42 6
11 2 43 34 15 6 47 38	62 18 35 15 26 54 7 43
19--28- -51--60---23--32---55 64	38-- 4- -59--29--- 2--40---31 57
3 12 35 44 7 16 39 48	11 45 22 52 47 9 50 24
20 52 24 56	53 44 17 16
4-----36----- 8-----40	28----- 5-----64-----33

955/ProtoT	/CC
26-----58-----30-----62	26----- 7-----62-----35
10 42 14 46	55 42 19 14
18 25 50 57 22 29 54 61	47 9 50 24 11 45 22 52
2 9---34---41--- 6--13---38--45	2 40---31---57---38-- 4---59--29
28 17 60 49 32 21 64 53	20 64 13 33 56 28 41 5
12 1 44 33 16 5 48 37	61 17 36 16 25 53 8 44
20--27- -52--59---24--31---56 63	37-- 3- -60--30--- 1--39---32 58
4 11 36 43 8 15 40 47	12 46 21 51 48 10 49 23
19 51 23 55	54 43 18 15
3-----35----- 7-----39	27----- 6-----63-----34

** Monitor List of Solution Counts according to the Values of n1 **

```
[ 1: 120] [ 2: 120] [ 3: 96] [ 4: 96] [ 5: 72] [ 6: 72] [ 7: 54] [ 8: 54]
[ 9: 48] [10: 48] [11: 30] [12: 30] [13: 12] [14: 12] [15: 0] [16: 0]
[17: 24] [18: 24] [19: 12] [20: 12] [21: 6] [22: 6] [23: 0] [24: 0]
[25: 6] [26: 6] [27: 0] [28: 0] [29: 0] [30: 0] [31: 0] [32: 0]
[Count = 960] OK!
```

I am sure we could successfully recomposed all what we have just wanted.

The 120 solutions with n1=1 and n43=64 are just the same with the 120 solutions we recomposed before for Composite pan-magic cubes with n1=1 and n43=64.

#8. The Fundamental 15 Solutions of 'Composite & Complete' PMC444

How about recomposing those beautiful Fundamental Solutions of 'C&C' PMC444, then? I remember we once composed 15 pieces of them and studied hard long ago about how to transform them into the other 6 types of C&P MC444 Fundamentals.

Can we really remake them only by our DAM Transformation and Prototype cubes?

We don't have to change anything of the Model, rules of transformation, 'Composite Conditions' for Prototypes and 'Complete Conditions'.

We only have to add the next two conditions as follows: ->

** Fundamental 15 Solutions of Prototypes and 'Composite & Complete' PMC444 **

1/ProtoT							/CC						
1-----17-----33-----49	1-----48-----49-----32												
2 18 34 50	63 18 15 34												
5 3 21 19 37 35 53 51	60 4 21 45 12 52 37 29												
6 4---22--20---38--36---54--52	6 62---43--19---54--14---27--35												
9 7 25 23 41 39 57 55	13 57 36 24 61 9 20 40												
10 8 26 24 42 40 58 56	51 7 30 42 3 55 46 26												
13--11- -29--27---45--43---61 59	56--16- -25--33--- 8--64---41 17												
14 12 30 28 46 44 62 60	10 50 39 31 58 2 23 47												
15 31 47 63	53 28 5 44												
16-----32-----48-----64	11-----38-----59-----22												

2/ProtoT							/CC						
1----- 9-----33-----41	1-----56-----41-----32												
2 10 34 42	63 10 23 34												
5 3 13 11 37 35 45 43	60 4 13 53 20 44 37 29												
6 4---14--12---38--36---46--44	6 62---51--11---46--22---27--35												
17 7 25 15 49 39 57 47	21 57 36 16 61 17 12 40												
18 8 26 16 50 40 58 48	43 7 30 50 3 47 54 26												
21--19- -29--27---53--51---61 59	48--24- -25--33--- 8--64---49 9												
22 20 30 28 54 52 62 60	18 42 39 31 58 2 15 55												
23 31 55 63	45 28 5 52												
24-----32-----56-----64	19-----38-----59-----14												

3/ProtoT							/CC						
1----- 9-----17-----25	1-----56-----25-----48												
2 10 18 26	63 10 39 18												
5 3 13 11 21 19 29 27	60 4 13 53 36 28 21 45												
6 4---14--12---22--20---30--28	6 62---51--11---30--38---43--19												
33 7 41 15 49 23 57 31	37 57 20 16 61 33 12 24												
34 8 42 16 50 24 58 32	27 7 46 50 3 31 54 42												
37--35- -45--43---53--51---61 59	32--40- -41--17--- 8--64---49 9												
38 36 46 44 54 52 62 60	34 26 23 47 58 2 15 55												
39 47 55 63	29 44 5 52												
40-----48-----56-----64	35-----22-----59-----14												

4/ProtoT							/CC						
1-----17-----33-----49	1-----48-----49-----32												
2 18 34 50	63 18 15 34												
3 5 19 21 35 37 51 53	62 6 19 43 14 54 35 27												
4 6---20--22---36--38---52--54	4 60---45--21---52--12---29--37												
9 7 25 23 41 39 57 55	11 57 38 24 59 9 22 40												
10 8 26 24 42 40 58 56	53 7 28 42 5 55 44 26												
11--13- -27--29---43--45---59 61	56--16- -25--33--- 8--64---41 17												
12 14 28 30 44 46 60 62	10 50 39 31 58 2 23 47												
15 31 47 63	51 30 3 46												
16-----32-----48-----64	13-----36-----61-----20												

5/ProtoT				/CC
1-----9-----33-----41	1-----56-----41-----32			
2 10 34 42	63 10 23 34			
3 5 11 13 35 37 43 45	62 6 11 51 22 46 35 27			
4 6---12---14---36---38---44---46	4 60---53---13---44---20---29---37			
17 7 25 15 49 39 57 47	19 57 38 16 59 17 14 40			
18 8 26 16 50 40 58 48	45 7 28 50 5 47 52 26			
19--21- -27--29--51--53--59 61	48--24- -25--33--8--64--49 9			
20 22 28 30 52 54 60 62	18 42 39 31 58 2 15 55			
23 31 55 63	43 30 3 54			
24-----32-----56-----64	21-----36-----61-----12			

6/ProtoT				/CC
1-----9-----17-----25	1-----56-----25-----48			
2 10 18 26	63 10 39 18			
3 5 11 13 19 21 27 29	62 6 11 51 38 30 19 43			
4 6---12---14---20---22---28---30	4 60---53---13---28---36---45---21			
33 7 41 15 49 23 57 31	35 57 22 16 59 33 14 24			
34 8 42 16 50 24 58 32	29 7 44 50 5 31 52 42			
35--37- -43--45--51--53--59 61	32--40- -41--17--8--64--49 9			
36 38 44 46 52 54 60 62	34 26 23 47 58 2 15 55			
39 47 55 63	27 46 3 54			
40-----48-----56-----64	37-----20-----61-----12			

7/ProtoT				/CC
1-----17-----33-----49	1-----48-----49-----32			
2 18 34 50	63 18 15 34			
3 9 19 25 35 41 51 57	62 10 19 39 14 58 35 23			
4 10---20---26---36---42---52---58	4 56---45---25---52--8---29---41			
5 11 21 27 37 43 53 59	7 53 42 28 55 5 26 44			
6 12 22 28 38 44 54 60	57 11 24 38 9 59 40 22			
7--13- -23--29--39--45--55 61	60--16- -21--33--12--64--37 17			
8 14 24 30 40 46 56 62	6 50 43 31 54 2 27 47			
15 31 47 63	51 30 3 46			
16-----32-----48-----64	13-----36-----61-----20			

8/ProtoT				/CC
1-----5-----33-----37	1-----60-----37-----32			
2 6 34 38	63 6 27 34			
3 9 7 13 35 41 39 45	62 10 7 51 26 46 35 23			
4 10---8--14---36---42---40---46	4 56---57---13---40---20---29---41			
17 11 21 15 49 43 53 47	19 53 42 16 55 17 14 44			
18 12 22 16 50 44 54 48	45 11 24 50 9 47 52 22			
19--25- -23--29--51--57--55 61	48--28- -21--33--12--64--49 5			
20 26 24 30 52 58 56 62	18 38 43 31 54 2 15 59			
27 31 59 63	39 30 3 58			
28-----32-----60-----64	25-----36-----61-----8			

9/ProtoT				/CC
1-----5-----17-----21	1-----60-----21-----48			
2 6 18 22	63 6 43 18			
3 9 7 13 19 25 23 29	62 10 7 51 42 30 19 39			
4 10---8--14---20---26---24---30	4 56---57---13---24---36---45---25			
33 11 37 15 49 27 53 31	35 53 26 16 55 33 14 28			
34 12 38 16 50 28 54 32	29 11 40 50 9 31 52 38			
35--41- -39--45--51--57--55 61	32--44- -37--17--12--64--49 5			
36 42 40 46 52 58 56 62	34 22 27 47 54 2 15 59			
43 47 59 63	23 46 3 58			
44-----48-----60-----64	41-----20-----61-----8			

10/ProtoT /CC

1-----9-----33-----41	1-----56-----41-----32
2 10 34 42	63 10 23 34
3 17 11 25 35 49 43 57	62 18 11 39 22 58 35 15
4 18---12---26---36---50---44---58	4 48---53---25---44---8---29---49
5 19 13 27 37 51 45 59	7 45 50 28 47 5 26 52
6 20 14 28 38 52 46 60	57 19 16 38 17 59 40 14
7--21- -15--29--39--53--47 61	60--24- -13--33--20--64--37 9
8 22 16 30 40 54 48 62	6 42 51 31 46 2 27 55
23 31 55 63	43 30 3 54
24-----32-----56-----64	21-----36-----61-----12

11/ProtoT /CC

1-----5-----33-----37	1-----60-----37-----32
2 6 34 38	63 6 27 34
3 17 7 21 35 49 39 53	62 18 7 43 26 54 35 15
4 18---8---22---36---50---40---54	4 48---57---21---40---12---29---49
9 19 13 23 41 51 45 55	11 45 50 24 47 9 22 52
10 20 14 24 42 52 46 56	53 19 16 42 17 55 44 14
11--25- -15--29--43--57--47 61	56--28- -13--33--20--64--41 5
12 26 16 30 44 58 48 62	10 38 51 31 46 2 23 59
27 31 59 63	39 30 3 58
28-----32-----60-----64	25-----36-----61-----8

12/ProtoT /CC

1-----5-----9-----13	1-----60-----13-----56
2 6 10 14	63 6 51 10
3 17 7 21 11 25 15 29	62 18 7 43 50 30 11 39
4 18---8---22---12---26---16---30	4 48---57---21---16---36---53---25
33 19 37 23 41 27 45 31	35 45 26 24 47 33 22 28
34 20 38 24 42 28 46 32	29 19 40 42 17 31 44 38
35--49- -39--53--43--57--47 61	32--52- -37--9---20--64--41 5
36 50 40 54 44 58 48 62	34 14 27 55 46 2 23 59
51 55 59 63	15 54 3 58
52-----56-----60-----64	49-----12-----61-----8

13/ProtoT /CC

1-----9-----17-----25	1-----56-----25-----48
2 10 18 26	63 10 39 18
3 33 11 41 19 49 27 57	62 34 11 23 38 58 19 15
4 34---12---42---20---50---28---58	4 32---53---41---28---8---45---49
5 35 13 43 21 51 29 59	7 29 50 44 31 5 42 52
6 36 14 44 22 52 30 60	57 35 16 22 33 59 24 14
7--37- -15--45--23--53--31 61	60--40- -13--17--36--64--21 9
8 38 16 46 24 54 32 62	6 26 51 47 30 2 43 55
39 47 55 63	27 46 3 54
40-----48-----56-----64	37-----20-----61-----12

14/ProtoT /CC

1-----5-----17-----21	1-----60-----21-----48
2 6 18 22	63 6 43 18
3 33 7 37 19 49 23 53	62 34 7 27 42 54 19 15
4 34---8---38---20---50---24---54	4 32---57---37---24---12---45---49
9 35 13 39 25 51 29 55	11 29 50 40 31 9 38 52
10 36 14 40 26 52 30 56	53 35 16 26 33 55 28 14
11--41- -15--45--27--57--31 61	56--44- -13--17--36--64--25 5
12 42 16 46 28 58 32 62	10 22 51 47 30 2 39 59
43 47 59 63	23 46 3 58
44-----48-----60-----64	41-----20-----61-----8

15/ProtoT										/CC									
1-----	5-----	9-----	13-----							1-----	60-----	13-----	56-----						
2	6	10	14							63	6	51	10						
3 33	7 37	11 41	15 45							62 34	7 27	50 46	11 23						
4 34---	8--38---	12--42---	16--46							4 32---	57--37---	16--20---	53--41						
17 35 21 39	25 43	29 47								19 29 42 40	31 17	38 44							
18 36	22 40	26 44	30 48							45 35	24 26	33 47	28 22						
19--49-	-23--53---	-27--57---	31 61							48--52-	-21--9---	-36--64---	25 5						
20 50	24 54	28 58	32 62							18 14	43 55	30 2	39 59						
51	55	59	63							15	54	3	58						
52-----	56-----	60-----	64-----							49-----	12-----	61-----	8-----						

[Count = 15] OK!

->

- (1) $n1==1$; to the Basic Conditions
- (2) $n63>n62$; $n60>n56$; $n48>n32$; to the set of Inequality Conditions:
 $n1<n62$; $n1<n56$; $n1<n11$; $n1<n32$; $n1<n35$; $n1<n41$; $n1<n22$; $n63>n60>n48$;

The result list above is just the same with the set of Fundamental 15 solutions of C&C pan-magic cubes of order 4. Prototype set demonstrates how the Basic Form can be transformed into the others. How beautiful it is!

These 15 Fundamentals must be the real fundamental solutions for all 105 ones of C&P MC444, that means they could reconstruct all 6720 standard solutions.

#9. Discussion

It is again in this chapter that we are taught everything by the Model solution.

- (1) We are taught how to make the rules of 'DAM Transformation'.
- (2) We are taught how to design the 'inverse function' of DAMT.
- (3) We are taught how to make all Prototype cubes.
- (4) We are taught how to recompose our object solutions.

How amazing it is that this single Model could make everything in reality!

What does our teacher do for his role? What does this Model mean? What makes all those miracles possible?

I don't yet know much about it, but I am still concerned with the meaning that the Model knows everything: the application 'DAMT', all Prototype solutions, all Object solutions and the beautiful one-to-one correspondence between them.

Does this Model mean it acts as the Only-one Most Fundamental Solution of all?

I am now thinking about it.

(First Edition written in English on July 21, 2001;

Revised New Edition on March 13, 2007 with MacOSX and Xcode2.2)

by Kanji Setsuda: E-Mail Address <jag12001@nifty.com>

** Appendix: Program List **

```

/** 'Prototype' Cubes of Order 4 and 'Composite & Pan-triagonal' **/
/** Magic Cubes of Order 4 Reconstructed by 'DAM Transformation' **/
/** 'ProtoMC4CP.c' built by Kanji Setsuda **/
/** on Jan. 12, 2005; Mar. 4, 2007; **/
/** Working on MacOSX and Xcode 2.2 **/
/**/
#include <stdio.h>
/**/
/* Global Var. */
short cnt;

```

```

short CC, LSM;
short nm[65], uflg[65];
short anm[841][65];
short tnm[65];
short p[3][65];
/**/
/* Functions(Sub-Routines) */
void stp01(void), stp02(void), stp03(void), stp04(void);
void stp05(void), stp06(void), stp07(void), stp08(void);
void stp09(void), stp10(void), stp11(void), stp12(void);
void stp13(void), stp14(void), stp15(void), stp16(void);
void stp17(void), stp18(void), stp19(void), stp20(void);
void stp21(void), stp22(void), stp23(void), stp24(void);
void stp25(void), stp26(void), stp27(void), stp28(void);
void stp29(void), stp30(void), stp31(void), stp32(void);
void stp33(void), stp34(void), stp35(void), stp36(void);
void stp37(void), stp38(void), stp39(void), stp40(void);
void stp41(void), stp42(void), stp43(void), stp44(void);
void stp45(void), stp46(void), stp47(void), stp48(void);
void stp49(void), stp50(void), stp51(void), stp52(void);
void stp53(void), stp54(void), stp55(void), stp56(void);
void stp57(void), stp58(void), stp59(void), stp60(void);
void stp61(void), stp62(void), stp63(void), stp64(void);
void ansrecord(void), pr2ans(void);
void damt(void);
void prsol(void);
void srtsol(void), excsol(short x);
/**/
/* Main Program */
int main(){
short n;
printf("\n** 'Prototype' Cubes of Order 4 and 'Composite & Pan-triagonal' **\n");
printf("** Magic Cubes of Order 4 Reconstructed by 'DAM Transformation' **\n");
LSM=130; CC=65; cnt=0;
for(n=0; n<65; n++){nm[n]=0; uflg[n]=0;}
stp01(); /* Begin the Calculations */
srtsol();
prsol();
printf("\n [Count = %d] OK!\n", cnt);
return 0;
}
/* Begin the Calculations */
/* Define Level 1: */
/* Set N1=1 */
void stp01(){
short a;
for(a=1; a<2; a++){
if(uflg[a]==0){
nm[1]=a; uflg[a]=1;
stp02();
uflg[a]=0;}
}
}
/* Set N63 */
void stp02(){
short a;
for(a=64; a>0; a--){
if(uflg[a]==0){
nm[63]=a; uflg[a]=1;
stp03();
uflg[a]=0;}
}
}
/* Set N62(>n1) */
void stp03(){

```

```

short a;
for(a=64; a>nm[1]; a--){
    if(uflg[a]==0){
        nm[62]=a; uflg[a]=1;
        stp04();
        uflg[a]=0; }
    }
}
/* Set n4=130-n1-n63-n62 */
void stp04(){
    short a;
    a=LSM-nm[1]-nm[63]-nm[62];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[4]=a; uflg[a]=1;
            stp05();
            uflg[a]=0; }}
    }
}
/* Set N60(<n63) */
void stp05(){
    short a;
    for(a=nm[63]-1; a>0; a--){
        if(uflg[a]==0){
            nm[60]=a; uflg[a]=1;
            stp06();
            uflg[a]=0; }
        }
    }
}
/* Set n6=130-n1-n63-n60 */
void stp06(){
    short a;
    a=LSM-nm[1]-nm[63]-nm[60];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[6]=a; uflg[a]=1;
            stp07();
            uflg[a]=0; }}
    }
}
/* Set n57=130-n63-n4-n6 */
void stp07(){
    short a;
    a=LSM-nm[63]-nm[4]-nm[6];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[57]=a; uflg[a]=1;
            stp08();
            uflg[a]=0; }}
    }
}
/* Set n7=130-n4-n62-n57 */
void stp08(){
    short a, b;
    a=LSM-nm[4]-nm[62]-nm[57];
    if((0<a)&&(a<65)){
        b=LSM-nm[62]-nm[1]-nm[60];
        if((a==b)&&(uflg[a]==0)){
            nm[7]=a; uflg[a]=1;
            stp09();
            uflg[a]=0; }}
    }
}
/* Define Level 2: */
/* Set N56(>n1) */
void stp09(){
    short a;
    for(a=64; a>nm[1]; a--){
        if(uflg[a]==0){

```

```

        nm[56]=a; uflg[a]=1;
        stp10();
        uflg[a]=0; }
    }
}
/* Set n13=130-n1-n60-n56 */
void stp10(){
    short a;
    a=LSM-nm[1]-nm[60]-nm[56];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[13]=a; uflg[a]=1;
            stp11();
            uflg[a]=0; }}
}
/* Set n51=130-n60-n6-n13 */
void stp11(){
    short a;
    a=LSM-nm[60]-nm[6]-nm[13];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[51]=a; uflg[a]=1;
            stp12();
            uflg[a]=0; }}
}
/* Set n16=130-n6-n57-n51 */
void stp12(){
    short a;
    a=LSM-nm[6]-nm[57]-nm[51];
    if((0<a)&&(a<65)){
        if(uflg[a]==0){
            nm[16]=a; uflg[a]=1;
            stp13();
            uflg[a]=0; }}
}
/* Set n50=130-n57-n7-n16 */
void stp13(){
    short a, b;
    a=LSM-nm[57]-nm[7]-nm[16];
    if((0<a)&&(a<65)){
        b=LSM-nm[7]-nm[60]-nm[13];
        if((a==b)&&(uflg[a]==0)){
            nm[50]=a; uflg[a]=1;
            stp14();
            uflg[a]=0; }}
}
/* Set n10=130-n13-n51-n56 */
void stp14(){
    short a, b;
    a=LSM-nm[13]-nm[51]-nm[56];
    if((0<a)&&(a<65)){
        b=LSM-nm[56]-nm[1]-nm[63];
        if((a==b)&&(uflg[a]==0)){
            nm[10]=a; uflg[a]=1;
            stp15();
            uflg[a]=0; }}
}
/* Set n53=130-n51-n16-n10 */
void stp15(){
    short a, b;
    a=LSM-nm[51]-nm[16]-nm[10];
    if((0<a)&&(a<65)){
        b=LSM-nm[10]-nm[63]-nm[4];
        if((a==b)&&(uflg[a]==0)){
            nm[53]=a; uflg[a]=1;

```

```

        stp16();
        ufl g[a]=0; }}
}
/* Set n11=130-n16-n50-n53 & n1<n11 */
void stp16(){
    short a, b, c, d;
    a=LSM-nm[16]-nm[50]-nm[53];
    if((nm[1]<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[50]-nm[13]-nm[56];
        c=LSM-nm[53]-nm[4]-nm[62];
        d=LSM-nm[56]-nm[62]-nm[1];
        if((a==b)&&(a==c)&&(a==d)){
            nm[11]=a; ufl g[a]=1;
            stp17();
            ufl g[a]=0; }}
}
/* Define Level 3: */
/* Set n48(<n60) */
void stp17(){
    short a;
    for(a=nm[60]-1; a>0; a--){
        if(ufl g[a]==0){
            nm[48]=a; ufl g[a]=1;
            stp18();
            ufl g[a]=0; }
    }
}
/* Set N32(>n1) */
void stp18(){
    short a;
    for(a=64; a>nm[1]; a--){
        if(ufl g[a]==0){
            nm[32]=a; ufl g[a]=1;
            stp19();
            ufl g[a]=0; }
    }
}
/* Set n49=130-n1-n48-n32 */
void stp19(){
    short a;
    a=LSM-nm[1]-nm[48]-nm[32];
    if((0<a)&&(a<65)){
        if(ufl g[a]==0){
            nm[49]=a; ufl g[a]=1;
            stp20();
            ufl g[a]=0; }}
}
/* Set n18=130-n1-n63-n48 */
void stp20(){
    short a;
    a=LSM-nm[1]-nm[63]-nm[48];
    if((0<a)&&(a<65)){
        if(ufl g[a]==0){
            nm[18]=a; ufl g[a]=1;
            stp21();
            ufl g[a]=0; }}
}
/* Set n45=130-n63-n4-n18 */
void stp21(){
    short a;
    a=LSM-nm[63]-nm[4]-nm[18];
    if((0<a)&&(a<65)){
        if(ufl g[a]==0){
            nm[45]=a; ufl g[a]=1;
            stp22();

```



```

        ufl g[a]=0; }}
}
/* Set n19=130-n4-n62-n45 */
void stp22(){
    short a, b;
    a=LSM-nm[4]-nm[62]-nm[45];
    if((0<a)&&(a<65)){
        b=LSM-nm[62]-nm[1]-nm[48];
        if((a==b)&&(ufl g[a]==0)){
            nm[19]=a; ufl g[a]=1;
            stp23();
            ufl g[a]=0; }}
}
/* Set n15=130-n48-n49-n18 */
void stp23(){
    short a;
    a=LSM-nm[48]-nm[49]-nm[18];
    if((0<a)&&(a<65)){
        if(ufl g[a]==0){
            nm[15]=a; ufl g[a]=1;
            stp24();
            ufl g[a]=0; }}
}
/* Set n52=130-n18-n15-n45 */
void stp24(){
    short a;
    a=LSM-nm[18]-nm[15]-nm[45];
    if((0<a)&&(a<65)){
        if(ufl g[a]==0){
            nm[52]=a; ufl g[a]=1;
            stp25();
            ufl g[a]=0; }}
}
/* Set n14=130-n45-n52-n19 */
void stp25(){
    short a, b;
    a=LSM-nm[45]-nm[52]-nm[19];
    if((0<a)&&(a<65)){
        b=LSM-nm[19]-nm[48]-nm[49];
        if((a==b)&&(ufl g[a]==0)){
            nm[14]=a; ufl g[a]=1;
            stp26();
            ufl g[a]=0; }}
}
/* Set n34=130-n49-n32-n15 */
void stp26(){
    short a, b;
    a=LSM-nm[49]-nm[32]-nm[15];
    if((0<a)&&(a<65)){
        b=LSM-nm[32]-nm[1]-nm[63];
        if((a==b)&&(ufl g[a]==0)){
            nm[34]=a; ufl g[a]=1;
            stp27();
            ufl g[a]=0; }}
}
/* Set n29=130-n15-n34-n52 */
void stp27(){
    short a, b;
    a=LSM-nm[15]-nm[34]-nm[52];
    if((0<a)&&(a<65)){
        b=LSM-nm[34]-nm[63]-nm[4];
        if((a==b)&&(ufl g[a]==0)){
            nm[29]=a; ufl g[a]=1;
            stp28();
            ufl g[a]=0; }}
}

```

```

}
/* Set n35=130-n52-n29-n14 & n1<n35 */
void stp28(){
  short a, b, c, d;
  a=LSM-nm[52]-nm[29]-nm[14];
  if((nm[1]<a)&&(a<65)&&(uflg[a]==0)){
    b=LSM-nm[29]-nm[4]-nm[62];
    c=LSM-nm[14]-nm[49]-nm[32];
    d=LSM-nm[32]-nm[62]-nm[1];
    if((a==b)&&(a==c)&&(a==d)){
      nm[35]=a; uflg[a]=1;
      stp29();
      uflg[a]=0; }}
}
/* Define Level 4: */
/* Set n21=130-n1-n48-n60 */
void stp29(){
  short a;
  a=LSM-nm[1]-nm[48]-nm[60];
  if((0<a)&&(a<65)){
    if(uflg[a]==0){
      nm[21]=a; uflg[a]=1;
      stp30();
      uflg[a]=0; }}
}
/* Set n36=130-n60-n21-n13 */
void stp30(){
  short a;
  a=LSM-nm[60]-nm[21]-nm[13];
  if((0<a)&&(a<65)){
    if(uflg[a]==0){
      nm[36]=a; uflg[a]=1;
      stp31();
      uflg[a]=0; }}
}
/* Set n25=130-n13-n36-n56 */
void stp31(){
  short a, b;
  a=LSM-nm[13]-nm[36]-nm[56];
  if((0<a)&&(a<65)){
    b=LSM-nm[56]-nm[1]-nm[48];
    if((a==b)&&(uflg[a]==0)){
      nm[25]=a; uflg[a]=1;
      stp32();
      uflg[a]=0; }}
}
/* Set n12=130-n48-n49-n21 */
void stp32(){
  short a;
  a=LSM-nm[48]-nm[49]-nm[21];
  if((0<a)&&(a<65)){
    if(uflg[a]==0){
      nm[12]=a; uflg[a]=1;
      stp33();
      uflg[a]=0; }}
}
/* Set n61=130-n21-n12-n36 */
void stp33(){
  short a;
  a=LSM-nm[21]-nm[12]-nm[36];
  if((0<a)&&(a<65)){
    if(uflg[a]==0){
      nm[61]=a; uflg[a]=1;
      stp34();
      uflg[a]=0; }}
}

```

```

}
/* Set n8=130-n36-n61-n25 */
void stp34(){
  short a, b;
  a=LSM-nm[36]-nm[61]-nm[25];
  if((0<a)&&(a<65)){
    b=LSM-nm[25]-nm[48]-nm[49];
    if((a==b)&&(uflg[a]==0)){
      nm[8]=a; uflg[a]=1;
      stp35();
      uflg[a]=0; }}
}
/* Set n37=130-n49-n32-n12 */
void stp35(){
  short a, b;
  a=LSM-nm[49]-nm[32]-nm[12];
  if((0<a)&&(a<65)){
    b=LSM-nm[32]-nm[1]-nm[60];
    if((a==b)&&(uflg[a]==0)){
      nm[37]=a; uflg[a]=1;
      stp36();
      uflg[a]=0; }}
}
/* Set n20=130-n12-n37-n61 */
void stp36(){
  short a, b;
  a=LSM-nm[12]-nm[37]-nm[61];
  if((0<a)&&(a<65)){
    b=LSM-nm[37]-nm[60]-nm[13];
    if((a==b)&&(uflg[a]==0)){
      nm[20]=a; uflg[a]=1;
      stp37();
      uflg[a]=0; }}
}
/* Set n41=130-n61-n20-n8 & n1<n41 */
void stp37(){
  short a, b, c, d;
  a=LSM-nm[61]-nm[20]-nm[8];
  if((nm[1]<a)&&(a<65)&&(uflg[a]==0)){
    b=LSM-nm[20]-nm[13]-nm[56];
    c=LSM-nm[8]-nm[49]-nm[32];
    d=LSM-nm[1]-nm[32]-nm[56];
    if((a==b)&&(a==c)&&(a==d)){
      nm[41]=a; uflg[a]=1;
      stp38();
      uflg[a]=0; }}
}
/* Define Level 5: */
/* Set n43=130-n63-n18-n6 */
void stp38(){
  short a, b, c;
  a=LSM-nm[63]-nm[18]-nm[6];
  if((0<a)&&(a<65)&&(uflg[a]==0)){
    b=LSM-nm[60]-nm[21]-nm[6];
    c=LSM-nm[48]-nm[18]-nm[21];
    if((a==b)&&(a==c)){
      nm[43]=a; uflg[a]=1;
      stp39();
      uflg[a]=0; }}
}
/* Set n30=130-n6-n43-n51 */
void stp39(){
  short a, b, c;
  a=LSM-nm[6]-nm[43]-nm[51];
  if((0<a)&&(a<65)&&(uflg[a]==0)){

```

```

    b=LSM-nm[13]-nm[36]-nm[51];
    c=LSM-nm[21]-nm[36]-nm[43];
    if((a==b)&&(a==c)){
        nm[30]=a; uflg[a]=1;
        stp40();
        uflg[a]=0; }}
}
/* Set n39=130-n51-n30-n10 */
void stp40(){
    short a, b, c, d, e;
    a=LSM-nm[51]-nm[30]-nm[10];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[56]-nm[25]-nm[10];
        c=LSM-nm[36]-nm[25]-nm[30];
        if((a==b)&&(a==c)){
            d=LSM-nm[10]-nm[63]-nm[18];
            e=LSM-nm[25]-nm[48]-nm[18];
            if((a==d)&&(a==e)){
                nm[39]=a; uflg[a]=1;
                stp41();
                uflg[a]=0; }}}
}
/* Set n24=130-n4-n45-n57 */
void stp41(){
    short a, b, c;
    a=LSM-nm[4]-nm[45]-nm[57];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[6]-nm[43]-nm[57];
        c=LSM-nm[18]-nm[43]-nm[45];
        if((a==b)&&(a==c)){
            nm[24]=a; uflg[a]=1;
            stp42();
            uflg[a]=0; }}
}
/* Set n33=130-n57-n24-n16 */
void stp42(){
    short a, b, c;
    a=LSM-nm[57]-nm[24]-nm[16];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[51]-nm[30]-nm[16];
        c=LSM-nm[43]-nm[30]-nm[24];
        if((a==b)&&(a==c)){
            nm[33]=a; uflg[a]=1;
            stp43();
            uflg[a]=0; }}
}
/* Set n28=130-n16-n33-n53 */
void stp43(){
    short a, b, c, d, e;
    a=LSM-nm[16]-nm[33]-nm[53];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[10]-nm[39]-nm[53];
        c=LSM-nm[30]-nm[39]-nm[33];
        if((a==b)&&(a==c)){
            d=LSM-nm[53]-nm[4]-nm[45];
            e=LSM-nm[39]-nm[18]-nm[45];
            if((a==d)&&(a==e)){
                nm[28]=a; uflg[a]=1;
                stp44();
                uflg[a]=0; }}}
}
/* Set n42=130-n62-n19-n7 */
void stp44(){
    short a, b, c, d, e;
    a=LSM-nm[62]-nm[19]-nm[7];

```

```

    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[57]-nm[24]-nm[7];
        c=LSM-nm[45]-nm[24]-nm[19];
        i f((a==b)&&(a==c)){
            d=LSM-nm[7]-nm[60]-nm[21];
            e=LSM-nm[19]-nm[48]-nm[21];
            i f((a==d)&&(a==e)){
                nm[42]=a; ufl g[a]=1;
                stp45();
                ufl g[a]=0; }}}
}
/* Set n31=130-n7-n42-n50 */
void stp45(){
    short a, b, c, d, e;
    a=LSM-nm[7]-nm[42]-nm[50];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[16]-nm[33]-nm[50];
        c=LSM-nm[24]-nm[33]-nm[42];
        i f((a==b)&&(a==c)){
            d=LSM-nm[50]-nm[13]-nm[36];
            e=LSM-nm[42]-nm[21]-nm[36];
            i f((a==d)&&(a==e)){
                nm[31]=a; ufl g[a]=1;
                stp46();
                ufl g[a]=0; }}}
}
/* Set n38=130-n50-n31-n11 */
void stp46(){
    short a, b, c, d, e, f, g;
    a=LSM-nm[50]-nm[31]-nm[11];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[53]-nm[28]-nm[11];
        c=LSM-nm[33]-nm[28]-nm[31];
        i f((a==b)&&(a==c)){
            d=LSM-nm[11]-nm[62]-nm[19];
            e=LSM-nm[25]-nm[19]-nm[48];
            i f((a==d)&&(a==e)){
                f=LSM-nm[11]-nm[56]-nm[25];
                g=LSM-nm[31]-nm[36]-nm[25];
                i f((a==f)&&(a==g)){
                    nm[38]=a; ufl g[a]=1;
                    stp47();
                    ufl g[a]=0; }}}}}
}
/* Define Level 7: */
/* Set n54=130-n18-n15-n43 */
void stp47(){
    short a, b, c;
    a=LSM-nm[18]-nm[15]-nm[43];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[21]-nm[12]-nm[43];
        c=LSM-nm[49]-nm[12]-nm[15];
        i f((a==b)&&(a==c)){
            nm[54]=a; ufl g[a]=1;
            stp48();
            ufl g[a]=0; }}
}
/* Set n3=130-n43-n54-n30 */
void stp48(){
    short a, b, c;
    a=LSM-nm[43]-nm[54]-nm[30];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[36]-nm[61]-nm[30];
        c=LSM-nm[12]-nm[61]-nm[54];
        i f((a==b)&&(a==c)){

```

```

        nm[3]=a; ufl g[a]=1;
        stp49();
        ufl g[a]=0; }}
}
/* Set n58=130-n30-n3-n39 */
void stp49(){
    short a, b, c, d, e;
    a=LSM-nm[30]-nm[3]-nm[39];
    if((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[25]-nm[8]-nm[39];
        c=LSM-nm[61]-nm[8]-nm[3];
        if((a==b)&&(a==c)){
            d=LSM-nm[39]-nm[18]-nm[15];
            e=LSM-nm[8]-nm[49]-nm[15];
            if((a==d)&&(a==e)){
                nm[58]=a; ufl g[a]=1;
                stp50();
                ufl g[a]=0; }}}
}
/* Set n9=130-n45-n52-n24 */
void stp50(){
    short a, b, c;
    a=LSM-nm[45]-nm[52]-nm[24];
    if((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[43]-nm[54]-nm[24];
        c=LSM-nm[15]-nm[54]-nm[52];
        if((a==b)&&(a==c)){
            nm[9]=a; ufl g[a]=1;
            stp51();
            ufl g[a]=0; }}}
}
/* Set n64=130-n24-n9-n33 */
void stp51(){
    short a, b, c;
    a=LSM-nm[24]-nm[9]-nm[33];
    if((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[30]-nm[3]-nm[33];
        c=LSM-nm[54]-nm[3]-nm[9];
        if((a==b)&&(a==c)){
            nm[64]=a; ufl g[a]=1;
            stp52();
            ufl g[a]=0; }}}
}
/* Set n5=130-n33-n64-n28 */
void stp52(){
    short a, b, c, d, e;
    a=LSM-nm[33]-nm[64]-nm[28];
    if((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[39]-nm[58]-nm[28];
        c=LSM-nm[3]-nm[58]-nm[64];
        if((a==b)&&(a==c)){
            d=LSM-nm[28]-nm[45]-nm[52];
            e=LSM-nm[58]-nm[15]-nm[52];
            if((a==d)&&(a==e)){
                nm[5]=a; ufl g[a]=1;
                stp53();
                ufl g[a]=0; }}}
}
/* Set n55=130-n19-n14-n42 */
void stp53(){
    short a, b, c, d, e;
    a=LSM-nm[19]-nm[14]-nm[42];
    if((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[24]-nm[9]-nm[42];
        c=LSM-nm[52]-nm[9]-nm[14];

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```

    i f((a==b)&&(a==c)){
        d=LSM-nm[42]-nm[21]-nm[12];
        e=LSM-nm[14]-nm[49]-nm[12];
        i f((a==d)&&(a==e)){
            nm[55]=a; ufl g[a]=1;
            stp54();
            ufl g[a]=0; }}}
}
/* Set n2=130-n42-n55-n31 */
void stp54(){
    short a, b, c, d, e;
    a=LSM-nm[42]-nm[55]-nm[31];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[33]-nm[64]-nm[31];
        c=LSM-nm[9]-nm[64]-nm[55];
        i f((a==b)&&(a==c)){
            d=LSM-nm[31]-nm[36]-nm[61];
            e=LSM-nm[55]-nm[12]-nm[61];
            i f((a==d)&&(a==e)){
                nm[2]=a; ufl g[a]=1;
                stp55();
                ufl g[a]=0; }}}
}
/* Set n59=130-n31-n2-n38 */
void stp55(){
    short a, b, c, d, e, f, g;
    a=LSM-nm[31]-nm[2]-nm[38];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[28]-nm[5]-nm[38];
        c=LSM-nm[64]-nm[5]-nm[2];
        i f((a==b)&&(a==c)){
            d=LSM-nm[38]-nm[19]-nm[14];
            e=LSM-nm[38]-nm[25]-nm[8];
            i f((a==d)&&(a==e)){
                f=LSM-nm[2]-nm[61]-nm[8];
                g=LSM-nm[8]-nm[14]-nm[49];
                i f((a==f)&&(a==g)){
                    nm[59]=a; ufl g[a]=1;
                    stp56();
                    ufl g[a]=0; }}}}}
}
/* Set n27=130-n15-n34-n54 */
void stp56(){
    short a, b, c, d, e, f;
    a=LSM-nm[15]-nm[34]-nm[54];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[12]-nm[37]-nm[54];
        c=LSM-nm[32]-nm[37]-nm[34];
        i f((a==b)&&(a==c)){
            d=LSM-nm[34]-nm[63]-nm[6];
            e=LSM-nm[37]-nm[60]-nm[6];
            f=LSM-nm[1]-nm[64]-nm[38];
            i f((a==d)&&(a==e)&&(a==f)){
                nm[27]=a; ufl g[a]=1;
                stp57();
                ufl g[a]=0; }}}
}
/* Set n46=130-n54-n27-n3 */
void stp57(){
    short a, b, c, d, e;
    a=LSM-nm[54]-nm[27]-nm[3];
    i f((0<a)&&(a<65)&&(ufl g[a]==0)){
        b=LSM-nm[61]-nm[20]-nm[3];
        c=LSM-nm[37]-nm[20]-nm[27];
        i f((a==b)&&(a==c)){

```

```

    d=LSM-nm[27]-nm[6]-nm[51];
    e=LSM-nm[20]-nm[13]-nm[51];
    if((a==d)&&(a==e)){
        nm[46]=a; uflg[a]=1;
        stp58();
        uflg[a]=0; }}}
}
/* Set n23=130-n3-n46-n58 */
void stp58(){
    short a, b, c, d, e, f, g, h;
    a=LSM-nm[3]-nm[46]-nm[58];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[8]-nm[41]-nm[58];
        c=LSM-nm[20]-nm[41]-nm[46];
        if((a==b)&&(a==c)){
            d=LSM-nm[46]-nm[51]-nm[10];
            e=LSM-nm[41]-nm[56]-nm[10];
            if((a==d)&&(a==e)){
                f=LSM-nm[58]-nm[15]-nm[34];
                g=LSM-nm[10]-nm[63]-nm[34];
                h=LSM-nm[1]-nm[42]-nm[64];
                if((a==f)&&(a==g)&&(a==h)){
                    nm[23]=a; uflg[a]=1;
                    stp59();
                    uflg[a]=0; }}}}}
}
/* Set n40=130-n52-n29-n9 */
void stp59(){
    short a, b, c, d, e;
    a=LSM-nm[52]-nm[29]-nm[9];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[54]-nm[27]-nm[9];
        c=LSM-nm[34]-nm[27]-nm[29];
        if((a==b)&&(a==c)){
            d=LSM-nm[29]-nm[4]-nm[57];
            e=LSM-nm[27]-nm[6]-nm[57];
            if((a==d)&&(a==e)){
                nm[40]=a; uflg[a]=1;
                stp60();
                uflg[a]=0; }}}
}
/* Set n17=130-n9-n40-n64 */
void stp60(){
    short a, b, c, d, e;
    a=LSM-nm[9]-nm[40]-nm[64];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[3]-nm[46]-nm[64];
        c=LSM-nm[27]-nm[46]-nm[40];
        if((a==b)&&(a==c)){
            d=LSM-nm[40]-nm[57]-nm[16];
            e=LSM-nm[46]-nm[51]-nm[16];
            if((a==d)&&(a==e)){
                nm[17]=a; uflg[a]=1;
                stp61();
                uflg[a]=0; }}}
}
/* Set n44=130-n64-n17-n5 */
void stp61(){
    short a, b, c, d, e, f, g, h;
    a=LSM-nm[64]-nm[17]-nm[5];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[58]-nm[23]-nm[5];
        c=LSM-nm[46]-nm[23]-nm[17];
        if((a==b)&&(a==c)){
            d=LSM-nm[5]-nm[52]-nm[29];

```



```

e=LSM-nm[23]-nm[34]-nm[29];
if((a==d)&&(a==e)){
    f=LSM-nm[17]-nm[16]-nm[53];
    g=LSM-nm[23]-nm[10]-nm[53];
    h=LSM-nm[53]-nm[4]-nm[29];
    if((a==f)&&(a==g)&&(a==h)){
        nm[44]=a; uflg[a]=1;
        stp62();
        uflg[a]=0; }}}
}
/* Set n26=130-n14-n35-n55 */
void stp62(){
    short a, b, c, d, e, f, g, h;
    a=LSM-nm[14]-nm[35]-nm[55];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[9]-nm[40]-nm[55];
        c=LSM-nm[29]-nm[40]-nm[35];
        if((a==b)&&(a==c)){
            d=LSM-nm[35]-nm[62]-nm[7];
            e=LSM-nm[40]-nm[57]-nm[7];
            if((a==d)&&(a==e)){
                f=LSM-nm[55]-nm[12]-nm[37];
                g=LSM-nm[35]-nm[32]-nm[37];
                h=LSM-nm[1]-nm[39]-nm[64];
                if((a==f)&&(a==g)&&(a==h)){
                    nm[26]=a; uflg[a]=1;
                    stp63();
                    uflg[a]=0; }}}
}
}
/* Set n47=130-n55-n26-n2 */
void stp63(){
    short a, b, c, d, e, f, g, h;
    a=LSM-nm[55]-nm[26]-nm[2];
    if((0<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[64]-nm[17]-nm[2];
        c=LSM-nm[40]-nm[17]-nm[26];
        if((a==b)&&(a==c)){
            d=LSM-nm[26]-nm[7]-nm[50];
            e=LSM-nm[17]-nm[16]-nm[50];
            if((a==d)&&(a==e)){
                f=LSM-nm[26]-nm[37]-nm[20];
                g=LSM-nm[2]-nm[61]-nm[20];
                h=LSM-nm[50]-nm[13]-nm[20];
                if((a==f)&&(a==g)&&(a==h)){
                    nm[47]=a; uflg[a]=1;
                    stp64();
                    uflg[a]=0; }}}
}
}
/* Set n22=130-n1-n43-n64 & n1<n22 */
void stp64(){
    short a, b, c, d, e, f, g, h;
    a=LSM-nm[1]-nm[43]-nm[64];
    if((nm[1]<a)&&(a<65)&&(uflg[a]==0)){
        b=LSM-nm[2]-nm[47]-nm[59];
        c=LSM-nm[5]-nm[44]-nm[59];
        if((a==b)&&(a==c)){
            d=LSM-nm[17]-nm[44]-nm[47];
            e=LSM-nm[59]-nm[14]-nm[35];
            if((a==d)&&(a==e)){
                f=LSM-nm[47]-nm[50]-nm[11];
                g=LSM-nm[11]-nm[35]-nm[62];
                h=LSM-nm[59]-nm[8]-nm[41];
                if((a==f)&&(a==g)&&(a==h)){
                    nm[22]=a; uflg[a]=1;
                    ansrecord();
                }
            }
        }
    }
}

```

```

        ufl g[a]=0; }}}}
    }
    /**/
    /* Record the Answers */
    void ansrecord(){
        short n;
        cnt++;
        anm[cnt][0]=cnt;
        for(n=1; n<65; n++){anm[cnt][n]=nm[n]; }
        damt();
    }
    /**/
    /* Print the Answers */
    void prsol (){
        short n, c;
        for(c=1; c<=cnt; c++){
            if(anm[c][2]!=anm[c-1][2]){
                p[0][0]=c;
                for(n=1; n<65; n++){p[0][n]=anm[c][n]; nm[n]=anm[c][n]; }
                damt();
                for(n=1; n<65; n++){p[1][n]=tnm[n]; }
                pr2ans(); }
        }
    }
    /**/
    /* Print the Two Answers */
    void pr2ans(void){
        printf("%29d/ProtoT /CP\n", p[0][0]);
        printf(" %2d-----%2d-----%2d-----%2d ",
            p[0][ 1], p[0][17], p[0][33], p[0][49]);
        printf(" %2d-----%2d-----%2d-----%2d\n",
            p[1][ 1], p[1][17], p[1][33], p[1][49]);
        printf(" |%2d      %2d      %2d      |%2d      ",
            p[0][ 2], p[0][18], p[0][34], p[0][50]);
        printf(" |%2d      %2d      %2d      |%2d\n",
            p[1][ 2], p[1][18], p[1][34], p[1][50]);
        printf(" %2d %2d %2d %2d %2d %2d %2d %2d ",
            p[0][ 5], p[0][ 3], p[0][21], p[0][19], p[0][37], p[0][35], p[0][53], p[0][51]);
        printf(" %2d %2d %2d %2d %2d %2d %2d %2d\n",
            p[1][ 5], p[1][ 3], p[1][21], p[1][19], p[1][37], p[1][35], p[1][53], p[1][51]);
        printf(" |%2d %2d---%2d---%2d---%2d---%2d---%2d---%2d ",
            p[0][ 6], p[0][ 4], p[0][22], p[0][20], p[0][38], p[0][36], p[0][54], p[0][52]);
        printf(" |%2d %2d---%2d---%2d---%2d---%2d---%2d---%2d\n",
            p[1][ 6], p[1][ 4], p[1][22], p[1][20], p[1][38], p[1][36], p[1][54], p[1][52]);
        printf(" %2d %2d | %2d %2d %2d %2d %2d %2d | ",
            p[0][ 9], p[0][ 7], p[0][25], p[0][23], p[0][41], p[0][39], p[0][57], p[0][55]);
        printf(" %2d %2d | %2d %2d %2d %2d %2d %2d | \n",
            p[1][ 9], p[1][ 7], p[1][25], p[1][23], p[1][41], p[1][39], p[1][57], p[1][55]);
        printf(" |%2d %2d %2d %2d %2d %2d |%2d %2d ",
            p[0][10], p[0][ 8], p[0][26], p[0][24], p[0][42], p[0][40], p[0][58], p[0][56]);
        printf(" |%2d %2d %2d %2d %2d %2d |%2d %2d\n",
            p[1][10], p[1][ 8], p[1][26], p[1][24], p[1][42], p[1][40], p[1][58], p[1][56]);
        printf(" %2d--%2d-|-%2d--%2d---%2d--%2d---%2d %2d | ",
            p[0][13], p[0][11], p[0][29], p[0][27], p[0][45], p[0][43], p[0][61], p[0][59]);
        printf(" %2d--%2d-|-%2d--%2d---%2d--%2d---%2d %2d | \n",
            p[1][13], p[1][11], p[1][29], p[1][27], p[1][45], p[1][43], p[1][61], p[1][59]);
        printf(" %2d %2d %2d %2d %2d %2d %2d %2d ",
            p[0][14], p[0][12], p[0][30], p[0][28], p[0][46], p[0][44], p[0][62], p[0][60]);
        printf(" %2d %2d %2d %2d %2d %2d %2d %2d\n",
            p[1][14], p[1][12], p[1][30], p[1][28], p[1][46], p[1][44], p[1][62], p[1][60]);
        printf(" %2d | %2d %2d %2d | ",
            p[0][15], p[0][31], p[0][47], p[0][63]);
        printf(" %2d | %2d %2d %2d | \n",
            p[1][15], p[1][31], p[1][47], p[1][63]);
        printf(" %2d-----%2d-----%2d-----%2d ",

```

```

    p[0][16], p[0][32], p[0][48], p[0][64]);
printf("      %2d-----%2d-----%2d-----%2d\n",
    p[1][16], p[1][32], p[1][48], p[1][64]);
}
/**/
/* Rules of the 'Do-it-After-the-Model Transformation' */
void damt(){
    tnm[1]=nm[1];   tnm[2]=nm[63];   tnm[3]=nm[4];   tnm[4]=nm[62];
    tnm[5]=nm[60];   tnm[6]=nm[6];   tnm[7]=nm[57];   tnm[8]=nm[7];
    tnm[9]=nm[13];   tnm[10]=nm[51];  tnm[11]=nm[16];  tnm[12]=nm[50];
    tnm[13]=nm[56];  tnm[14]=nm[10];  tnm[15]=nm[53];  tnm[16]=nm[11];
    tnm[17]=nm[48];  tnm[18]=nm[18];  tnm[19]=nm[45];  tnm[20]=nm[19];
    tnm[21]=nm[21];  tnm[22]=nm[43];  tnm[23]=nm[24];  tnm[24]=nm[42];
    tnm[25]=nm[36];  tnm[26]=nm[30];  tnm[27]=nm[33];  tnm[28]=nm[31];
    tnm[29]=nm[25];  tnm[30]=nm[39];  tnm[31]=nm[28];  tnm[32]=nm[38];
    tnm[33]=nm[49];  tnm[34]=nm[15];  tnm[35]=nm[52];  tnm[36]=nm[14];
    tnm[37]=nm[12];  tnm[38]=nm[54];  tnm[39]=nm[9];   tnm[40]=nm[55];
    tnm[41]=nm[61];  tnm[42]=nm[3];   tnm[43]=nm[64];  tnm[44]=nm[2];
    tnm[45]=nm[8];   tnm[46]=nm[58];  tnm[47]=nm[5];   tnm[48]=nm[59];
    tnm[49]=nm[32];  tnm[50]=nm[34];  tnm[51]=nm[29];  tnm[52]=nm[35];
    tnm[53]=nm[37];  tnm[54]=nm[27];  tnm[55]=nm[40];  tnm[56]=nm[26];
    tnm[57]=nm[20];  tnm[58]=nm[46];  tnm[59]=nm[17];  tnm[60]=nm[47];
    tnm[61]=nm[41];  tnm[62]=nm[23];  tnm[63]=nm[44];  tnm[64]=nm[22];
}
/**/
/* Sort the Solutions according to n1,n2,... and n5 */
void srtsol (void){
    short m, n, f;
    m=cnt;
    do{f=0;
        for(n=1; n<m; n++){
            if(anm[n][2]>anm[n+1][2]){excsol (n); f=1;}
            else if((anm[n][2]==anm[n+1][2])&&(anm[n][3]>anm[n+1][3])){excsol (n); f=1;}
            else if((anm[n][2]==anm[n+1][2])&&(anm[n][3]==anm[n+1][3])){
                if(anm[n][4]>anm[n+1][4]){excsol (n); f=1;}
                else if((anm[n][4]==anm[n+1][4])&&(anm[n][5]>anm[n+1][5])){excsol (n); f=1;}
                else if((anm[n][4]==anm[n+1][4])&&(anm[n][5]==anm[n+1][5])){
                    if(anm[n][9]>anm[n+1][9]){excsol (n); f=1;}}
            }
        }
        m--; }while(f>0);
}
/* Exchange solution pairs according to their own values */
void excsol (short x){
    short p, sv;
    for(p=1; p<65; p++){sv=anm[x][p]; anm[x][p]=anm[x+1][p]; anm[x+1][p]=sv;}
}
/**/

```