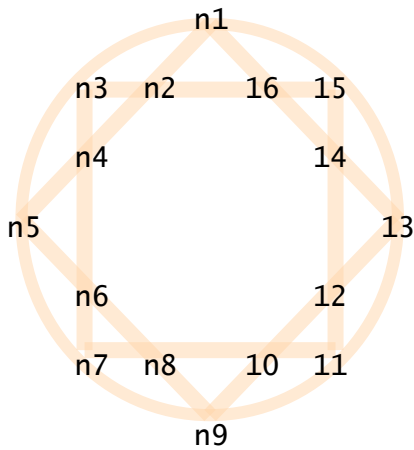


Part 2: Basic Studies of Magic Stars II: Kanji Setsuda

Chapter 5: Algebraic Study of Double-Ringed Magic Stars 8

Let's study about Double-Ringed type of Magic Stars of order 8 next.

Two more numerical elements and one more simultaneous equation are added to the case of order 7. What do they new comers give to our object?



* Basic Definition *

$$\begin{aligned} n1+n2+n4+n5 &= C & \dots & r1 \\ n3+n4+n6+n7 &= C & \dots & r2 \\ n5+n6+n8+n9 &= C & \dots & r3 \\ n7+n8+n10+n11 &= C & \dots & r4 \\ n9+n10+n12+n13 &= C & \dots & r5 \\ n11+n12+n14+n15 &= C & \dots & r6 \\ n13+n14+n16+n1 &= C & \dots & r7 \\ n15+n16+n2+n3 &= C & \dots & r8 \end{aligned}$$

$$\begin{aligned} 2*(n1+n2+n3+\dots+n15+n16) &= 8*C \\ 2*136 &= 8*C \end{aligned}$$

Therefore $C=34 \dots r1$

First of all, I dictated a program and made my computer calculate and list out all the standard solutions of magic star of order 8. The next list shows the recent result.

*** Composing Magic Stars of Order 8 ***

** Collective List of Standard Solutions: **

[Type n1=1:]

1#

```

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

2#

```

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

3#

```

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

4#

```

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

5#

```

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

6#

```

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

7#

```

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

8#

```

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

9#

```

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

10#

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

11#

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

12#

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

13#

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

14#

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

15#

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

16#

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

17#

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

18#

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

19#

1
 10 9 12 3
 16 7
 8 6 14 119
 2 15 4 13
 5

20#

1
 2 12 15 5
 13 7
 8 16 11 13
 10 14 4 6
 3

21#

1
 5 15 3 11
 10 14
 8 2 16
 6 9 12 7
 4

22#

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

23#

1
 3 16 10 5
 9 119
 8 7 12 14
 15 13 2 4
 6

24#

1
 5 16 11 2
 12
 8 7 10
 13 4 3 14
 15

25#

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

26#

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

27#

1
 11 10 5 8
 14 16
 9 7 12
 2 15 13 4
 3

28#

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

29#

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

30#

1
 4 7 8 15
 16 11
 10 2 14
 12 13 6 3
 9

<p>31#</p> <p>14 11 1 4 5 12 13 10 6 7 16 2 15 8 9 3</p>	<p>32#</p> <p>4 14 1 5 11 9 12 10 15 3 16 6 7 13 8 2</p>	<p>33#</p> <p>11 14 1 5 4 9 15 10 6 12 13 8 16 7 3 2</p>
<p>34#</p> <p>8 13 1 6 7 9 15 11 14 12 3 5 16 10 4</p>	<p>35#</p> <p>5 15 1 4 10 7 13 11 8 9 16 14 12 6 2 3</p>	<p>36#</p> <p>14 6 1 9 5 15 11 12 2 10 13 3 16 7 8 4</p>
<p>37#</p> <p>4 15 1 10 5 6 9 12 8 7 14 16 3 2 13 11</p>	<p>38#</p> <p>4 5 1 16 9 15 3 13 8 12 14 7 11 6 10 2</p>	<p>39#</p> <p>5 9 1 16 4 11 3 13 8 12 14 10 7 2 15 6</p>
<p>40#</p> <p>5 11 1 10 8 9 7 13 6 16 14 3 2 15 12</p>	<p>41#</p> <p>4 15 1 8 7 5 11 13 16 14 9 3 12 10 2</p>	<p>42#</p> <p>10 15 1 3 6 5 14 13 8 2 16 11 4 7 12 9</p>
<p>43#</p> <p>6 3 1 13 12 16 5 14 2 15 10 11 4 9 7</p>	<p>44#</p> <p>15 8 1 4 7 11 13 14 5 2 16 3 9 10 12 6</p>	<p>45#</p> <p>8 10 1 4 12 9 13 14 2 6 16 15 11 5 3 7</p>
<p>46#</p> <p>5 13 1 7 9 6 10 14 15 16 8 3 12 11 2</p>	<p>47#</p> <p>9 16 1 7 2 3 11 14 10 15 12 4 5 13 6</p>	<p>48#</p> <p>6 13 1 7 8 5 10 15 14 4 16 9 2 11 12 3</p>
<p>49#</p> <p>9 14 1 5 6 4 12 15 10 16 11 2 8 13 7</p>		

[Type n2=1:]

50#		15				51#		15				52#		15			
	13	1	8	12			11	1	9	13			14	1	6	13	
	2			7			2			6			2			4	
16					4	16					4	16					9
	5			9			7			10			7			12	
	14	3	11	6			14	3	12	5			11	8	10	5	
		10						8						3			
53#		16				54#		16				55#		16			
	13	1	8	12			13	1	6	14			15	1	6	12	
	2			6			2			4			3			4	
15					4	15					8	14					8
	5			9			9			11			7			5	
	14	3	10	7			10	7	12	5			9	2	10	13	
		11						3						11			
56#		14				57#		14				58#		14			
	16	1	5	12			12	1	5	16			12	1	5	16	
	4			2			4			2			4			2	
15					13	15					13	15					13
	6			11			7			10			10			7	
	8	10	7	9			119	8	6				8	6	119		
		3						3						3			
59#		16				60#		16				61#		13			
	11	1	7	15			12	1	6	15			16	1	7	10	
	4			8			4			5			5			8	
13					3	13					7	15					6
	5			9			10			11			4			14	
	14	6	12	2			8	9	14	3			9	12	11	2	
		10						2						3			
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	14	1	10	9			14	1	6	13			16	1	8	9	
	5			6			5			2			6			10	
13					3	12					10	15					4
	11			7			8			4			5			13	
	4	2	16	12			7	3	9	15			7	11	14	2	
		8						11						3			
65#		13				66#		14				67#		12			
	16	1	10	7			15	1	7	11			8	19	16		
	6			9			6			8			7			3	
14					2	13					5	14					10
	4			15			9			3			4			13	
	8	11	12	3			4	2	16	12			15	11	6	2	
		5						10						5			
68#		12				69#		14				70#		9			
	8	19	16		16	1		8	9				7	1	11	15	
	7			3			7			10				8			2
14					10	12					2	16					12
	13			4			6			4			5			13	
	6	2	15	11			5	3	15	11			14	10	6	4	
		5						13						3			

<p>71#</p> <p>11</p> <p>6 1 12 15</p> <p>8 2</p> <p>14 9 12 16</p> <p>4 7</p> <p>16 3 5 10</p> <p>13</p>	<p>72#</p> <p>13</p> <p>16 1 14 3</p> <p>8 5</p> <p>12 2 16 10</p> <p>6 15</p> <p>4 9 10 11</p> <p>7</p>	<p>73#</p> <p>8</p> <p>7 1 12 14</p> <p>9 4</p> <p>16 2 16 10</p> <p>3 5</p> <p>15 2 6 11</p> <p>13</p>
<p>74#</p> <p>8</p> <p>15 1 11 7</p> <p>9 10</p> <p>16 5 16 10</p> <p>4 14</p> <p>6 12 13 3</p> <p>2</p>	<p>75#</p> <p>7</p> <p>13 1 15 5</p> <p>10 4</p> <p>16 8 15 10</p> <p>9 11</p> <p>2 6 12 14</p> <p>3</p>	<p>76#</p> <p>8</p> <p>16 1 14 3</p> <p>10 7</p> <p>15 8 15 10</p> <p>6 13</p> <p>2 9 12 11</p> <p>4</p>
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<p>80#</p> <p>12</p> <p>5 1 13 15</p> <p>10 2</p> <p>11 7 9 10</p> <p>3 9</p> <p>16 6 4 8</p> <p>14</p>	<p>81#</p> <p>14</p> <p>13 1 15 5</p> <p>10 2</p> <p>9 3 15 10</p> <p>7 11</p> <p>4 6 8 16</p> <p>12</p>	<p>82#</p> <p>7</p> <p>9 1 14 10</p> <p>11 5</p> <p>15 8 15 10</p> <p>2 16</p> <p>12 13 6 3</p> <p>4</p>
<p>83#</p> <p>7</p> <p>12 1 13 8</p> <p>11 4</p> <p>15 10 15 10</p> <p>2 16</p> <p>9 14 5 6</p> <p>3</p>	<p>84#</p> <p>7</p> <p>9 1 14 10</p> <p>11 5</p> <p>15 8 13 16</p> <p>12 6</p> <p>2 3 16 13</p> <p>4</p>	<p>85#</p> <p>9</p> <p>5 1 12 16</p> <p>11 7</p> <p>13 6 13 16</p> <p>4 3</p> <p>14 2 10 8</p> <p>15</p>
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<p>89#</p> <p>6</p> <p>3 1 16 14</p> <p>12 4</p> <p>15 8 14 10</p> <p>10 16</p> <p>9 7 13 5</p> <p>2</p>	<p>90#</p> <p>7</p> <p>11 1 13 9</p> <p>12 4</p> <p>14 10 14 10</p> <p>3 16</p> <p>8 15 6 5</p> <p>2</p>	<p>91#</p> <p>7</p> <p>13 1 15 5</p> <p>12 2</p> <p>14 10 14 10</p> <p>3 11</p> <p>6 8 4 16</p> <p>9</p>

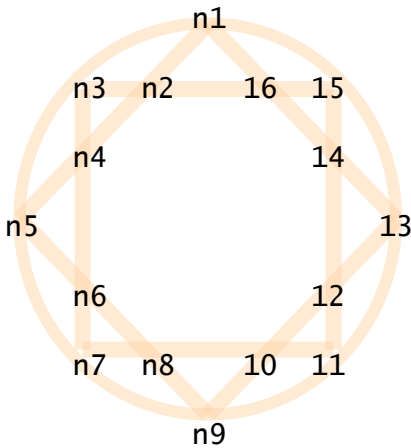
<p>92#</p> <p>4 1 8 14 15</p> <p>12 5</p> <p>13 7</p> <p>2 11</p> <p>16 9 6 3</p> <p>10</p>	<p>93#</p> <p>16 1 8 14 3</p> <p>12 5</p> <p>13 7</p> <p>2 11</p> <p>4 9 6 15</p> <p>10</p>	<p>94#</p> <p>2 1 11 16 15</p> <p>12 3</p> <p>10 4</p> <p>6 9</p> <p>14 5 8 7</p> <p>13</p>
<p>95#</p> <p>12 1 6 16 5</p> <p>13 3</p> <p>14 9</p> <p>2 11</p> <p>7 8 4 15</p> <p>10</p>	<p>96#</p> <p>7 1 8 16 10</p> <p>13 4</p> <p>12 6</p> <p>11 5</p> <p>3 2 14 15</p> <p>9</p>	<p>97#</p> <p>7 1 9 16 10</p> <p>13 4</p> <p>11 5</p> <p>12 6</p> <p>2 3 15 14</p> <p>8</p>
<p>98#</p> <p>3 1 11 16 14</p> <p>13 5</p> <p>9 2</p> <p>6 7</p> <p>12 4 10 8</p> <p>15</p>	<p>99#</p> <p>11 1 3 15 7</p> <p>14 6</p> <p>16 10</p> <p>4 13</p> <p>5 12 9 8</p> <p>2</p>	<p>100#</p> <p>7 1 4 16 10</p> <p>14 2</p> <p>15 12</p> <p>5 13</p> <p>8 11 6 9</p> <p>3</p>
<p>101#</p> <p>8 1 4 16 9</p> <p>14 2</p> <p>15 12</p> <p>5 13</p> <p>7 11 6 10</p> <p>3</p>	<p>102#</p> <p>2 1 6 16 15</p> <p>14 5</p> <p>13 7</p> <p>8 11</p> <p>10 9 12 3</p> <p>4</p>	<p>103#</p> <p>5 1 6 16 12</p> <p>14 3</p> <p>13 9</p> <p>8 4</p> <p>7 2 10 15</p> <p>11</p>
<p>104#</p> <p>7 1 6 15 11</p> <p>14 8</p> <p>13 5</p> <p>9 3</p> <p>4 2 16 12</p> <p>10</p>	<p>105#</p> <p>5 1 7 15 13</p> <p>14 8</p> <p>12 4</p> <p>9 3</p> <p>6 2 16 10</p> <p>11</p>	<p>106#</p> <p>5 1 7 15 13</p> <p>14 8</p> <p>12 4</p> <p>9 11</p> <p>6 10 16 2</p> <p>3</p>
<p>107#</p> <p>12 1 11 16 5</p> <p>14 4</p> <p>8 3</p> <p>6 15</p> <p>2 13 9 10</p> <p>7</p>	<p>108#</p> <p>5 1 11 16 12</p> <p>14 3</p> <p>8 4</p> <p>13 9</p> <p>2 7 15 10</p> <p>6</p>	<p>109#</p> <p>3 1 6 16 14</p> <p>15 2</p> <p>12 10</p> <p>7 5</p> <p>9 4 8 13</p> <p>11</p>
<p>110#</p> <p>3 1 11 16 14</p> <p>15 2</p> <p>7 5</p> <p>12 10</p> <p>4 9 13 8</p> <p>6</p>	<p>111#</p> <p>7 1 13 16 10</p> <p>15 3</p> <p>5 2</p> <p>4 12</p> <p>8 11 6 9</p> <p>14</p>	<p>112#</p> <p>8 1 13 16 9</p> <p>15 3</p> <p>5 2</p> <p>4 12</p> <p>7 11 6 10</p> <p>14</p>

$$[\text{Count} = 49 + 63 = 112]$$

But, I have not yet discovered how I should have them classified smart and what system of transformations I should take for that purpose.

Let's study the structure of our object here with some algebraic calculations.

*** Algebra for Magic Star of Order 8 ***



*** Basic Definition ***

$$\begin{aligned} n1+n2+n4+n5=C & \dots r1 \\ n3+n4+n6+n7=C & \dots r2 \\ n5+n6+n8+n9=C & \dots r3 \\ n7+n8+n10+n11=C & \dots r4 \\ n9+n10+n12+n13=C & \dots r5 \\ n11+n12+n14+n15=C & \dots r6 \\ n13+n14+n16+n1=C & \dots r7 \\ n15+n16+n2+n3=C & \dots r8 \end{aligned}$$

$$\begin{aligned} 2*(n1+n2+n3+\dots+n15+n16) &= 8*C \\ 2*136 &= 8*C \end{aligned}$$

$$\text{Therefore } C=34 \dots r1$$

L2+L3+L5+L6+L8

$$\begin{aligned} n3+n4+n6+n7+n5+n6+n8+n9+n9+n10+n12+n13+n11+n12+n14+n15+n15+n16+n2+n3 &= 5*C \\ (n3+n6+n9+n12+n15)+(n2+n3+n4+n5+n6+n7+n8+n9+n10+n11+n12+n13+n14+n15+n16) &= 170 \end{aligned}$$

Add n1 to both sides.

$$\begin{aligned} (n3+n6+n9+n12+n15)+(n1+n2+n3+n4+n5+n6+\dots+n14+n15+n16) &= 170+n1 \\ (n3+n6+n9+n12+n15)+136 &= 170+n1 \end{aligned}$$

$$\text{Therefore } n1=n3+n6+n9+n12+n15-34 \dots r2$$

L1+L3+L4+L6+L7

$$\begin{aligned} n1+n2+n4+n5+n5+n6+n8+n9+n7+n8+n10+n11+n11+n12+n14+n15+n13+n14+n16+n1 &= 5*C \\ (n1+n5+n8+n11+n14)+(n1+n2+n4+n5+n6+n7+n8+n9+n10+n11+n12+n13+n14+n15+n16) &= 170 \end{aligned}$$

Add n3 to both sides.

$$(n1+n5+n8+n11+n14)+(n1+n2+n3+n4+n5+n6+\dots+n14+n15+n16)=170+n3$$

$$\text{Therefore } n3=n1+n5+n8+n11+n14-34 \dots r3$$

$$\text{Similarly } n5=n3+n7+n10+n13+n16-34 \dots r4$$

$$n7=n2+n5+n9+n12+n15-34 \dots r5$$

$$n9=n1+n4+n7+n11+n14-34 \dots r6$$

$$n11=n3+n6+n9+n13+n16-34 \dots r7$$

$$n13=n2+n5+n8+n11+n15-34 \dots r8$$

$$n15=n1+n4+n7+n10+n13-34 \dots r9$$

T2+T3+T5+T6+T7

$$\begin{aligned} n3+n4+n6+n7+n5+n6+n8+n9+n9+n10+n12+n13+n11+n12+n14+n15+n13+n14+n16+n1 &= 5*C \\ (n6+n9+n12+n13+n14)+(n1+n3+n4+n5+n6+n7+n8+n9+n10+n11+n12+n13+n14+n15+n16) &= 170 \end{aligned}$$

Add n2 to both sides.

$$(n6+n9+n12+n13+n14)+(n1+n2+n3+n4+n5+\dots+n14+n15+n16)=170+n2$$

$$\text{Therefore } n2=n6+n9+n12+n13+n14-34 \dots r10$$

T3+T4+T6+T7+T8

$$\begin{aligned} n5+n6+n8+n9+n7+n8+n10+n11+n11+n12+n14+n15+n13+n14+n16+n1+n15+n16+n2+n3 &= 5*C \\ (n8+n11+n14+n15+n16)+(n1+n2+n3+n5+n6+n7+n8+n9+n10+n11+n12+n13+n14+n15+n16) &= 170 \end{aligned}$$

Add n4 to both sides.

$$(n8+n11+n14+n15+n16)+(n1+n2+n3+n4+n5+\dots+n14+n15+n16)=170+n4$$

$$\text{Therefore } n4=n8+n11+n14+n15+n16-34 \dots r11$$

$$\text{Similarly } n6=n1+n2+n10+n13+n16-34 \dots r12$$

$$n8=n2+n3+n4+n12+n15-34 \dots r13$$

$$n10=n1+n4+n5+n6+n14-34 \dots r14$$

$$\begin{aligned} n_{12} &= n_3 + n_6 + n_7 + n_8 + n_{16} - 34 && \dots r_{15} \\ n_{14} &= n_2 + n_5 + n_8 + n_9 + n_{10} - 34 && \dots r_{16} \\ n_{16} &= n_4 + n_7 + n_{10} + n_{11} + n_{12} - 34 && \dots r_{17} \end{aligned}$$

L1+L3+L5+L7

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_6 + n_8 + n_9 + n_{10} + n_{12} + n_{13} + n_{14} + n_{16} + n_1 &= 4 * C \\ (n_1 + n_5 + n_9 + n_{13}) + (n_1 + n_2 + n_4 + n_5 + n_6 + n_8 + n_9 + n_{10} + n_{12} + n_{13} + n_{14} + n_{16}) &= 136 \end{aligned}$$

Add (n3+n7+n11+n15) to both sides.

$$\begin{aligned} (n_1 + n_5 + n_9 + n_{13}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + \dots + n_{14} + n_{15} + n_{16}) &= 136 + n_3 + n_7 + n_{11} + n_{15} \\ (n_1 + n_5 + n_9 + n_{13}) + 136 &= 136 + n_3 + n_7 + n_{11} + n_{15} \end{aligned}$$

Therefore $n_1 + n_5 + n_9 + n_{13} = n_3 + n_7 + n_{11} + n_{15}$... r18

T1+T2+T4+T7

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_3 + n_4 + n_6 + n_7 + n_7 + n_8 + n_{10} + n_{11} + n_{13} + n_{14} + n_{16} + n_1 &= 4 * C \\ (n_1 + n_4 + n_7) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_8 + n_{10} + n_{11} + n_{13} + n_{14} + n_{16}) &= 136 \end{aligned}$$

Add n9+n12+n15 to both sides.

$$\begin{aligned} (n_1 + n_4 + n_7) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) &= 136 + n_9 + n_{12} + n_{15} \\ (n_1 + n_4 + n_7) + 136 &= 136 + n_9 + n_{12} + n_{15} \end{aligned}$$

Therefore $n_1 + n_4 + n_7 = n_9 + n_{12} + n_{15}$... r19

T1+T3+T6+T8

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_5 + n_6 + n_8 + n_9 + n_{11} + n_{12} + n_{14} + n_{15} + n_{15} + n_{16} + n_2 + n_3 &= 4 * C \\ (n_2 + n_5 + n_{15}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_8 + n_9 + n_{11} + n_{12} + n_{14} + n_{15} + n_{16}) &= 136 \end{aligned}$$

Add n7+n10+n13 to both sides.

$$(n_2 + n_5 + n_{15}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_7 + n_{10} + n_{13}$$

Therefore $n_2 + n_5 + n_{15} = n_7 + n_{10} + n_{13}$... r20

T2+T3+T5+T8

$$\begin{aligned} n_3 + n_4 + n_6 + n_7 + n_5 + n_6 + n_8 + n_9 + n_9 + n_{10} + n_{12} + n_{13} + n_{15} + n_{16} + n_2 + n_3 &= 4 * C \\ (n_3 + n_6 + n_9) + (n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_8 + n_9 + n_{10} + n_{12} + n_{13} + n_{15} + n_{16}) &= 136 \end{aligned}$$

Add n1+n11+n14 to both sides.

$$(n_3 + n_6 + n_9) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_1 + n_{11} + n_{14}$$

Therefore $n_3 + n_6 + n_9 = n_1 + n_{11} + n_{14}$... r21

T1+T3+T4+T6

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_5 + n_6 + n_8 + n_9 + n_7 + n_8 + n_{10} + n_{11} + n_{11} + n_{12} + n_{14} + n_{15} &= 4 * C \\ (n_5 + n_8 + n_{11}) + (n_1 + n_2 + n_4 + n_5 + n_6 + n_7 + n_8 + n_9 + n_{10} + n_{11} + n_{12} + n_{14} + n_{15}) &= 136 \end{aligned}$$

Add n3+n13+n16 to both sides.

$$(n_5 + n_8 + n_{11}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_3 + n_{13} + n_{16}$$

Therefore $n_5 + n_8 + n_{11} = n_3 + n_{13} + n_{16}$... r22

T1+T2+T6+T7

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_3 + n_4 + n_6 + n_7 + n_{11} + n_{12} + n_{14} + n_{15} + n_{13} + n_{14} + n_{16} + n_1 &= 4 * C \\ (n_1 + n_4 + n_{14}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_{11} + n_{12} + n_{13} + n_{14} + n_{15} + n_{16}) &= 136 \end{aligned}$$

Add n8+n9+n10 to both sides.

$$(n_1 + n_4 + n_{14}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_8 + n_9 + n_{10}$$

Therefore $n_1 + n_4 + n_{14} = n_8 + n_9 + n_{10}$... r23

T1+T3+T4+T8

$$\begin{aligned} n_1 + n_2 + n_4 + n_5 + n_5 + n_6 + n_8 + n_9 + n_7 + n_8 + n_{10} + n_{11} + n_{15} + n_{16} + n_2 + n_3 &= 4 * C \\ (n_2 + n_5 + n_8) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_8 + n_9 + n_{10} + n_{11} + n_{15} + n_{16}) &= 136 \end{aligned}$$

Add n12+n13+n14 to both sides.

$$(n_2 + n_5 + n_8) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_{12} + n_{13} + n_{14}$$

Therefore $n_2 + n_5 + n_8 = n_{12} + n_{13} + n_{14}$... r24

Similarly $n_6 + n_9 + n_{12} = n_1 + n_2 + n_{16}$... r25

$n_{10} + n_{13} + n_{16} = n_4 + n_5 + n_6$... r26

T2+T3+T7+T8

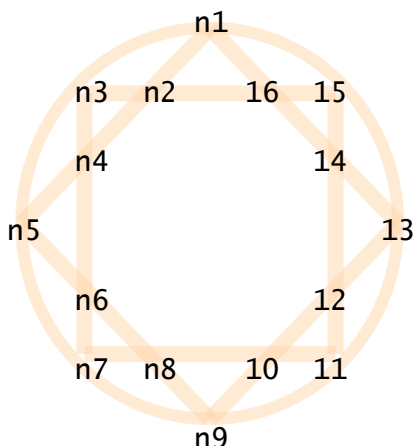
$$\begin{aligned} n_3 + n_4 + n_6 + n_7 + n_5 + n_6 + n_8 + n_9 + n_{13} + n_{14} + n_{16} + n_1 + n_{15} + n_{16} + n_2 + n_3 &= 4 * C \\ (n_3 + n_6 + n_{16}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + n_7 + n_8 + n_9 + n_{13} + n_{14} + n_{15} + n_{16}) &= 136 \end{aligned}$$

Add n10+n11+n12 to both sides.

$$(n_3 + n_6 + n_{16}) + (n_1 + n_2 + n_3 + n_4 + n_5 + n_6 + \dots + n_{14} + n_{15} + n_{16}) = 136 + n_{10} + n_{11} + n_{12}$$

Therefore $n_3 + n_6 + n_{16} = n_{10} + n_{11} + n_{12}$... r27

Similarly $n_4+n_7+n_{10}=n_{14}+n_{15}+n_{16}$... r28
 $n_8+n_{11}+n_{14}=n_2+n_3+n_4$... r29
 $n_2+n_{12}+n_{15}=n_6+n_7+n_8$... r30



$n_1+n_2+n_4+n_5=C$... 11
 $n_3+n_4+n_6+n_7=C$... 12
 $n_5+n_6+n_8+n_9=C$... 13
 $n_7+n_8+n_{10}+n_{11}=C$... 14
 $n_9+n_{10}+n_{12}+n_{13}=C$... 15
 $n_{11}+n_{12}+n_{14}+n_{15}=C$... 16
 $n_{13}+n_{14}+n_{16}+n_1=C$... 17
 $n_{15}+n_{16}+n_2+n_3=C$... 18

*** Summary: List of Relations ***

$n_1=n_3+n_6+n_9+n_{12}+n_{15}-34$... r2; $n_2=n_6+n_9+n_{12}+n_{13}+n_{14}-34$... r10
 $n_3=n_1+n_5+n_8+n_{11}+n_{14}-34$... r3; $n_4=n_8+n_{11}+n_{14}+n_{15}+n_{16}-34$... r11
 $n_5=n_3+n_7+n_{10}+n_{13}+n_{16}-34$... r4; $n_6=n_1+n_2+n_{10}+n_{13}+n_{16}-34$... r12
 $n_7=n_2+n_5+n_9+n_{12}+n_{15}-34$... r5; $n_8=n_2+n_3+n_4+n_{12}+n_{15}-34$... r13
 $n_9=n_1+n_4+n_7+n_{11}+n_{14}-34$... r6; $n_{10}=n_1+n_4+n_5+n_6+n_{14}-34$... r14
 $n_{11}=n_3+n_6+n_9+n_{13}+n_{16}-34$... r7; $n_{12}=n_3+n_6+n_7+n_8+n_{16}-34$... r15
 $n_{13}=n_2+n_5+n_8+n_{11}+n_{15}-34$... r8; $n_{14}=n_2+n_5+n_8+n_9+n_{10}-34$... r16
 $n_{15}=n_1+n_4+n_7+n_{10}+n_{13}-34$... r9; $n_{16}=n_4+n_7+n_{10}+n_{11}+n_{12}-34$... r17

$n_1+n_5+n_9+n_{13}=n_3+n_7+n_{11}+n_{15}$... r18

$n_1+n_4+n_7=n_9+n_{12}+n_{15}$... r19; $n_6+n_9+n_{12}=n_1+n_2+n_{16}$... r25
 $n_2+n_5+n_{15}=n_7+n_{10}+n_{13}$... r20; $n_{10}+n_{13}+n_{16}=n_4+n_5+n_6$... r26
 $n_3+n_6+n_9=n_1+n_{11}+n_{14}$... r21; $n_3+n_6+n_{16}=n_{10}+n_{11}+n_{12}$... r27
 $n_5+n_8+n_{11}=n_3+n_{13}+n_{16}$... r22; $n_4+n_7+n_{10}=n_{14}+n_{15}+n_{16}$... r28
 $n_1+n_4+n_{14}=n_8+n_9+n_{10}$... r23; $n_8+n_{11}+n_{14}=n_2+n_3+n_4$... r29
 $n_2+n_5+n_8=n_{12}+n_{13}+n_{14}$... r24; $n_2+n_{12}+n_{15}=n_6+n_7+n_8$... r30

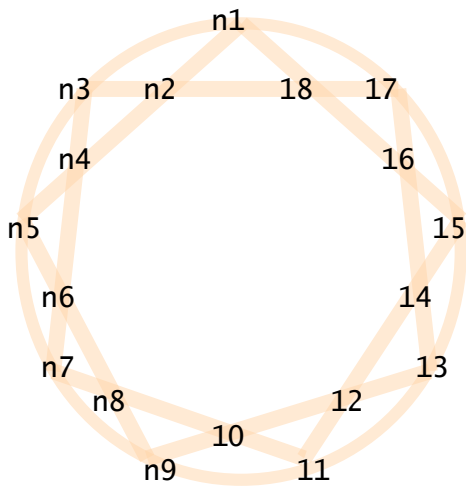
Those relational equations above seem to imply various types of transformations may possibly be discovered. However, the solution counts of the two types are different from each other: 49 for the type whose $n_1=1$ and 63 for the one whose $n_2=1$. That means you might have no such smart system of transformations and classifying methods on the whole, I am afraid.

About higher orders than 8, let me report of my newest result only with the data-sheets as follows. Otherwise, it might be too long and boring for you to follow.

(Original in Japanese: Written first on Aug.22, 2000;
 English Version: Written on Nov.23, 2005;
 By Kanji Setsuda working on MacOSX and Xcode 1.5)

Chapter 6: Algebraic Study of Magic Stars of Higher Orders

Section 1: Data for Double-Ringed Magic Stars of Order 9



* Basic Definition for **Order 9** *

$$\begin{aligned} n1+n2+n4+n5 &= C & \dots & \text{r1} \\ n3+n4+n6+n7 &= C & \dots & \text{r2} \\ n5+n6+n8+n9 &= C & \dots & \text{r3} \\ n7+n8+n10+n11 &= C & \dots & \text{r4} \\ n9+n10+n12+n13 &= C & \dots & \text{r5} \\ n11+n12+n14+n15 &= C & \dots & \text{r6} \\ n13+n14+n16+n17 &= C & \dots & \text{r7} \\ n15+n16+n18+n1 &= C & \dots & \text{r8} \\ n17+n18+n2+n3 &= C & \dots & \text{r9} \end{aligned}$$

$$\begin{aligned} 2*(n1+n2+n3+\dots+n17+n18) &= 9*C \\ 2*171 &= 9*C \end{aligned}$$

Therefore $C=38 \dots r0$

Algebraic Calculations:

$$r1+r3+r5+r7+r9$$

$$n1+n2+n2+n3+n4+n5+n5+n6+n8+n9+n9+n10+n12+n13+n13+n14+n16+n17+n17+n18=5C$$

$$+) n7+n11+n15=n7+n11+n15$$

$$\begin{aligned} (n1+n2+n3+n4+n5+\dots+n16+n17+n18) &+ n2+n5+n9+n13+n17=5C+n7+n11+n15 \\ 171 & \qquad \qquad \qquad +n2+n5+n9+n13+n17=190+n7+n11+n15 \end{aligned}$$

Therefore

$$n2=19-n5+n7-n9+n11-n13+n15-n17 \dots r1$$

In the same way you can get:

$$r2+r4+r6+r8+r10$$

$$n4=19-n7+n9-n11+n13-n15+n17-n1 \dots r2$$

$$r3+r5+r7+r9+r11$$

$$n6=19-n9+n11-n13+n15-n17+n1-n3 \dots r3$$

$$n8=19-n11+n13-n15+n17-n1+n3-n5 \dots r4$$

$$n10=19-n13+n15-n17+n1-n3+n5-n7 \dots r5$$

$$n12=19-n15+n17-n1+n3-n5+n7-n9 \dots r6$$

$$n14=19-n17+n1-n3+n5-n7+n9-n11 \dots r7$$

$$n16=19-n1+n3-n5+n7-n9+n11-n13 \dots r8$$

$$n18=19-n3+n5-n7+n9-n11+n13-n15 \dots r9$$

$$r1+r4+r5+r8+r9$$

$$n1+n2+n4+n5=C \dots r1$$

$$n7+n8+n10+n11=C \dots r4$$

$$n9+n10+n12+n13=C \dots r5$$

$$n15+n16+n18+n1=C \dots r8$$

$$+) n17+n18+n2+n3=C \dots r9$$

$$n1+n1+n2+n2+n3+n4+n5+n7+n8+n9+n10+n10+n11+n12+n13+n15+n16+n18+n17+n18=5*C$$

$$(n1+n2+n10+n18)+(n1+n2+n3+n4+n5+n7+n8+n9+n10+n11+n12+n13+n15+n16+n17+n18)=190$$

Add (n6+n14) to both sides

$$(n1+n2+n10+n18)+(n1+n2+n3+n4+n5+n6+\dots+n14+n15+n16+n17+n18)=190+n6+n14$$

Therefore $n1=19-n2+n6-n10+n14-n18 \dots r10$

$$r1+r2+r5+r6+r9$$

$$n1+n2+n4+n5+n3+n4+n6+n7+n9+n10+n12+n13+n11+n12+n14+n15+n17+n18+n2+n3=5*C$$

$$(n2+n3+n4+n12)+(n1+n2+n3+n4+n5+n6+n7+n9+n10+n11+n12+n13+n14+n15+n17+n18)=190$$

Add (n8+n16) to both sides

$$(n2+n3+n4+n12)+(n1+n2+n3+n4+n5+n6+n7+n8+\dots+n16+n17+n18)=190+n8+n16$$

Therefore $n_3=19-n_2-n_4+n_8-n_{12}+n_{16} \dots r_{11}$

$11+12+13+16+17$

$n_1+n_2+n_4+n_5+n_3+n_4+n_6+n_7+n_5+n_6+n_8+n_9+n_{11}+n_{12}+n_{14}+n_{15}+n_{13}+n_{14}+n_{16}+n_{17}=5 \cdot C$

$(n_4+n_5+n_6+n_{14})+(n_1+n_2+n_3+n_4+n_5+n_6+n_7+n_8+n_9+n_{11}+n_{12}+n_{13}+n_{14}+n_{15}+n_{16}+n_{17})=190$

Add $(n_{10}+n_{18})$ to both sides

$(n_4+n_5+n_6+n_{14})+(n_1+n_2+n_3+n_4+n_5+n_6+n_7+n_8+n_9+n_{10}+\dots+n_{16}+n_{17}+n_{18})=190+n_{10}+n_{18}$

Therefore $n_5=19-n_4-n_6+n_{10}-n_{14}+n_{18} \dots r_{12}$

Similarly

$n_7=19+n_2-n_6-n_8+n_{12}-n_{16} \dots r_{13}$

$n_9=19+n_4-n_8-n_{10}+n_{14}-n_{18} \dots r_{14}$

$n_{11}=19-n_2+n_6-n_{10}-n_{12}+n_{16} \dots r_{15}$

$n_{13}=19-n_4+n_8-n_{12}-n_{14}+n_{18} \dots r_{16}$

$n_{15}=19+n_2-n_6+n_{10}-n_{14}-n_{16} \dots r_{17}$

$n_{17}=19+n_4-n_8+n_{12}-n_{16}-n_{18} \dots r_{18}$

**** Making Magic Stars of Order 9 ****

**** List of Standard Solutions: ****

[Type $n_1=1$:]

<p>1#</p> <pre> 1 3 17 14 4 18 10 2 13 12 8 5 16 15 6 9 7 11 </pre> <p>39#</p> <pre> 1 2 14 13 9 18 8 5 16 12 4 6 17 10 3 11 7 15 </pre> <p>154#</p> <pre> 1 2 11 16 9 18 14 8 7 12 10 6 5 15 17 3 13 4 </pre> <p>370#</p> <pre> 1 3 8 17 10 18 14 11 6 13 9 4 5 12 16 2 15 7 </pre>	<p>6#</p> <pre> 1 2 16 12 8 18 14 3 11 13 6 5 10 7 4 15 9 17 </pre> <p>63#</p> <pre> 1 2 13 9 14 18 11 6 17 15 5 3 8 7 4 10 16 12 </pre> <p>211#</p> <pre> 1 2 10 15 11 18 16 9 6 13 8 5 3 12 17 4 14 7 </pre> <p>426#</p> <pre> 1 3 7 11 17 18 10 12 16 13 2 4 9 5 6 8 15 14 </pre>	<p>16#</p> <pre> 1 2 15 9 12 18 17 4 11 13 3 5 6 7 8 14 10 16 </pre> <p>108#</p> <pre> 1 2 12 14 10 18 6 7 17 15 9 3 13 11 4 5 16 8 </pre> <p>296#</p> <pre> 1 2 9 11 16 18 12 10 14 15 4 3 6 5 7 8 17 13 </pre> <p>540#</p> <pre> 1 2 6 14 16 18 15 13 8 11 3 7 4 9 17 5 12 10 </pre>
--	--	--

659#

```

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

```

1176#

```

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

```

[Type n2=1:]

1513#

```

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

```

1627#

```

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

```

1838#

```

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

```

2118#

```

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

```

793#

```

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

```

1439#

```

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

```

1541#

```

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

```

1693#

```

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

```

1923#

```

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

```

2204#

```

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

```

958#

```

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

```

1582#

```

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

```

1773#

```

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

```

2029#

```

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

```

2319#

```

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

```

2423# 2549# 2670#

```

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

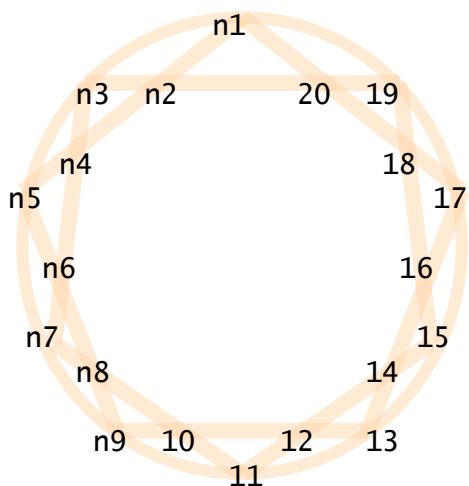
2817# 2959#

```

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

[Count = 1512 + 1502 = 3014] OK!

Section 2: Data for Double-Ringed Magic Stars of Order 10



* Basic Definition for **Order 10** *

$n_1+n_2+n_4+n_5=C$... 11
 $n_3+n_4+n_6+n_7=C$... 12
 $n_5+n_6+n_8+n_9=C$... 13
 $n_7+n_8+n_{10}+n_{11}=C$... 14
 $n_9+n_{10}+n_{12}+n_{13}=C$... 15
 $n_{11}+n_{12}+n_{14}+n_{15}=C$... 16
 $n_{13}+n_{14}+n_{16}+n_{17}=C$... 17
 $n_{15}+n_{16}+n_{18}+n_{19}=C$... 18
 $n_{17}+n_{18}+n_{20}+n_1=C$... 19
 $n_{19}+n_{20}+n_2+n_3=C$... 110

$2*(n_1+n_2+n_3+\dots+n_{19}+n_{20})=10*C$
 $2*210=10*C$
 Therefore $C=42$... r0

11+13+15+17+19

$$n_1+n_2+n_4+n_5+n_6+n_8+n_9+n_{10}+n_{12}+n_{13}+n_{14}+n_{16}+n_{17}+n_{18}+n_{20}+n_1=5*C$$

$$(n_1+n_5+n_9+n_{13}+n_{17})+(n_1+n_2+n_4+n_5+n_6+n_8+n_9+n_{10}+n_{12}+n_{13}+n_{14}+n_{16}+n_{17}+n_{18}+n_{20})=210$$

Add (n3+n7+n11+n15+n19) to both sides.

$$(n_1+n_5+n_9+n_{13}+n_{17})+(n_1+n_2+n_3+n_4+\dots+n_{18}+n_{19}+n_{20})=210+n_3+n_7+n_{11}+n_{15}+n_{19}$$

Therefore $n_1+n_5+n_9+n_{13}+n_{17}=n_3+n_7+n_{11}+n_{15}+n_{19}$... r1

11+12+14+16+18+110

$$n_1+n_2+n_4+n_5+n_6+n_7+n_8+n_{10}+n_{11}+n_{12}+n_{14}+n_{15}+n_{16}+n_{18}+n_{19}+n_{19}+n_{20}+n_2+n_3=252$$

$$(n_2+n_3+n_4+n_7+n_{11}+n_{15}+n_{19})+(n_1+n_2+n_3+n_4+n_5+n_6+n_7+n_8+n_{10}+n_{11}+n_{12}+n_{14}+n_{15}+n_{16}+n_{18}+n_{19}+n_{20})=252$$

Add (n9+n13+n17) to both sides.

$$(n_2+n_3+n_4+n_7+n_{11}+n_{15}+n_{19})+(n_1+n_2+n_3+n_4+\dots+n_{18}+n_{19}+n_{20})=252+n_9+n_{13}+n_{17}$$

Therefore $n_2+n_3+n_4+n_7+n_{11}+n_{15}+n_{19}=42+n_9+n_{13}+n_{17}$... r2

.....

** Composing Standard Magic Stars of Order 10 **
 ** List of Solutions of Type n1=1 & n2=1(Part): **

1#					42#				
		1					1		
	3	19	7	13		2	18	9	13
	20			18		20			15
2				16	3				17
15				5	16				6
4				6	4				8
	17			12		12			5
	8	11	14	9		11	7	10	14
		10					19		
84#					198#				
		1					1		
	2	17	9	14		2	16	14	10
	20			19		20			19
4				13	5				8
15				3	17				4
5				6	3				9
	12			10		13			12
	11	7	8	16		7	11	6	18
		18					15		
307#					440#				
		1					1		
	2	15	14	11		2	14	10	16
	20			19		20			13
6				8	7				18
17				5	15				4
3				7	5				9
	9			13		12			3
	10	12	4	16		8	6	11	17
		18					19		
611#					814#				
		1					1		
	2	13	10	17		2	12	15	13
	20			15		20			7
8				16	9				19
6				3	16				5
14				7	4				17
	19			12		14			8
	9	4	18	11		3	18	11	10
		5					6		
1031#					1279#				
		1					1		
	2	11	17	12		2	10	16	14
	20			19		20			7
10				5	11				18
16				8	17				8
4				3	3				13
	7			15		5			4
	9	13	6	14		9	15	6	12
		18					19		

1468#

2 9 1
20
12
13
7
6
11 10
19

1953#

2 7 1
20
14
12
8
10
6 11
13

2600#

2 5 1
20
16
12
8
11
3 19
4

3464#

4 3 1
20
18
12
6
10
2 17
9

4694#

5 2 1
19
20
12
6
7
3 15
14

1660#

2 8 1
20
13
3
5
7 19
15

2298#

3 6 1
20
15
12
7
10
5 9
16

3021#

3 4 1
20
17
11
8
9
5 18
7

4073#

5 2 1
20
19
13
4
7
3 16
15

14 18
11
16
4
9
12
6 10

19 14
18
4
8
2
13
11 17

19 16
10
12
2
14
15
6 13

17 18
10
14
8
6
9
12 11

5304#

19 1 18
 3
 20 4
 16 11
 7 13
 2

5393#

17 1 16
 5
 20 2
 18 7
 13 6
 11

5619#

16 1 14
 7
 20 2
 17 12
 8 10
 3

5948#

13 1 12
 9
 20 2
 18 4
 16 15
 5

6440#

14 1 10
 11
 20 2
 15 3
 17 5
 19

5318#

19 1 17
 4
 20 3
 16 11
 8 10
 5

5472#

16 1 15
 6
 20 2
 18 3
 17 13
 8

5767#

14 1 13
 8
 20 2
 18 4
 16 11
 9

6129#

13 1 11
 10
 20 2
 17 14
 6 3
 8

6671#

10 1 9
 12
 20 2
 18 7
 13 6
 11

9 13
 2
 14
 15
 12
 7
 6
 18

14 11
 9
 4
 12
 10
 19
 7
 15

17 10
 7
 5
 19
 6
 15
 3

19 9
 5
 7
 16
 12
 4
 18 15

14 17
 16
 3
 5
 4
 19
 15

6940#

7241#

		8					7		
9	1		17	15		9	1	19	13
13				12		14			6
20				5	20				10
2				11	2				12
18				4	17				11
14				16	4				5
6	7		19	10	16	3		8	15
		3					18		

7578#

7912#

		6					5		
8	1		19	14		7	1	19	15
15				5		16			10
20				12	20				8
2				16	2				3
17				7	17				14
9				4	9				18
11	3		18	10	11	12		6	13
		13					4		

8442#

8893#

		4					3		
9	1		19	13		9	1	15	17
17				12		18			5
20				7	20				19
2				11	2				8
14				6	13				12
15				8	6				4
5	3		18	16	14	7		10	11
		10					16		

9493#

10157#

		2					2		
6	1		18	17		6	1	17	18
19				9		20			9
20				13	19				14
3				12	3				11
14				4	13				4
8				7	5				10
11	5		16	10	15	8		12	7
		15					16		

[Count = 5303 + 5579 = 10882] OK!

Section 3: Data for Double-Ringed Magic Stars of Order 11

11+13+15+17+19+111

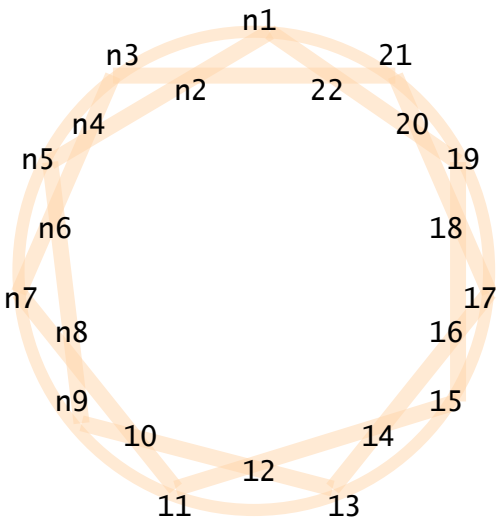
$$n1+n2+n4+n5+n5+n6+n8+n9+n9+n10+n12+n13+n13+n14+n16+n17+n17+n18+n20+n21+n21+n22+n2+n3=6*C$$

$$(n2+n5+n9+n13+n17+n21)+(n1+n2+n3+n4+n5+n6+n8+n9+n10+n12+n13+n14+n16+n17+n18+n20+n21+n22)=276$$

Add (n7+n11+n15+n19) to both sides.

$$(n2+n5+n9+n13+n17+n21)+(n1+n2+n3+n4+...+n20+n21+n22)=276+n7+n11+n15+n19$$

Therefore $n_2+n_5+n_9+n_{13}+n_{17}+n_{21}=23+n_7+n_{11}+n_{15}+n_{19} \dots r_1$



* Basic Definition *

- $n_1+n_2+n_4+n_5=C \dots r_1$
- $n_3+n_4+n_6+n_7=C \dots r_2$
- $n_5+n_6+n_8+n_9=C \dots r_3$
- $n_7+n_8+n_{10}+n_{11}=C \dots r_4$
- $n_9+n_{10}+n_{12}+n_{13}=C \dots r_5$
- $n_{11}+n_{12}+n_{14}+n_{15}=C \dots r_6$
- $n_{13}+n_{14}+n_{16}+n_{17}=C \dots r_7$
- $n_{15}+n_{16}+n_{18}+n_{19}=C \dots r_8$
- $n_{17}+n_{18}+n_{20}+n_{21}=C \dots r_9$
- $n_{19}+n_{20}+n_{22}+n_1=C \dots r_{10}$
- $n_{21}+n_{22}+n_2+n_3=C \dots r_{11}$

 $2*(n_1+n_2+n_3+\dots+n_{21}+n_{22})=11*C$
 $2*253=11*C$

Therefore $C=46 \dots r_0$

**** List of Standard Magic Stars of Order 11 ****

[Type n1=1]

<p>1#</p> <pre> 3 21 1 14 8 22 18 2 17 4 20 7 16 6 11 12 561# 2 19 1 15 10 22 16 4 17 5 18 7 20 3 13 6 1563# 2 17 1 16 11 22 21 6 15 7 12 13 9 18 5 19 3 </pre>	<p>294#</p> <pre> 2 20 1 15 9 22 12 13 5 6 19 8 11 10 14 13 1061# 2 18 1 15 11 22 17 14 12 8 3 11 9 20 7 8 12 2471# 2 16 1 15 13 22 20 8 4 10 3 14 20 17 12 5 18 8 </pre>	<p>1</p> <pre> 15 9 12 18 4 21 7 17 5 1061# 2 18 1 15 11 22 17 13 14 4 9 10 21 8 12 1563# 2 16 1 15 13 22 20 10 4 9 11 21 8 5 18 8 </pre>	<p>1</p> <pre> 15 9 12 18 4 21 7 17 5 1061# 2 18 1 15 11 22 17 13 14 4 9 10 21 8 12 1563# 2 16 1 15 13 22 20 10 4 9 11 21 8 5 18 8 </pre>
--	--	--	--

3243#

2 15 1 20 9
 22 11 14 9
 8 19 10 19
 3 13 16 3
 6 5 11 7
 12 17 17
 18 7 21

4340#

2 14 1 20 10
 22 13 12 5
 18 8 21
 4 4
 6 16
 15 6 16

5378#

2 13 1 20 11
 22 21 4 11
 10 19 8 13
 3 12 6 9
 5 18 19
 17 16 3
 7 8
 9 15

6649#

2 12 1 18 14
 22 21 6 7
 4 11 13 6
 9 19 17 4
 3 16 16
 8 5
 15 20
 10 15 20

7797#

2 11 1 15 18
 22 9 21 13
 12 16 14 5
 6 8 4 8
 10 7 12 7
 13 17 9
 19 3 20

8980#

2 10 1 18 16
 22 21 6 5
 13 14 8 4
 8 12 20 4
 7 7 15
 9 9 3
 11 19
 17 17 19

9958#

2 9 1 19 16
 22 6 20 15
 14 12 11 18
 10 17 13 4
 3 7 8 10
 4 8 3 21
 18 5 21
 15 21

11347#

2 8 1 19 17
 22 6 20 7
 15 18 4 16
 4 10 5 16
 3 3 14
 21 12
 9 9 12
 17 19 13

12687#

2 7 1 19 18
 22 15 11 17
 16 13 10 14
 9 12 3 8
 5 17 12
 8 3
 21 20 19
 14 20 13
 4 6 7 13

14328#

2 6 1 20 18
 22 9 16 15
 17 14 16 15
 8 12 10 5
 3 3
 19 21
 7 11

16001#

2 5 1 20 19
 22 16
 18 9 19
 14 7 15
 8 4 6
 11 17 10
 3 13 2
 21 15 17
 6 12 13 7 20
 10

17983#

3 4 1 21 18
 22 8
 9 19 16
 7 15 11
 4 6 9
 17 10 5
 13 2 14
 17 12
 13 7 20

19805#

4 3 1 21 18
 22 7
 20 17 21
 14 5 13
 6 16 6
 10 9 8
 2 15 4
 19 8 18
 11 12 9 11
 12 13 14 15

22288#

5 2 1 19 20
 22 2 19 20
 17 21 10
 5 13 7
 16 6 3
 9 8 17
 15 4 12
 8 18 11
 9 15

24491#

5 2 1 19 20
 21 16
 22 10
 13 6
 7 4
 8 18
 3 12
 17 9
 14 11 15

[Type n2=1]

27224#

21 1 20 5 19
 3 10
 22 11 22
 4 2 3
 18 15 18
 6 16 5
 14 17 16
 13 8 8
 9 12 7 12 10
 18

27253#

21 1 19 11 13
 4 1 7
 11 22 9
 2 3 6
 15 18 20
 16 5 14
 17 16 17
 8 8 2
 15 12 10
 17

27544#

19 1 18 10 16
 5 3
 22 15 22
 2 6 2
 20 21 20
 8 12 3
 14 13 19
 11 9 8
 7 17 4 9 8 10 5
 15 9

27828#

18 1 17 13 14
 6 1 4
 15 22 12
 6 2 7
 21 20 21
 12 3 11
 13 19 16
 9 8 5
 15 10 9

28423#

17 1 16 10 18
 7 11
 22 9 22
 2 12 2
 20 5 20
 3 21 9
 19 4 13
 8 14 7
 15 13 6 10 12 14 5

28949#

16 1 15 11 18
 8 3
 9 22 17
 12 2 4
 5 20 21
 21 9 6
 4 13 19
 7 5
 10 12 14

29845#

15 1 14 13 17
 9 3
 22 16 22
 2 5 2
 20 21 20
 4 6 7
 18 19 15
 10 8 16
 12 7 11 3 4 11 21

30615#

14 1 13 19 12
 10 8
 16 22 6
 5 2 17
 21 20 9
 6 7 5
 19 15 18
 16 21
 3 4 11

31822#

14 1 12 21 10
 11 8
 22 5 22
 2 15 2
 19 13 18
 6 9 3
 16 17 19
 3 4 8
 18 7 20 17 13 6 9

32765#

14 1 11 10 21
 12 5
 22 22 20
 2 2 4
 18 18 16
 9 3 15
 17 19 7
 8 9
 17 13 6

34030#

11 1 10 18 16
 13 6
 22 12 22
 2 9 2
 20 15 20
 5 4 5
 17 21 17
 7 8 18
 14 3 19 3 7 4 21

35053#

10 1 9 19 16
 14 6
 12 22 12
 9 2 11
 15 20 13
 4 5 8
 21 17 15
 18 21
 3 7 4

36553#

9 1 8 17 19
 15 11
 22 10 22
 2 3 2
 20 13 20
 4 12 17
 18 21 5
 16 14 6
 6 5 7 3 21 14 13

38131#

8 1 7 18 19
 16 11
 10 22 10
 3 2 12
 13 20 4
 12 17 15
 21 5 9
 6 13
 3 21 14

39959#

8 1 6 21 16
 17 5
 22 14 22 20
 2 12 2 8
 19 13 19 13
 4 11 10 3
 18 9 12 15
 3 7 11 16
 20 10 6 9 14

41662#

7 1 5 17 21
 18 4
 14 22 20
 12 2 8
 13 19 13
 11 10 3
 9 12 15
 11 16
 6 9 14

43781#

7 1 4 17 21
 19 16
 22 9 22 13
 2 6 2 10
 18 3 16 5
 10 20 7 9
 12 11 15 14
 5 8 6 11
 13 14 15 17 4 21

45726#

8 1 3 18 19
 20 12
 22 22 13
 6 2 10
 3 16 5
 20 7 9
 11 15 14
 6 11
 17 4 21

48205#

6 1 2 19 20
 21 11
 22 14 21 16
 3 10 3 5
 16 5 15 14
 8 15 4 12
 13 7 18 13
 4 9 10 9
 18 12 17 7 11

50434#

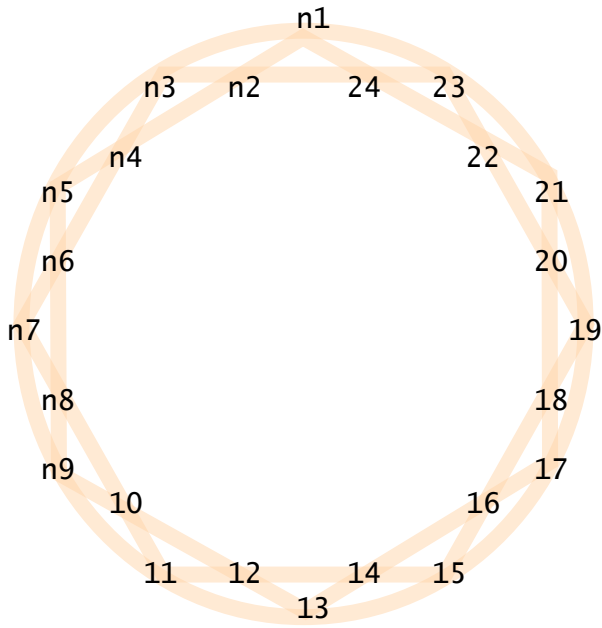
6 1 2 20 19
 22 8
 14 21 16
 10 3 5
 5 15 14
 15 4 12
 7 18 13
 10 10 9
 17 7 11

[Count = 27223 + 26305 = 53528] OK!

(English Version: Written on Nov. 25, 2005 by Kanji Setsuda)

*** E-Mail Address:<jag12001@nifty.com>

Section 4: Data for Magic Stars of Order 12



Basic Definition for Order 12

- $n1+n2+n4+n5=C \quad \dots \quad \uparrow 11$
- $n3+n4+n6+n7=C \quad \dots \quad \uparrow 12$
- $n5+n6+n8+n9=C \quad \dots \quad \uparrow 13$
- $n7+n8+n10+n11=C \quad \dots \quad \uparrow 14$
- $n9+n10+n12+n13=C \quad \dots \quad \uparrow 15$
- $n11+n12+n14+n15=C \quad \dots \quad \uparrow 16$
- $n13+n14+n16+n17=C \quad \dots \quad \uparrow 17$
- $n15+n16+n18+n19=C \quad \dots \quad \uparrow 18$
- $n17+n18+n20+n21=C \quad \dots \quad \uparrow 19$
- $n19+n20+n22+n23=C \quad \dots \quad \uparrow 10$
- $n21+n22+n24+n1=C \quad \dots \quad \uparrow 11$
- $n23+n24+n2+n3=C \quad \dots \quad \uparrow 12$

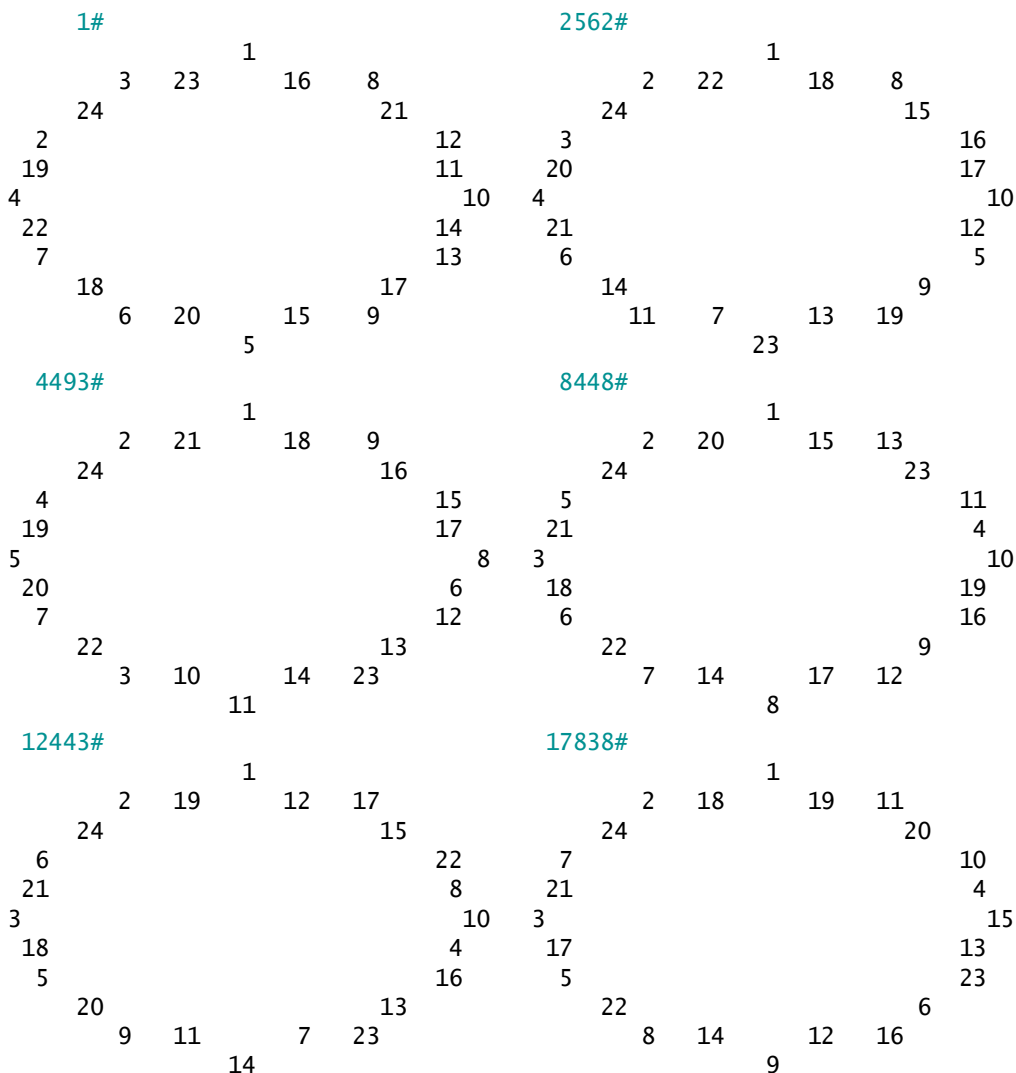
$$2*(n1+n2+n3+\dots+n23+n24)=12*C$$

$$2*300=12*C$$

Therefore $C=50 \quad \dots \quad r0$

** List of Standard Magic Stars of Order 12 **

[Type n1=1]



23060#

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

29959#

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

37046#

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

45013#

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

52938#

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

61991#

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

69902#

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

78373#

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

86931#

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

97513#

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

107974#

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

119730#

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

131758#

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

145627#

3 4 1 20 23 12
 24 17
 21 7
 5 8
 11 9 10
 16 2 16
 7 22 13
 14 11 6 19
 15

159756#

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

175701#

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

190989#

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

[Type n2=1]

207028#

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

207314#

23 1 21 10 16 12
 4 7
 24 3 13
 20 5 22
 18 18 8
 6 17
 19 15 14 2
 11

208669#

20
 21 1 11 17
 5
 24 12
 2 16
 22 10 22
 6 14 3
 18 8 21
 9 23
 13 19 15 3
 4

210282#

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

213472#

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

216551#

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

221419#

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

226413#

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

232907#

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

239531#

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

247782#

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

255158#

11
 12 1 17 20
 14 18
 24 4
 2 7
 21 5
 3 23
 10 16
 6 9
 19 8 10 13
 15

263935#

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

272711#

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

283195#

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

294106#

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

306525#

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

318860#

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

333178#

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

347903#

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

363514#

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

379881#

6 1 2 21 22
 24 15
 24 12 12
 3 3 8
 7 17 5
 9 4 14
 13 20 16
 10 18
 19 11 7 13
 9

[Count = 207027 + 189903 = 396930] OK!