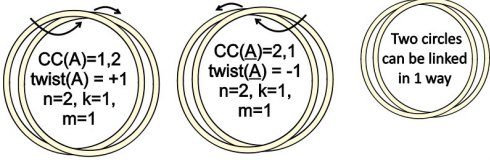


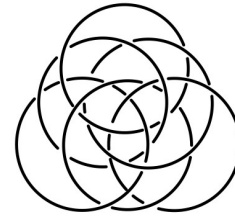
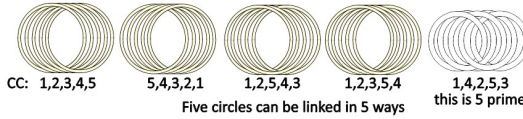
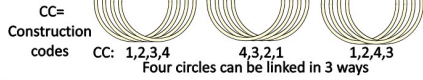
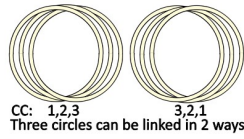
Some Properties of Linked Circles

(when every pair of circles is linked)

(Acl,k1 (All circle links, k1), k1 means every pair of circles is linked)



Two linked circles can exhibit +1 or -1 twist depending on how they lay over.
 total twist=Mtt, $Mtt(A\#A) = 0$ (A is a mirror image of A)
 The mirror image CC code is CC written in reverse



*The Smallest Rogue Link, 6r is made with 6 circles. A Rogue Link can not be linear like 5p and must also be prime like 5p. As the number of circles n increases the number of possible nr increases much faster than np. A construction code for nr must account for non linear structure. The circles can not be arranged so that their centers lie in a straight line.

How twist is calculated from the CC or FO integer code.

Compare all possible left right pairs of the CC or FO code.

$twist(CC) = \sum [(CC_p, CC_q)]$ of all CC pairs $i < j$
 where if $CC_p < CC_q$, then $t = +1$
 or if $CC_p > CC_q$, then $t = -1$
 FO twist is calculated the same way from the FO code.

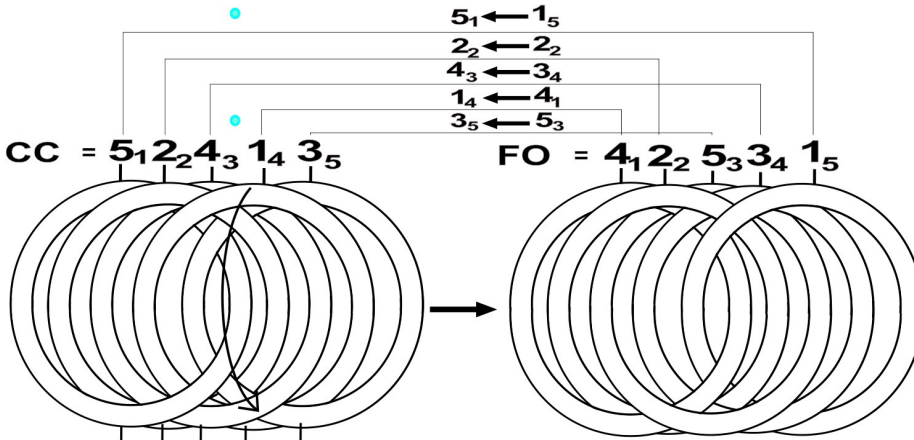
Twist of FO = twist of CC.
 For a link of n circles there are n CC and FO matrix rows. The sum of the twist of all the CC rows is always a constant no matter how you rearrange the circles before starting the fold matrix. This is called the Mtt or Matrix total twist. The Mtt is the same for the FO matrix. Any CC or FO added to its mirror image CC or FO has a twist of zero

<http://www.puzzleatomic.com/ALCircleCalc/allcirclecalc.html>

http://www.puzzleatomic.com/All_Circle_Links.htm

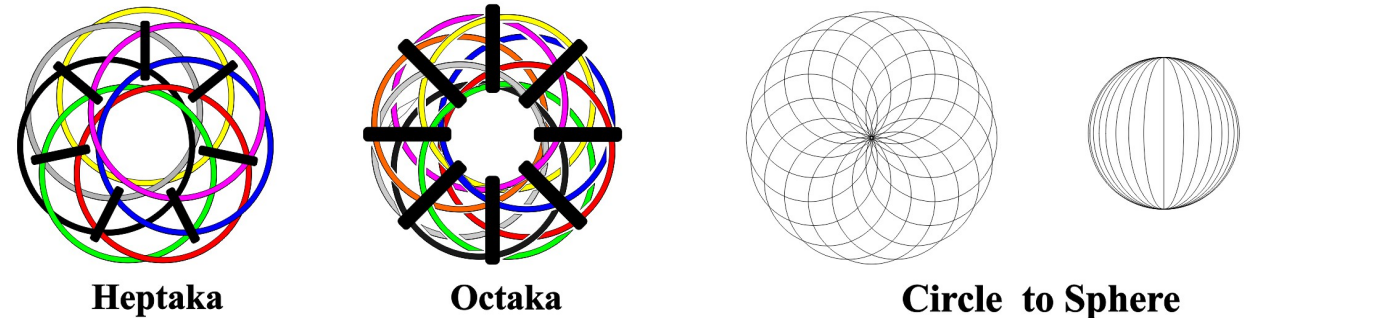
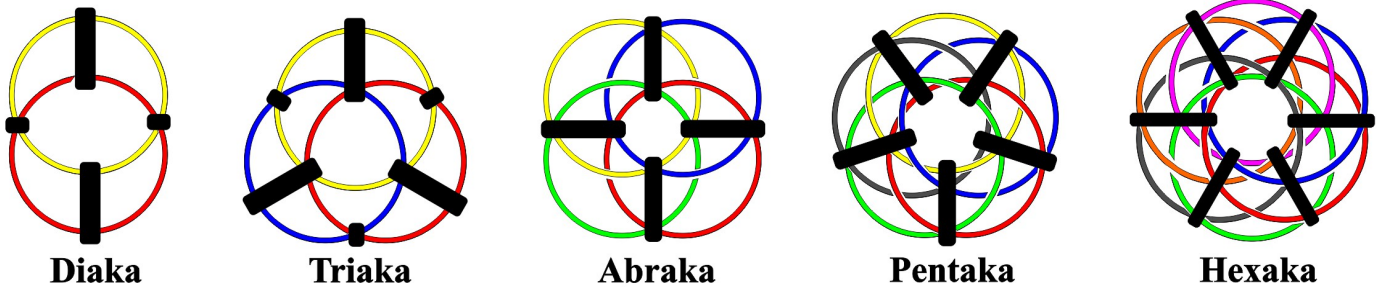
<http://www.puzzleatomic.com/Integer%20Code%20For%20Linked%20Circles.pdf>

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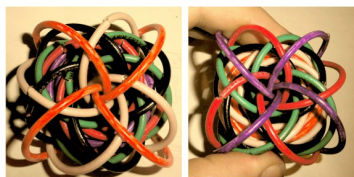


This is the Smallest Prime Link 5p, made with 5 circles (total twist=Mtt(5p) = 0) CC is the construction code, FO is the fold order. To be prime no two adjacent CC numbers can be sequential (m=0, if m=1 there is one set of close links) no matter how the circles are rearranged into a linear CC, (construction code). The FO is the order of folding the CC links down like the arrow shown to create the next row of a CC matrix. The CC is also the fold order of the FO but the FO is developed by getting its code from the CC, not by folding like the CC. The twist of the CC always equals the twist of the FO

Linked circles that appear to turn inside out transform from a flat to a 3D shape using node keepers.



A set of 4 links twisting one way and 3 links twisting the other way



Six sets of 4 links twisting in alternate ways can turn inside out

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Space Numbers

Space numbers are a simple way of seeing ordinary linear numbers as planar or higher dimensional. A quick way to illustrate this is to break the Jain magic square into a 4x4 binary space number. Subtract 1 from all the cells of the magic square. This puts 0 to 15 in the cells. Magic constant = 30.

Now write the equivalent binary number in each cell. Then draw four 4x4 squares and put the leftmost binary power $2^3=8$ for a binary one, or zero in each of the 4x4 cells of the leftmost square. Continue doing this for the rest of the squares, $2^2=4$, or 0, $2^1=2$, or 0, $2^0=1$ or 0. This produces the top right 4 squares in the upper right figure. Now make four 4x4 squares and leave the cells white for a zero and black for a number > 0. This is the set of power patterns for the Jain magic square.

Common power pattern symmetries:
Shuffle symmetry: Ss You can prove to yourself any two power patterns for a 0 to n sequential list of numbers can be exchanged and the listing will change the way it is ordered but will still contain all the integers from 0 thru n. Thus shuffle symmetry allows b! (factorial)

Magic constant=30

6	11	0	13
1	12	7	10
15	2	9	4
8	5	14	3

2^3

0	8	0	8
0	8	0	8
8	0	8	0
8	0	8	0

2^2

4	0	0	4
0	4	4	0
4	0	0	4
0	4	4	0

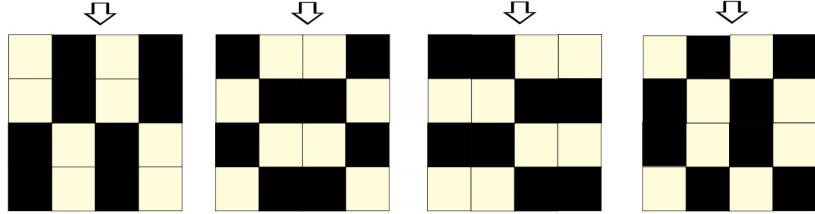
2^1

2	2	0	0
0	0	2	2
2	2	0	0
0	0	2	2

2^0

0	1	0	1
1	0	1	0
1	0	1	0
0	1	0	1

The 1000 AD Jain magic square as a binary space number in 2D. Symmetry allows it to produce 384 magic squares



shufflings for an a^b set of power patterns. This Ss symmetry applies to all types of space numbers $axbxc\dots$

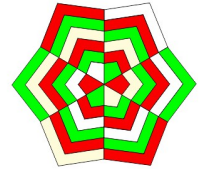
Rotation symmetry: Rs Rotation for the Jain Pp's does not apply since shuffling and binary reversal produce the same effect.

Mirror symmetry: Ms For the Jain just reverse the black and white.

Permutation symmetry: Ps Permutation symmetry not used here.

So shuffling = $4! = 24$ and reversal = $2^4 = 16$ and $24 \times 16 = 384$ different magic squares by doing the allowed symmetries for the Jain Pp. The Puzzleatomic.com web site has many

space number games that you can play. Some are a mixture of bases and have lots of colors and when stumped some have hint buttons and all have a solve button. The games exist in 2D and 3D and in circular geometries as well. Much great fun with math.



Trinary Pp

Links

Jain Magic Sq. Space # game
<http://www.puzzleatomic.com/GAMES/jm4x4/jm4x4.html>

40,000 8x8 magic squares game
<http://www.puzzleatomic.com/GAMES/barink8x8/barink8x8.html>

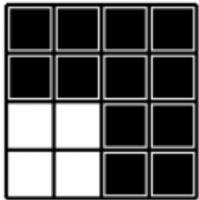
3D cube game
<http://www.puzzleatomic.com/GAMES/esn2x2x2R/esn2x2x2R.html>

Hexa base 2, base 3 game
http://www.puzzleatomic.com/GAMES_3.htm#Hexa36

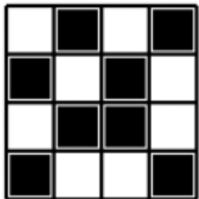
Space Game links page
http://www.puzzleatomic.com/GAMES_3.htm

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Solution



Current



Not Clear

Space Logic Games

White squares are zeroes(false) and colored squares are ones(true).

2X2 Parameters

a

And	Or
Nand	Xor
Reverse	

b

And	Or
Nand	Xor
Reverse	Rotate

c

And	Or
Nand	Xor
Reverse	Rotate

d

And	Or
Nand	Xor
Reverse	

Click on "New Puzzle" to get a new game. You have a solution pattern and a current pattern. Object of the game is to make the current pattern match the solution pattern.

The game shown here has 4 binary patterns that you can

logically and, or, nand, xor with the current pattern. The game has a flaw in that some of the puzzles are too easy to solve, but most of them are quite challenging.

You can also reverse and rotate the logical parameter patterns. The code makes the solution pattern by doing

the same logical operations that you can do. However the only reversible operation is Xor, so you will probably use a different set of button pushes to solve than the computer uses to create a new puzzle. A solution should always be possible. Great fun learning logical boolean with a game.

<http://www.puzzleatomic.com/GAMES/spacelogicjain/spacelogicjain.html>

<http://www.puzzleatomic.com/GAMES/spacelogic4x4/spacelogic4x4.html>

Space Game main links page
http://www.puzzleatomic.com/GAMES_3.htm

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