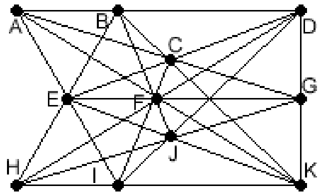
# COMMENTARY ON WEEKLY PUZZLES

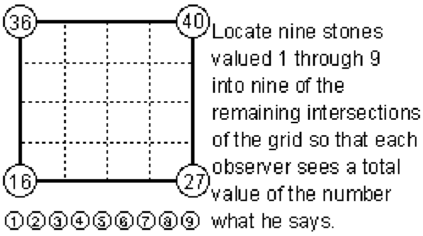
**material added 17 February 2001**

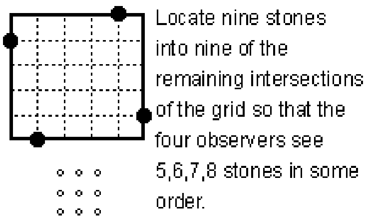
Erich Friedman made a page about Circles through Points. David Eppstein (Geometry Junkyard) suggested combining these problems. What is the fewest number of continuous arcs needed to pass through a grid of points? David shows that three arcs are enough for the 4x4 case. What's the answer for the 5x5? Solutions on the Connect the Dots page.

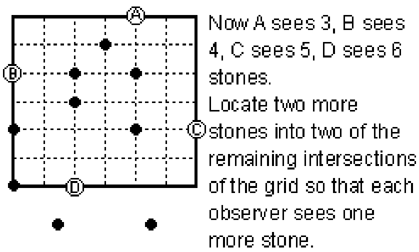
Consider the following diagram of observers. If you're observer D, the only other observers you can see are B, C, F, J, and G, or five observers. The other observers are blocked. Observer B can see A, C, D, E, F, G, and I, or seven other observers. Observer A can see six other observers. If I gave the problem, "Plant 11 observers so that 4 of them can see exactly 7 other observers," then the following diagram would work (B E G I).




Cihan Altay sent me three Observer puzzles. As in the example above, observers can 'see' in any direction, not just along grid lines. The group of problems forms my puzzle of the week. Answers. A similar problem is to arrange 6 observers so that each one sees exactly 4 others. If you have *n* observers, and each one sees *k* or fewer others, how small can *k* be? At Cihan's site, he is currently running a competition problem: (It starts *Asagidaki diyagramdaki toplam ...*).



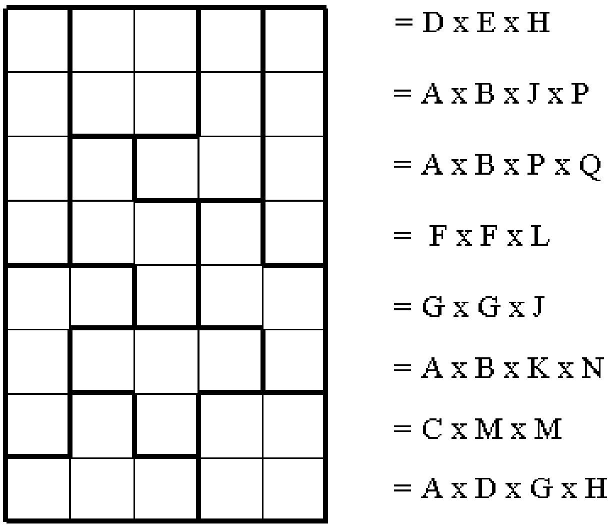




**Material added 14 January 2001**

Here in the United States, The INAUGURAL happens this week. Rearrange those 9 letters so that they form the ending of an 11 letter word describing a type of triangle. This was solved by Al Zimmermann, Reuben Fries, Nick Gardner, Nick Gardner, Stephen Kloder, Al Stanger, Joseph DeVincentis, John Gowland, and Sudipta Das. Answer.

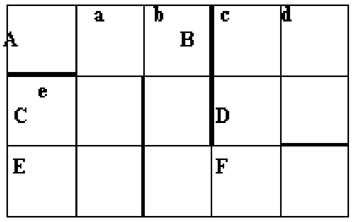
John Gowland has sent me some new puzzles. If you solve either one, Tetris Squares was solved by Nick Gardner, Timothy Firman, Bob Kraus, Brooke Dane, and Joseph DeVincentis. Solution.

**Tetris Squares, by John Gowland**




1.In this game of Tetris, two sets of tetrominoes have fallen into a 5 by 8 grid.
2.Each piece contains the digits 1, 2, 3 and 4.
3.Each row is a five digit number found by multiplying the unknowns together.
4.Each unknown is a prime less than 100.
5.A < B < C < D…<N < P < Q.

**Double Squares by John Gowland**

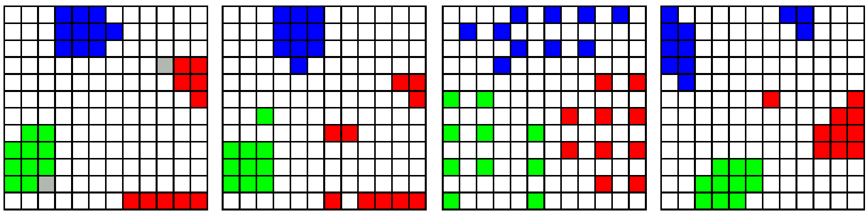



Some squares look as if they should be expressed in two halves.
$9805^2 = 96138025$ looks like $31^2\_195^2$ and $60526^2 = 3663396676$ looks like $1914^2\_26^2$.

In this crossnumber, $x^2 = y^2\_z^2 = 1000y^2 + z^2$.
There are no zeroes in the completed diagram.

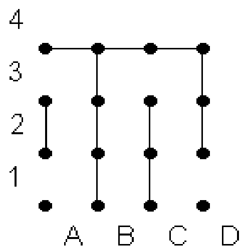
| x | y | z |
|---|---|---|
| | | |
| A/2 | e/6 | E |
| 4F | 2b/e | C/4 |
| 5a | 7d/5 | B/3 |
| c | B/3 | D/3 |

Double Squares was solved by Dwight Kidder.


Nick Gardner Michael Dufour Roger Phillips Bob Henderson

The 12x12 Peaceful Queens problem lead to an interesting range of solutions, as you can see above. Nick and Bob even squeezed in an extra queen. As the diagrams above suggest, there is still much to be discovered. I'll gladly publish any results. Ulrike Schütz, Stas Soumarokov and Eugen Zotov also found solutions.

**The Dots and Boxes Game** by Elwyn Berlekamp. A hundred problems in Dots and Boxes, with increasing difficulty. The third problem from the book is below, play and win. The 97 problems that follow are harder, several problems towards the end (on a 5x5 board!) are unsolved. In addition, a full wealth of the known strategies are explained. He even provides a Nimbers calculator, for more difficult positions. Solved by Stan Isaacs, Stephen Kloder, and Joseph DeVincentis.




What is the winning move? Answer.

No notation scheme is given in the book (pictures are used), so I'll introduce one. Any move will be either the lower edge (—) or left edge (|)of a given square. Thus, the moves already made are A2|, A4—, B1|, B2|, B3|, B4—, C1|, C2|, C4—, D2|, and D3|. Such a scheme, for a 5x5 grid, would use A-F and 1-6.

Koshi Arai -- Make a numeric formula whose answer is 2001 using the 9 digits from 1 to 9 in that order. The four rules (+, -, /, x), ^(power) and ( ) are usable. Incidentally, 13^3 - 14^2 = 2001.
Chris Lusby Taylor: 2001=(1+2)*(-3-4+5+678-9)
Jon Palin
> 2001 = 1 x (2^(3 x 4 + 5 - 6)) - 7 x 8 + 9
> 2001 = 1^2 + (34 x 56) + 7 + 89
> 2001 = 1 + 2345 - (6 x 7 x 8) - 9
> 2001 = - (1 - 2) x (345 x 6) - 78 + 9
> 2001 = - (1 x 2) + 3 - (4^5) + (6 x 7 x 8 x 9)
Koshi Arai:

$$(1 \underset{(x)}{+} 2 \underset{(x)}{+} 3)^4 + 5 \times (6 + (7 + 8) \times 9) = 2001$$

$$1 + (2 + 3)^4 / 5 \times (6 - 7 + 8 + 9) = 2001$$

$$1 \times 2 \times (3 + 4^5 + 6) - (7 \times 8 + 9) = 2001$$

**material added 2 January 2001**

Marek Penszko let me know that $2001 = 7^4 - 7^3 - 7^2 - 7^1 - 7^0$. He also sent the following puzzle. It was solved by Michael Dufour, Stephen Kloder, Scott Purdy, Koshi Arai, Akisuke Arai, Dick Saunders Jr, and Matt Elder. Solution.

| | | | | | |
|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 2 |
| 2 | 2 | 1 | 0 | 0 | 1 |
| 0 | 2 | 1 | 2 | 1 | 0 |
| 2 | 0 | 0 | 1 | 0 | 0 |
| 1 | 2 | 0 | 0 | 2 | 0 |
| 0 | 1 | 2 | 0 | 0 | 1 |
| 0 | 1 | 0 | 2 | 0 | 1 |
| 0 | 0 | 2 | 0 | 0 | 2 |

Example

| | | | |
|---|---|---|---|
| 0 | 2 | 1 | 0 |
| 0 | 2 | 0 | 0 |
| 2 | 1 | 1 | 0 |

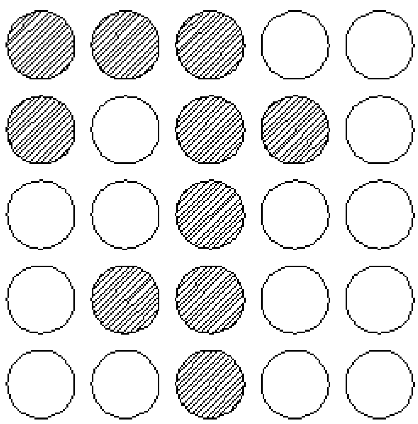
**material added 28 December**

Erich Friedman -- P and S are given the product and sum of two non-zero **digits** (1 to 9).

1. P says "I don't know the numbers".
   S says "I don't know the numbers".
2. P says "I don't know the numbers".
   S says "I don't know the numbers".
3. P says "I don't know the numbers".
   S says "I don't know the numbers".
4. P says "I don't know the numbers".
   S says "I don't know the numbers".
5. P says "I know the numbers".

what are they? Solved by Stas Soumarokov, Reuben Fries, Mehmet Eroglu, Canan Erdogan, Andrew Lord, Dane Brooke, Bob Kraus, Andrew Ofiesh, Carl John Ragnarsson, and Nick Baxter. Solution.

At the World Puzzle Championship 2000 page, I list a Erich Friedman-inspired puzzle few have solved. Put the numbers 1-15 into the unshaded circles so that the distances are constantly increasing. That is, the distance from 1 to 2 will be less than the distance from 2 to 3, which is less than the distance from 3 to 4, and so on. Here is my easy version of that puzzle. Dane Brook and Michael Dufour have solved it.



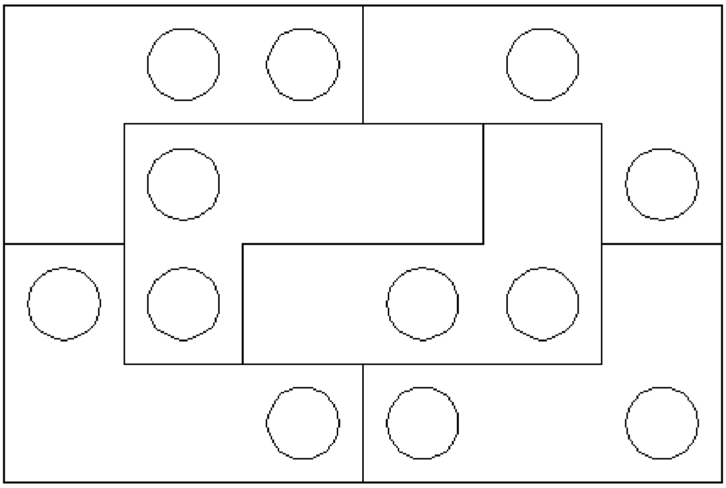
Jed Martinez -- Taking the nine letters in the word LOITERING and rearranging them, you'll come up with the words LION and

TIGER - which are not only two animals, but two from the very same species (felines, or big cats). Given this premise, can you anagram the eleven letters in the word MARIONETTES, and spell out two different animals who also belong to similar species? Marionettes solved by Bob Kraus, Roger Phillips and Sudipta Das. Answer.

Kate Jones -- "I just sent Arthur C Clarke a Logo Puzzle, for writing pentominoes into his science fiction thiller, *Imperial Earth*, in 1976." Hmmm. Build a set of pentominoes out of obsidian, one meter for each unit square, and a half meter thick. Add two 2x3 hexominoes at the same scale. Assemble the 14 pieces into 1 x 4 x 9 monolith. Monolith was solved by John Gowland, Bob Henderson, Patrick Hamlyn and Michael O'Brien. Answer. Incidentally, Kate has made the 12 piece Iamond Hex available at her site.

--Michael W. O'Brien -- I saw your "2001"-inspired monolith puzzle and... well, as I believe Dr. Poole would have put it: "My God--it's full of solutions!" Actually, the puzzle simply amounts to finding out how to make two 4-by-9 rectangles using the pentominoes and two 2-by-3 rectangles. I used the Universal Polyomino Solver and found the solution shown in the attached picture (I recolored the blocks myself). Not a bad puzzle--and at least MY computer cooperated!

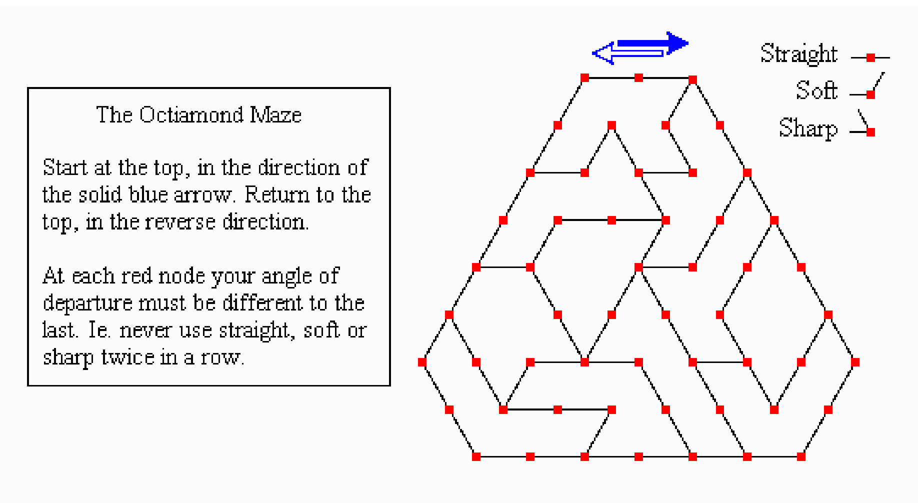
**material added 21 December**



I recently mentioned that I like Fill-Agree by Kadon. I managed to solve a tiny subpuzzle, and enjoyed it a lot. The above shows the complete set of all six ways to put two dots on an L tetromino. Looking horizontally and vertically, the 12 dots are not connected. Connect the dots in a new 4x6 rectangle. Answer.

**material added 17 December**

Andrea Gilbert (clickmazes.com)-- "I have Christmas Maze for you ... the Octiamond Maze. Inspired (indirectly) by Border-Patrol. Given the abundance of available octiamond pieces (and solutions) you might think it would be possible to design plenty of challenging mazes with this rule, but infact a decent maze relies heavily on the few pieces which you can circum-navigate using the rule (or nearly so). Since there are only 5 pieces that you can completely circum-navigate, and only 7 pieces with a single break-point (if I counted right), options are actually quite limited." Nice. Can you solve it? Answer. You may now get octiamonds from Cleverwood or Kadon.




I've been going through a computer restore, and looking at mysterious things I guess I must have done, but forgot about. I found a file called 12cards.txt: **3**-2**4**-3**5**-7**6**-11**7**-16**8**-20**9**-25**10**-26**11**-26**12**-25**13**-20**14**-16**15**-11**16**-7**17**-3**18**-2. There was also the cryptic note, "groups of three." I figured out that I had found 12 cards so that picking three at random would give the indicated distribution. Can you figure out the twelve cards? Answer.

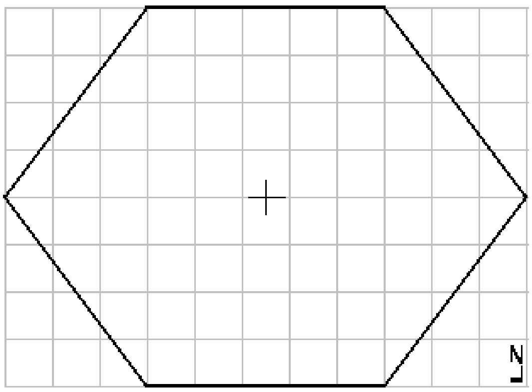
Bob Kraus -- Glad to see a few people solved my Number Cycle puzzle. So I've made another one just in case someone wants more! Actually, I made another one because they are fun to make!!! Making puzzles can (sometimes) be more fun than solving them! **Number Cycle 2**: Find a cycle of six 4-digit numbers such that the last 2 digits of each number are equal to the first 2 digits of the next number in the cycle. Each of the 6 numbers must be one of the following types (with all 6 types being represented): Square, Cube, Triangular, Prime, Fibonacci, Power-of-Two. The solution is unique. Answer.

Derek Bosch -- I thought of a puzzle while wrapping packages last night... what is the SMALLEST square of wrapping paper you need to wrap a unit cube without cutting the paper? Probably an old classic, but I liked it. Answer.

**material added 14 December**

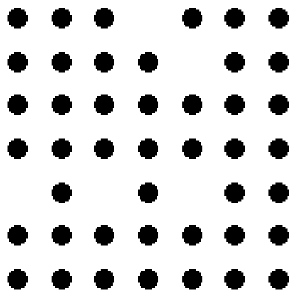
Define a chess position as **peaceful** if no attacks exist on the board. An initial chess position is peaceful, for example. Can you put 3 cavalaries of 14 knights on an 8x8 board in a peaceful position? Can you put 3 collections of **10** queens on a 12x12 board in a peaceful position? Guenter Stertenbrink and Juha Saukkola helped me with these problems. Roger Phillips is the first person to solve the Queens problem. Answers.
Mario Velluchi and Optimization Magazine have both written about peaceful positions.

Livio Zucca -- I have a very very fine puzzle for you. I tested it with Italian friends. In attachment you have an equilateral not-regular hexagon with edge=5 and key=8, that you can draw on squared paper. The problem is to divide it into similar triangles (triangles which have identical angles). The winner is who uses the lower number of triangles. The solutions are many (Pyt3-4-5, DOMs, etc.) but only one is the best!!! I hope you like it and you publish it. Only Joseph DeVincentis found the Answer.



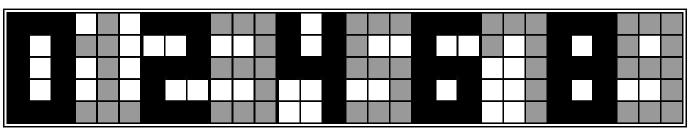
Divide it into n similar triangles.

Erich Friedman -- The dots are the corners of a collection of squares. The squares never share a corner, though they can share part of an edge. Draw the squares. The solution is unique, having been generated and checked by a computer. What is the area of the third largest square? Answer.



Number Cycle by Bob Kraus: Find a cycle of five 4-digit numbers such that the last 2 digits of each number are equal to the first 2 digits of the next number in the cycle. Each of the 5 numbers must be one of the following types (with all 5 types being represented): Square, Cube, Triangular, Prime, Fibonacci. The solution is unique. Answer.

Cihan Altay runs the excellent turkish puzzle site otuzoyun.com. He offers an optimization problem.



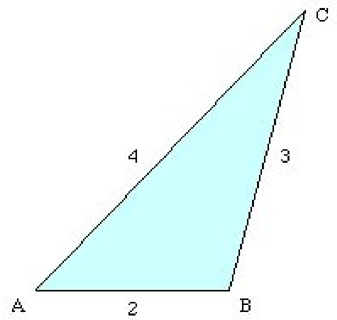
Here, zero touches 2 squares from other numbers, 1 touches 3 squares from other numbers, 2 touches 4 squares from other numbers, and so on to 9, which touches 4 squares from other numbers. If you multiplied each number by the number of squares it touched, and summed the result, you'd get 0x2 + 1x3 + 2x4 + 3x6 + 4x7 + 5x8 + 6x5 + 7x6 + 8x9 + 9x4 = 277. Rearrange the numbers to maximize this sum. Answer.

Lunar Lockout was voted the Puzzle of the Year by Games Magazine. For commercial games, I have to agree. I presented something similar, Queens on Roller Skates, last year. Guenter Stertenbrink recently solved this problem. He found a way to put 11 obstructions on a 10x10 board so that a QORS in the corner could make a series of moves to stop on any unobstructed square (A QORS can only stop if it hits an obstruction or the edge). Answer.

Old puzzle -- Arrange 7 cylinders so that they all touch each other. Here's the answer. Torsten Sillke asks for the shortest cylinder with a radius of 1. New Puzzle -- Arrange 8 identical rectangular boxes (of any dimension) so that they all touch each other. If the short side is 1, what is the minimum length of the long side? Answer.

Occasionally I'll ask a question that I don't have an answer for. This week... Is there a single shape that can be folded into both a regular tetrahedron **and** a regular cube? Partial Answer.

Junk Kato sent me a lovely little puzzle. Here is a triangle with side lengths of 2, 3, and 4. Make a tetrahedron by folding along three lines. Answer.



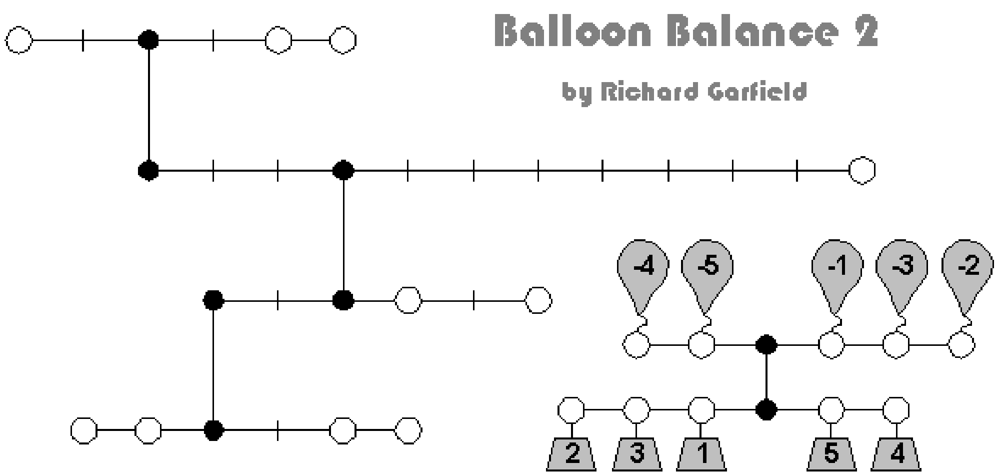

Wei-Hwa Huang took a look at the 4 Pentiamonds. These are the 4 shapes made with 5 equilateral triangles. 4x5 = 20, which is the number of faces on an icosahedron. Obvious puzzle -- cover the icosahedron with the 4 pentiamonds! How many distinct solutions are there? Answer.

Tan[ArcSin[Cos[ArcTan[Cos[ArcTan[Sqrt[3]]]]]]] = 2. Luc Kumps has managed to convert 3 into 1, 2, 3, 6, 18, 30, 36, 45, 54, 60, 72, 84, 87, and 88, using just trig functions and square roots. Can you match him or beat him? Answer.


Add a single point to make the above expression true. The puzzle is by Jaime Poniachik of Argentina.

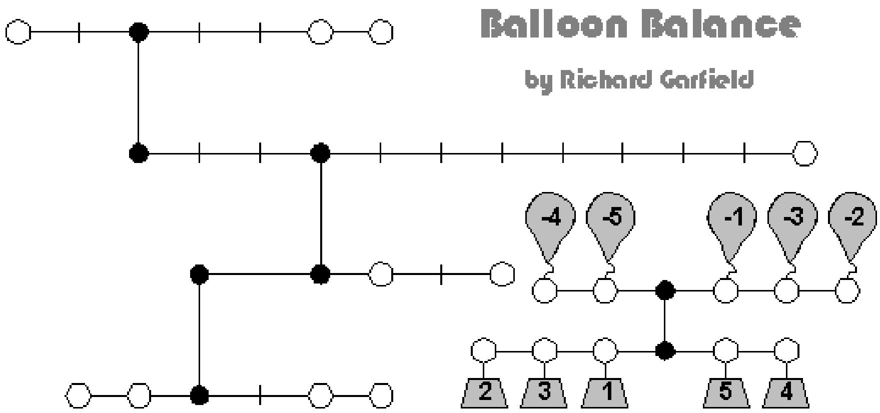
Solvers included Chris Abdnour, Cihan Altay, Koshi Arai, Tim Atkinson, Jim Boyce, Byron Calver, Aram Hakobyan, Emmanuel Harang, Neil Harris, Annemarie Hulbert, Jason Jamison, Matt Jones, Craig Kasper, Dwight Kidder, Murat Kipel, Bob Kraus, Charles Main, Ali Muñiz, Lance Nathan, Matthew Newell, Carlos Ernesto Penedo, Marek Penszko, Roger Phillips, Dick Plugge, Tim Price, Gerry Quinn, Juha Saukkola, Dick Saunders Jr., Daniel Scher, Stas Soumarokov, Al Stanger, Jonathan Tang, Mark Thompson, Ton Tillemans, Bob Wainwright, Christian Willumsen, Michael Winterstein, Fairfax, HappyMutant, and Vortechz. Solution.

**Oct 25th** Some comments on Balloon Balance, by Richard Garfield. He's the mathematician that invented *Magic: The Gathering*. I made a subtle mistake in the diagram, however. Miraculously, the problem was still solvable. So, now that you've seen an easier version, try out **the intended version**.




I'm intrigued by my own mistake -- a subtle change, and the solution is mostly different. Can someone find another problem of this type, with two hazy nodes. A balloon or weight can go on one hazy node or the other. Depending on which node you pick, all the balloons and weights go to different positions. Solvers inculded Brooke Dane, Bill Daly, Jarom Lechner, Ignacio Ruiz de Conejo, Hong Zhang, Koshi Arai, Evgeni Lukin, and Bob Kraus

**Oct 19th** The puzzle for the week is Balloon Balance by Richard Garfield of Wizards of the Coast. It was my favorite puzzle from part 6 of the competition. Notice that the weights and balloons are in equilibrium on the smaller figure. Move them to the larger figure and obtain equilibrium.




Balloon Balance (c) 2000 by Richard Garfield. Used with permission.

Solvers included Chris Lusby Taylor, Hong Zhang, Colin Bown, Jarom Lechner, Koshi Arai, Brooke Dane, Joseph DeVincentis, Happy Mutant, and Bill Daly.

What is the longest queen's tour of the chessboard? Juha Saukkola found a tour of length 373.445742855.

60 47 51 28 13 54 07 40
17 62 49 30 11 45 36 24
56 15 58 42 09 38 26 57
33 21 19 64 34 22 32 20
04 02 06 41 01 46 05 03
53 44 37 27 14 59 43 52
08 35 25 31 12 18 61 48
39 23 50 29 10 55 16 63

This makes me wonder about a slightly different puzzle. What is the longest possible closed Rook's tour?
**Fabio Buffoni** I found a tour of length 376.830688 I made it in a hurry. It should be right, but please check it. [Bryce Herdt - The length of the queen's tour Fabio Buffoni found is slightly less than what he said- it's actually 376.8305191. ]

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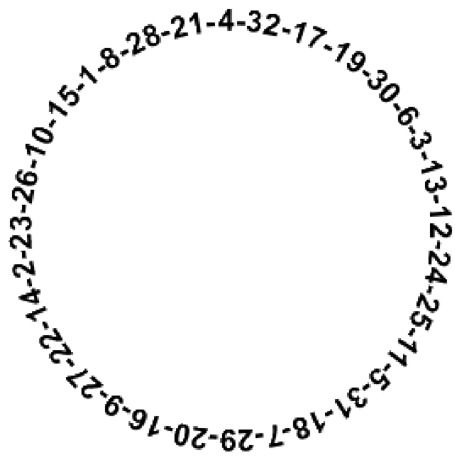
58 25 47 19 40 44 32 01
52 60 23 17 38 34 05 15
42 50 62 21 36 03 13 49
08 10 54 56 07 11 09 55
29 27 31 00 63 26 28 30
45 33 06 16 39 61 24 46
35 02 12 20 41 53 59 22
04 14 48 18 37 43 51 57
```

**Arrange the numbers 1-15 in a line so that any two adjacent numbers sum to a square number.** This puzzle was given to me by Bernardo Recaman of Columbia. Solvers -- Walt Hoppe, Bob Wainwright, Ulrich Voigt, Ogzu Tokgoz, Chuck Keelan, Walsh, Joe Kisenwether, David Wilson, Bill Daly, Ole Poul Pedersen, Nick Baxter, Seth Kleineman, Febrizio Achille Polo, Anand Vishnubhotla, Rajkumar Gopalan, Sean Sandquist, Joseph DeVincentis, and Jon Palin

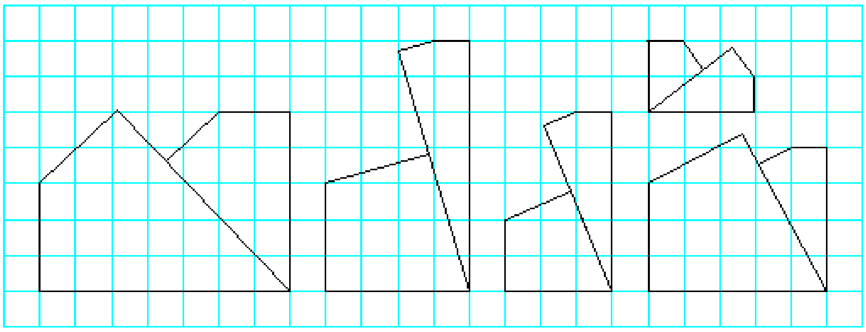
Joe Kisenwether has upped the ante. **Arrange the numbers 1-32 in a circle so that any two adjacent numbers sum to a square number.** The answer is unique (I've verified this). 1-32 Squares solvers -- Andy Lewis, Evgeni Lukin, Gerry Quinn, David Yamanishi, Dick Saunders Jr, Happy Mutant, Byron Calver, Tim Firman, David Wilson, Chuck Keelan, Stephen Kloder, Koshi Arai, Joe Kisenwether, J B Gill, Dane Brooke, Monica Joubert, Jon Palin, Ole Poul, and Francis Heaney. Here is Koshi Arai's picture of the 1-32 squares problem.




Solvers of puzzles at my World Puzzle Championship page. Lunar Lockout -- Ulrich Voigt ( B-L, C-RD, A-DR, C-UL, B-DR, A-D, X-LDL ) Nob's Triangle -- David Molnar, Greg Frederickson. (Turns out Nob only inspired it. The new attribution is Andy

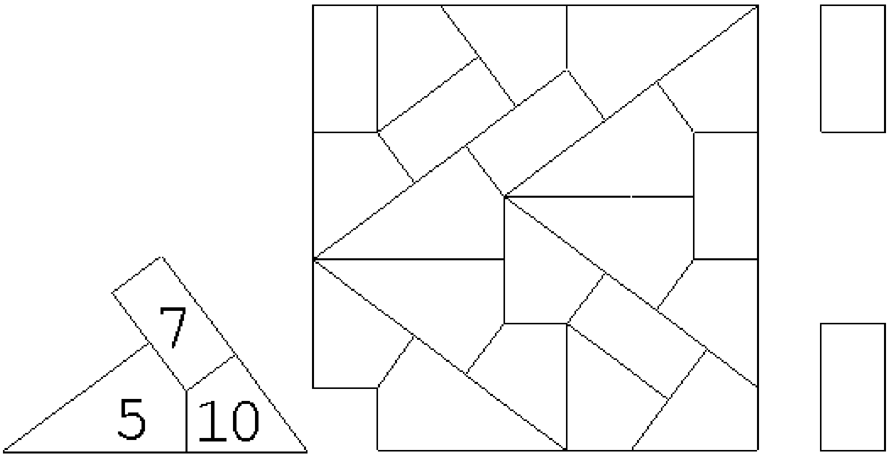
Liu/Nick Baxter). Triangular Battleships -- Joseph DeVincentis, Nick Baxter. Figure substitution -- John Gowland.

I've been looking at Kites recently. Here's a little fact I've never fully appreciated: Pi/4 = ArcTan[y/x] + ArcTan[(x-y)/(x+y)]. If you have a 1-2 right triangle and a 1-3 right triangle, their smaller angles will sum to 45 degrees (Pi/4). 2-1 = 1, 2+1 = 3. If you make kite shapes by reflecting the 1-2 triangles and 1-3 triangles on the hypotenuses, the sharper points together will make a 90 degree angle. Other pairs of triangles also work very nicely together.



Kites that will make 90 degree angles together.

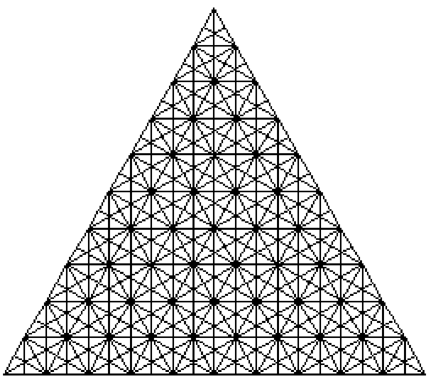
The nicest of these is the 1-2, 1-3 pair. Make a 7x7 square out of 7 dominoes, 10 1-2 kites, and 5 1-3 kites. Below you can see an 'almost' solution. It has an extra 1-3 kite, and two dominoes are missing. Here is a bigger diagram, for printing. This is a **fantastic** puzzle for hand solving. Try it!




Make a 7x7 square with three different shapes as indicated.

My Kites&Bricks puzzle was solved by Koshi Arai and his sons, Adrian Fisher, David Molnar, Livio Zucca, Roger Phillips, Roel Huisman, and Joseph DeVincentis. Koshi Arai found the same three solutions (1, 2, 3) that I found. Joseph found a different puzzle: Make a 7x7 square out of 8 dominoes, 12 1-2 kites, and 3 1-3 kites. I'd like to see other tricky combinations. Many of these solvers mentioned that this puzzle was particularly nice to solve. I thought so, too. Koshi Arai has made a PDF file of Kites & Bricks puzzles and solutions. I made a puzzle with the kites.

The figure below is one David Singmaster has wondered about. He found it in an old puzzle magazine, along with this quote: "And of course, this figure has [some huge number] triangles." He hasn't found a quick way to check the answer, yet.



**How many triangles are in this figure?**

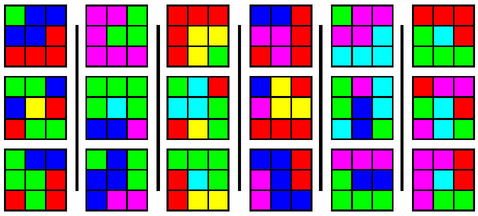
Nick Baxter, Bill Daly, Wei-Hwa Huang, and James Boyce found 8292 triangles. Bill Daly found a formula that will give the answer for a triangle of this type of any size (1678*S^3 + 3117*S^2 + 88*S - 345*(Mod[S, 2]) - 320*(Mod[S, 3]) - 90*(Mod[S, 4]) - 288*(Mod[(S^3 - S^2 + S), 5]))/240.&nbssp; So, for a side of 100, there are 7121577 triangles, and for a side of 1000, there are 7004654532 triangles. Here's lots of explanations.

**Divide a 3x3x3 cube into 4 pieces that cannot be taken apart**. Locked assemblies have been studied peripherally by Burr programs. You can read more about Burr puzzles at the IBM Research Burr Puzzle site. A locked burr of different woods would be an impossible object.

I started thinking about locked assemblies when Patrick Hamlyn's programs figured out how to pack the 1023 heptacubes in 31 3x7x11 boxes. I asked him if all of these boxes could be disassembled, and he answered that he didn't check for that.

What are the smallest *n* polycubes of the same order that can be locked together, for *n* = 2-8? A 3x4 rectangle with the center two cubes missing makes a decacube that can build locked chains. What is the highest number of locked pieces in a 2x6x6 box?

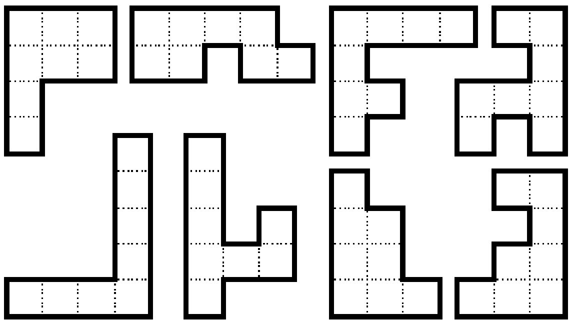
I received solutions from Alexandre Owen Muniz, Roger Phillips, Rod Bogart, David Wilson, Colin Blackhurst, and Zach Archer. The solutions are below. The last one is **not** locked, it turns out.



Roger Phillips found two hexacubes of the same shape that can be locked together. He also found 3 hexacubes of the same shape that can be locked together. Beyond that, the field looks wide open. How many locked pieces is a 2x5x5 block capable of?

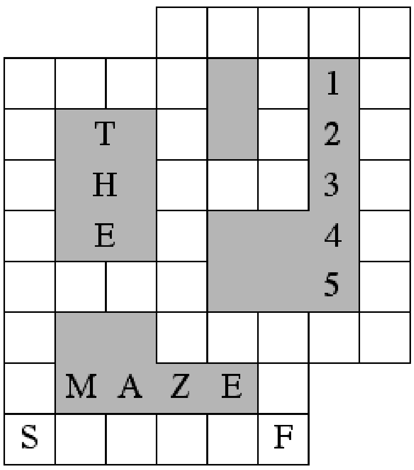
Wei-Hwa Huang sent this puzzle. "**Divide a square into 7 triangles. One triangle must have edge lengths in the ratio 3:4:5. The other 6 triangles must be arrangeable into another square!**" He asks if the same task can be done with less than seven triangles. Solutions were found by Wei-Hwa Huang, Junk Kato, Andrew Cook, and Livio Zucca. Joseph DeVincentis found a lovely 9 triangle solution.

Rodolfo Kurchan wondered if a set of 8 different octominoes could make each of the 5 tetrominoes. Patrick Hamlyn found a solution. You can buy this puzzle as a marvelous wooden set in a square frame by sending $25 to Rodolfo Kurchan, Lavalle 3340 torre 3, piso 21, dpto 3, (1190) Buenos Aires, ARGENTINA. Shipping is included. You may write to him at rkurchan@yahoo.com. This puzzle was solved by Roel Huisman.

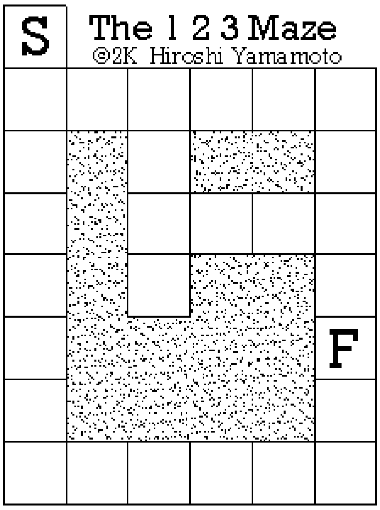


Make each of the 5 tetrominoes using all of these shapes.

Erich Friedman was one of many impressed by the 1-2-3 maze (below). Here is his homage to it ... the 1 2 3 4 5 maze! Start at the **S**. Move **one** space north, south, east or west. Follow that by moving **two** spaces in one of the 4 main compass directions. Follow that by moving **three** spaces in one of the 4 main compass directions. Follow that by moving **four** spaces in one of the 4 main compass directions. Follow that by moving **five** spaces in one of the 4 main compass directions. Repeat this sequence of moving **1 2 3 4** and **5** spaces as many times as you like, until you finish at **F**. See solution.




The 12345 Maze was solved by Robert Abbott, Koshi Arai, Zach Archer, Colin Blackhurst, Rod Bogart, Denis Borris, Derek Bosch, Jim Boyce, Michael Brazier, Andy Brown, Bill Daly, Joseph DeVincentis, Dave Diaz, Matt Elder, Timothy Firman, Brett Gilbert, Francis Heaney, Carl Hoff, Mark Ingram, Michael McKee, Gary Mulkey, Marcelo Nogueira, Carlos Ernesto Penedo, Roger Phillip, Simon Plantinga, Warren Power, Gerry Quinn, Gareth Rees, Juha Saukkola, Al Stanger, George Tolley, Hakan Yaman, Meghan & David Yamanishi, Hong Zhang, and Livio Zucca.




A nice multistate maze by Hiroshi Yamamoto. Start at S. Take 1 step in a direction, then two steps, then three steps. Repeat taking 1, 2, and 3 steps to finish at F. You may not turn a corner or turn back while taking a step. Tricky.

Hiroshi Yamamoto's 123 Maze (above) was solved by Robert Abbott, Koshi Arai, Zach Archer, Colin Backhurst, Nick Baxter, Joseph Becker, Dan Blum, Rod Bogart, Denis Borris, Derek Bosch, Laurie Brokenshire, Andy Brown, Bill Daly, Sandra Daoust, Dave, Joseph DeVincentis, Dave Diaz, Brad Dowden, Matt Elder, Tim Firman, Erich Friedman, Andrea Gilbert, Brett Gilbert, Francis Heaney, Ken Hinds, Carl Hoff, Mark Ingram, Stephen Kloder, Sekeol Kim, Luc Kumps, Magnus Lindgren, Eugeni Lukin, Richard McDowell, Michael McKee, Paul McMahon, Mark Michell, Gary Mulkey, Marcelo Nogueira, Carlos Penedo, Roger Phillips, Simon Plantinga, Juha Saukkola, Daniel Scher, Al Stanger, Mark Thompson, Desmond Tynan, Wei, Hakan Yaman, Meghan & David Yamanishi, and Livio Zucca. This makes it the second favorite puzzle ever, after only the Theseus and the Minotaur mazes. I received a number of false solutions with six moves. The shortest solution needs 15 moves, or 5 sets of 1 2 3.

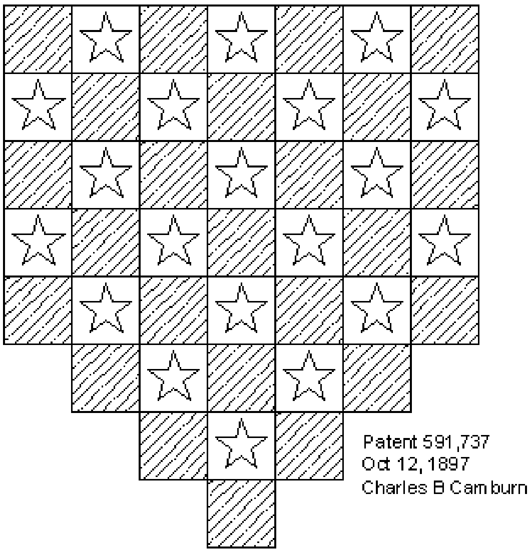
Can two identical 4x7 rectangles be made with a set of 28 dominoes? This was solved by Juha Saukkola, Michael Reid, Joe Logic, Joseph DeVincentis, Andy Brown, and Dan Haoyuep. Here are the interesting write-ups.

## Entropy

Tadao Kitazawa of Japan has designed a superior little puzzle. You'll need a 4x4 grid of squares and four coins.
**START**: Put the four coins on the central four squares.
**RULES**: If adjacent to another coin horizontally or vertically, it may move one, two, or three spaces horizontally or vertically. If the coin is then adjacent to another coin, it may travel again as part of the same move. Jumping coins is not allowed.
**GOAL**: Get the four coins to the four corner squares.
The Entropy Puzzle can be solved in as few as 8 moves, but it is difficult to do in any number of moves. Try it! It is an *excellent* puzzle. Wei-Hwa Huang and Rodolfo Kurchan found different 9 move solutions by hand. Wei-Hwa found the 8 move solution by computer, and wishes he'd kept at it. Can you find a solution of any length?
Entropy solvers: Al Langen, Colin Backhurst, Rodolfo Kurchan, Brian Gain, Antonius Tillemans, Daniel Scher, Robert Kraus, Chin-Mei Fu, Wei-Hwa Huang, Marek14, Eugene Lukin, S.Suresh, Brian Kwoh-Gain, Francis Heaney, and JP Ikaheimonen.
Here is a write up of the eight move solutions by Gary Mulkey.

The Pythagoras Figure problem has been moved here.

An 1897 puzzle by Charles Camburn (patent 591,737) is nice. You have 19 pawns and one king. Place the pawns on 19 of the 20 starred squares, and the king on one of the shaded squares. In a series of 19 horizontal/vertical jumps, remove all the pawns. Camburn claims (in his patent claims) that the solution is unique. Miroslav Figlar, Adam Dewbery, Marcelo Nogueira, Dave Tuller, Wei-Hwu Huang, Juha Saukkola, Chris Lusby Taylor, Bill Daly, and Joseph DeVincentis have solved Camburn's Jumping puzzle. Here is a write-up by Dave Tuller, with an image by Marcelo Nogueira.

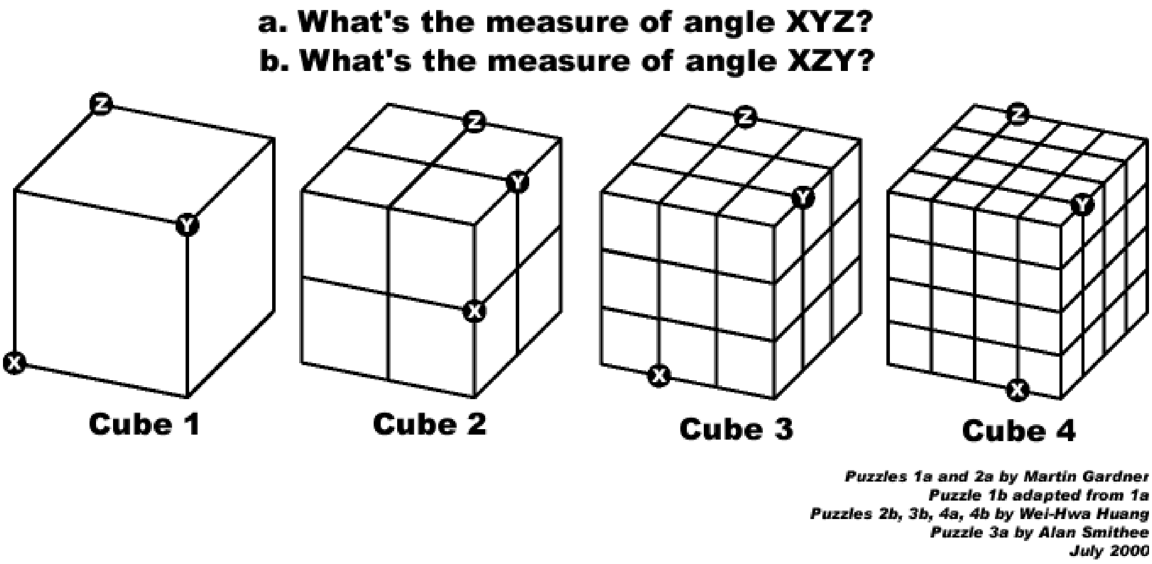



Can your king jump all 19 pawns? Larger image.

The Prime Minister Maze and the Dot maze have been moved to the Multistate Maze page.

The tetracairos have been put here.

Wei-Hwa Huang sent me the following angle puzzle. Most can be solved without using either the Pythagorean Theorem or The Law of Cosines. Solvers: Phil Cohen, John Gowland, Brett Gilbert, Stephen Kloder, and Michael Reid.




The Sokoban puzzle was invented in 1982 for Thinking Rabbit by Hiroyuki Imabayashi. A history is here. A scholarly analysis is here. The German site Sokomind has a program, solver, and levels by many people. Erich Friedman's Math Magic did an analysis of longest paths in Sokoban.

**material added july 16th**

Joseph Becker on Coffin's Three Piece Block Puzzle: I made several out of transparent acrylic cubes, the puzzle is a natural for the optical properties of acrylic. In fact I keep one such adjacent to my mousepad here, so in that sense it is my #1 choice too. BTW, the "glue" for acrylic actually unites the two pieces into one, preserving the optical clarity ... IF you don't dribble it nor mess up the join! Anyhow, somehow being able to see the whole structure at once from any angle just makes it harder to comprehend!

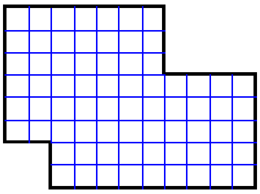
I've built it myself, now (pretty easy). And I solved it after another hour of twiddling. It's very nice, and quite attractive when solved. I found some cheap wooden cubes at a $1 store. 98 wooden cubes for $1.

| | | | | | | |
|---|---|---|---|---|---|---|
| | ¸ | | + | | = | 7 |
| ´ | | ´ | | + | | |
| | ´ | | + | | = | 14 |
| ¸ | | - | | + | | |
| | + | | ´ | | = | 15 |
| = | | = | | = | | |
| 6 | | 7 | | 8 | | |

The above is from the May 28, 1940 patent (#2202078) by Joseph R Bartelt. Fill in the blanks so the equations will work. I'd seen these before, but I wasn't aware of the (expired) patent.

If two squares share a corner, then the vertical triangles on either side of that point have equal area. See this in an interactive applet. There is an easy trigonometric proof of this, since area = 1/2 *ab*sin(*C*), and sin(C) = sin(Pi-C). Andrew Clarke, John Gowland, Naoki Sato, Nils Bruin, and Roger Phillips sent geometric proofs. Here's my favorite.

I came up with a new puzzle for my similar dissections page. See if you can dissect the following figure into 4 similar shapes. It was solved by Joseph DeVincentis, Michael Reid, Serhiy Grabarchuk and Carlos Penedo.



Matthew Daly, Andy Lewis, Hugh Rutherford, Nick Baxter, Andy Brown, and Gary Mulkey have solved Andrea Gilbert's challenge. All of them used a printout and some analysis to solve it.

**FROGS TO PRINCES by Laurie Brokenshire**

**Somewhere in England, there is a magic bog.**

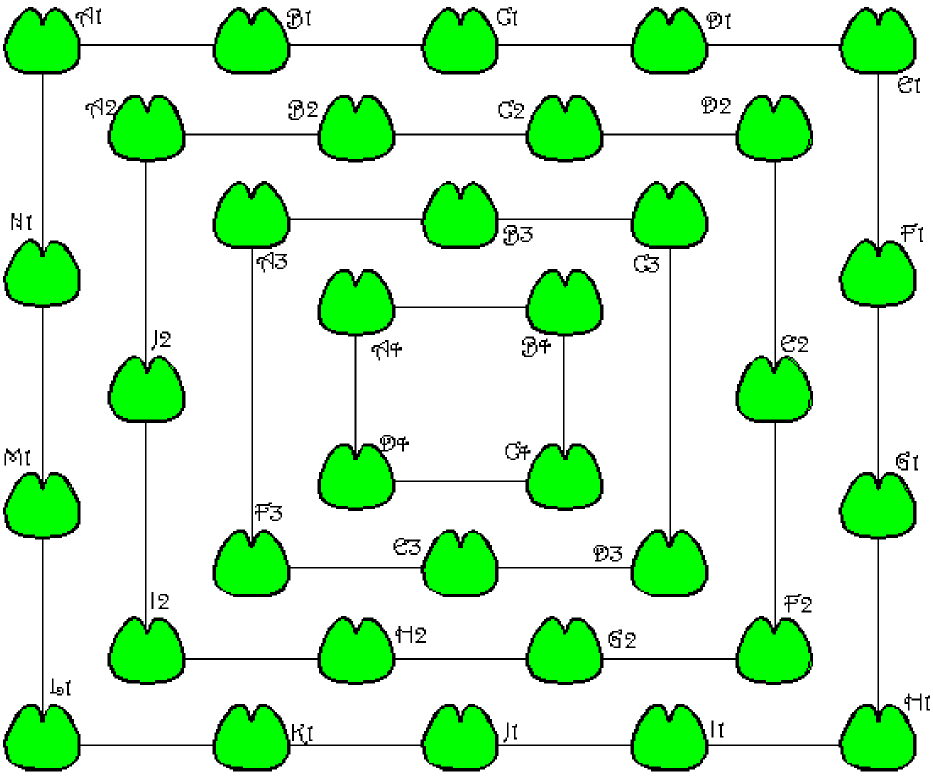
If four frogs can reach the center of the bog at once, they will turn into princes. But the lilypads need to be marked, else the princes will lose their way and drown in the bog.

Being a magic bog, several conditions must be satisfied.

1. Each of the four frogs must start at one of the outer lilypads (A1, E1, H1, L1), and mark those spaces when they enter.
2. Each route must be inward only, and the two lilypads of an inward jump must be marked. Examples: N1-A2, B3-A4, F1-D2.
3. A frog may travel as far as they like in a ring, but only one pad at a time, they may not change direction, and they may not jump onto a pad with a marker.
4. Each route to the center must use exactly **13** lilypads.
5. A frog may only jump to a nearby lilypad, either vertically or horizontally, or diagonally inward.

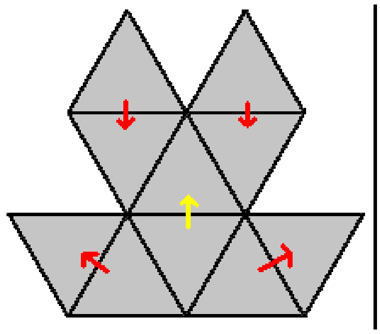
So, the first frog might try E1-D1-C1-C2-D2-E2-D3-C3-B3-A3-F3-E3-C4, leaving markers on E1 (C1 C2) (E2 D3) (E3 C4). The next frog would not be able to use or jump over any of the marked lilypads.

Can you get four frogs to the center, so that they may turn into princes?

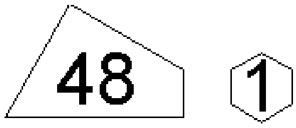



Laurie Brokenshire's Frogs to Princes puzzle. The solution is believed to be unique. The puzzle was first solved by Laurie Brokenshire, who presented it at an International Puzzle Party. He never got a solution for it, so I presented it on my site. The first solver was Matt Elder. Here is his solution.

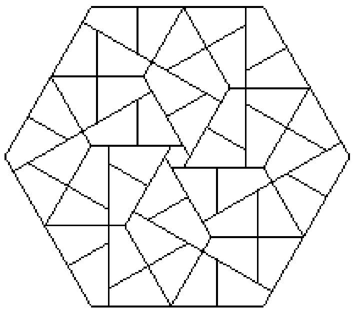
The Rolling Rhomboid maze by Wei Hwa-Huang is here. Solvers included Rod G. Bogart, Andrea Gilbert, Matthew Daly and Hugh Rutherford. You can see the solution here. The diagram below might be useful.



Those of you that have a copy of my Mitre System set can try out a discovery of mine:  Arrange 48 fins and one small hexagon to make a much larger perfect hexagon.  Fortunately, the Mitre set comes with 48 fins.  You can order it at my Orders page.




Michael Reid was the only solver of my 48 fins challenge.  He had these comments.



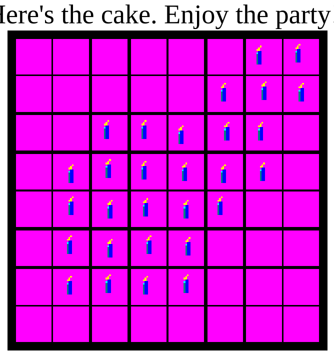
The following is a nice little puzzle I got from Craig Kasper.  Solvers included Michael Reid, John Gowland, skinned knee, Carl Hoff, and Gary Mulkey

A Piece of Cake
Below please find my birthday cake. You are welcome to have a piece if you can cut it correctly.

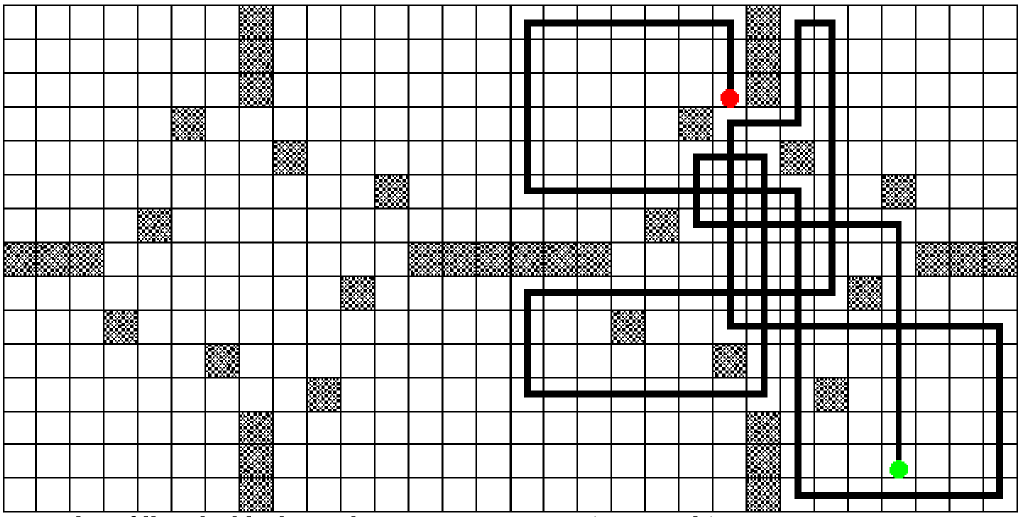
Here's how I want you to cut my cake:

Cut it into four pieces.
Cut into pieces of equal shape and size.
Cut it so that each piece of cake has a different prime number of candles on it.

Here's the cake. Enjoy the party!



CROSSWORD MAZE was solved by Andrea Gilbert, Luc Kumps, Juha Saukkola, Nick Baxter, and Jens-Christian Larsen.  Luc Kumps found many other interesting crossword mazes.
A puzzle I made long ago involved finding the longest path inside a crossword grid.  Start at some square, travel until you hit a black square or wall, turn left or right, and keep going.  If the next square will force you to retrace part of your path, stop.  One of the more interesting grids I analyzed is below.  My longest path was 142 units long.  The example path is 113 long.  Can you beat it (or me)?  What 15x15 crossword grid gives the most interesting maze?



Here's a little Easter puzzle -- fill in the blanks to obtain a common item (two words).

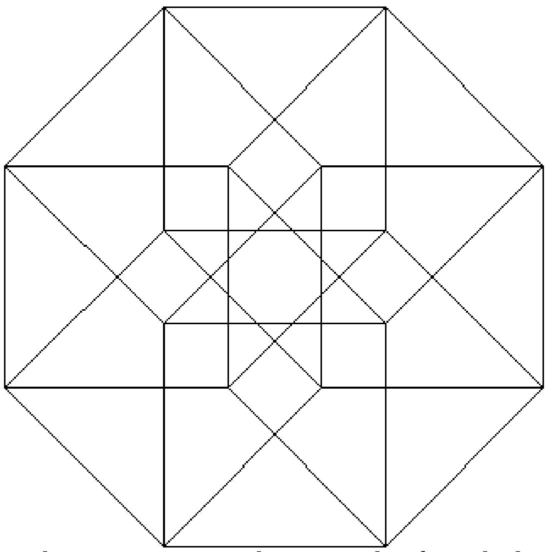
_ _ _ E _ _ A _ S _ _ T _ _ E _ _ R _ _ _

And another.  Here is a *complete* list -- what is it?  Mathematica showed tthis to me.

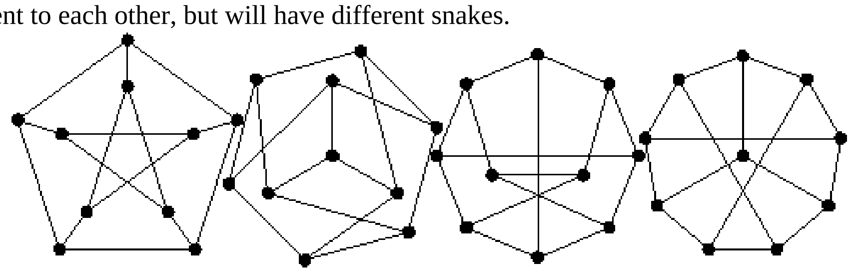
{350, 357, 378, 385}

Dronon has made a very funny article about getting rich by calligraphy.  It's semireligious, so I thought it might fit.  If you can solve the two above puzzles, or if you have the slightest clue what the calligraphy is supposed to say, please write me.

For G4G4, Serhiy Grabarchuk, Bill Ritchie, Steve Wagner, and Binary Arts presented a few puzzles based on the following graph of the hypercube:



Here's my favorite: Place as many matchsticks as you can onto the 2-D grid to form the longest possible matchstick snake.  You may place a matchstick on any free line segment of the grid.  Matchsticks must not cross each other, and your snake must not touch itself even at one point including its head and tail.  How many matchsticks are in the longest possible snake?  Solutions were sent by Stephen Kloder and Joseph DeVincentis.  You might have fun trying the same thing with the Petersen graph.  All of the graphs below are equivalent to each other, but will have different snakes.



Wei-Hwa Huang's 8833 puzzle was solved by Ben Chaffin, Russell McCormick, Carl N Hoff, Tim Atkinson, Jim Boyce, Serhiy Grabarchuk, Andrej Jakobcic, and Andrew Lord.  The answer was 8/(3-8/3).  No other mathematical operators were necessary.  Juha Saukkola suggested ( 8 / .3 ) - ( 8 / 3 ), but decimal points tend to spoil the game.  Wei-Hwa did a search of all possible problems with a decimal point added, and found only one interesting one: 4 7 7 9.  So, try to make 24 with those 4 numbers, + * / - and the decimal point.  See more at the Solutions Page.

***Wei-Hwa Huang***: **"**The game of "**Twenty-four**" is simple **--** it is a more sophisticated form of the game "War". Take a deck of playing cards, and remove all the tens, jacks, queens, and kings, leaving only cards 1-9 in each suit. (Or combine two decks for a longer game.) Deal them out equally to four players. The players do NOT look at their cards, but hold them in a stack face down.

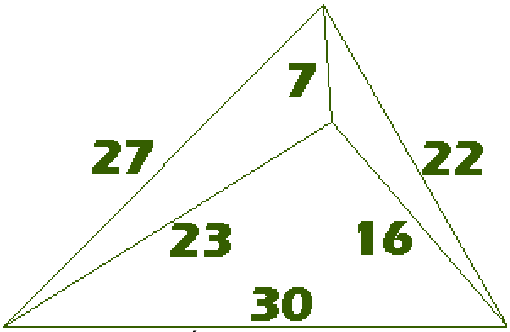
All four players simultaneously flip over their top card, so everyone sees four different cards. Then, all players try to form 24 with those four cards, using only the operations +, **-**, x, and /. Whoever does so first calls out "24" (or "Got it!") and tells the others how to do it. For instance, if the cards were 4, 1(ace), 8, and 8, you might win with:

4188 ==> (8/4+1)x8 **or** (8-4-1)x8 **or** (8x4)-(8x1)

The winner takes the four cards and puts them on the bottom of their own stack, so they have three more cards while everyone else has one less card. Then repeat. Whenever someone runs out of cards, the player with the most cards is declared the winner.

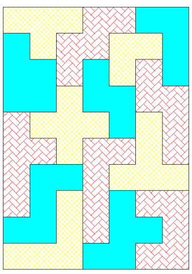
Recently, I [Wei-Hwa Huang] wrote a computer program to generate all possible solutions to the problem. Here are some puzzles for you to try, in increasing difficulty: 9642 4133 7321 8477 9651 7641 8875 8566 8522 3444 9752 1555 8166 8833.**"** For the Puzzle of the Week, find the solution for making 8833 equal 24.

Wei-Hwa Huang's 8833 puzzle was solved by Ben Chaffin, Russell McCormick, Carl N Hoff, Tim Atkinson, Jim Boyce, Serhiy Grabarchuk, Andrej Jakobcic, and Andrew Lord. The answer was 8/(3-8/3).




What is wrong with this picture? Alan O'Donnell, Miguel Ángel Serrano Aguilar, Koi Morris, J. B. Gill, Dick Saunders Jr., Seth Kleinerman, Charles Hanna, and David Eddy all explained that the figure doesn't quite measure correctly. The simplest way to see that something is wrong is to use the law of cosines on each of the three small triangles to determine the central angles. cos A = (b^2 + c^2 **-** a^2)/(2bc), so plugging in the 16-23-30, 7-16-22, and 7-23-27 triangles, we see that the cosines of the interior angles are **-**179/224, **-**151/322, and **-**5/32. The sum of the inverse cosines of these angles should add up to 2 pi, but they actually add up to *very* slightly more: 6.283185343 as compared to 6.283185307. This figure confounds my research of strange tilings. If you cut these precisely with a laser, the error would be undetectable. It makes me ponder how precise a mathematical solution needs to be for a real world problem. Robert Becker wrote me with this analysis. Much more on integer triangles is at my Triangle page.

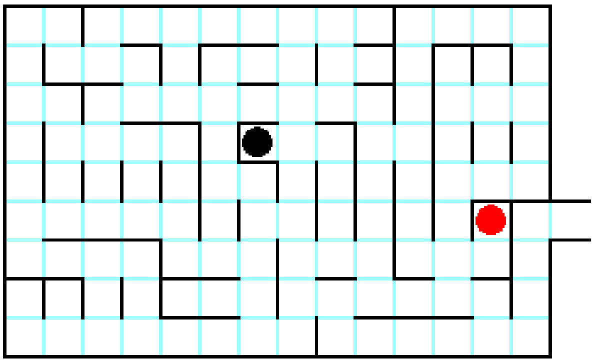
The below 7x10 rectangle has the property that no two pieces of the same color touch each other. There is a **single** other solution with the same property. Can you find it? Click here for a larger image of this puzzle. Many thanks to Patrick M Hamlyn for help with this. If you can solve it, describe the placement of the X piece when you write me.



From Nick Baxter: Find the smallest integer triangle where one angle is double the size of another. Bonus points for finding 3x, 4x, 5x, 6x, and 7x. Bill Daly, Konstantin Knop, Stephen Kloder, and Steven Stadnicki sent solutions, which I'll write up soon. Steven Stadnicki made a *wonderful* observation. The [**4 5 6**] is the minimal **2x** integer triangle. The [**3 8 10**] is the minimal **3x** integer triangle. ***These two triangles have the same area***! Find a three piece dissection that allows you to build either triangle.

Jim Boyce has modified Serhiy Grabarchuk's weighing problem: You have **13** different weights labeled from 1 to 13 decagrams. One of them weighs slightly more or less than its label. With three weighings on a balance scale, identify the inaccurate weight, and whether it is heavier or lighter. Answer.

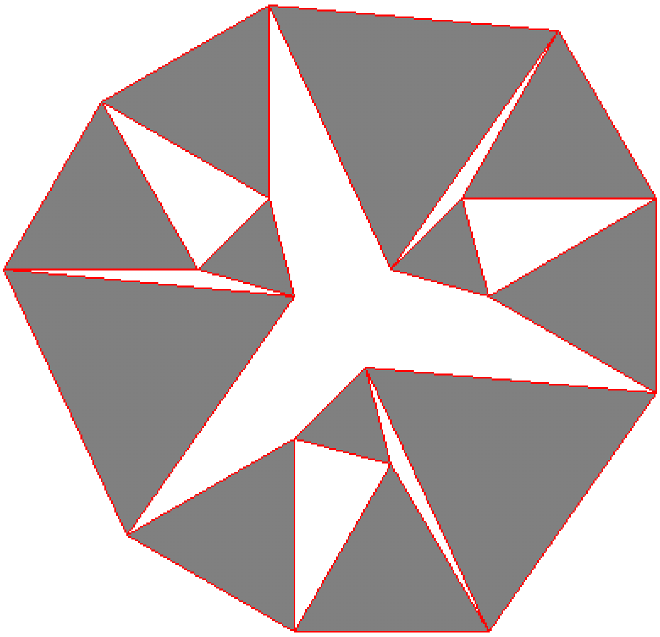
One of the hardest mazes ever published was Theseus and the Minotaur by Robert Abbott, in *Mad Mazes*. Toby Nelson has taken this maze, and designed 15 new mazes of the same type, each one harder than the last. The final maze is probably the most difficult maze ever designed. Robert Abbott has it on his site as **The Dread Maze Fifteen**. See the list of solvers here. I'm happy to make it my puzzle of the week. The image below is just a picture of the maze **--** if you go to Robert's site, you'll have an interactive Java applet to experiment with. Robert Abbott's site is logicmazes.com. Toby Nelson's site is here.



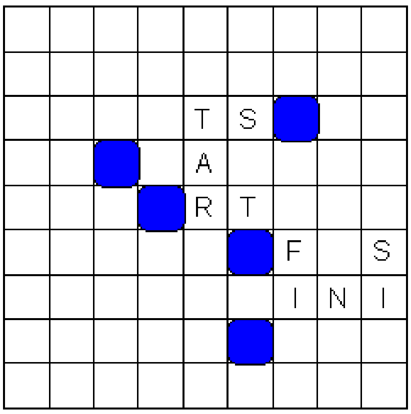
The dreaded maze Fifteen

Here's a little puzzle by Nob Yoshigahara: A father and his son are speaking. "My age now is expressed as XY and your age is as YX by decimal system," says one. The other replies, "Tomorrow, my age is just twice of yours!!" Find two solutions. Solvers included Ton Tillemans, Theresa L, Leonardo Bitrán, Marek Ctrnact, Frank Karlinski, Franz P, George Fehrenbach, Jack Heaney, Jim Boyce, Erwin Eichner, Andre Luiz Rodrigues, and Werner Acker.

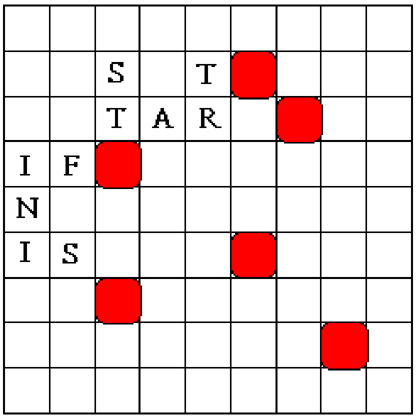
The math journal Geombinatorics recently published an article on saturated triangles. That is, triangles that touch each other only at the vertex, with every vertex being shared by two triangles. The journal publishes an example of a saturated packing with 42 identical equilateral triangles. Erich Friedman has found a saturated triangle packing with 12 equilateral triangles of two different sizes, and of 10 equilateral triangles of 3 different sizes. You might enjoy finding them. Below is a non-optimal solution.



For those that like Rolling Block puzzles, here is another by Luc Kumps. It's very hard.




Robert Abbott and Joseph DeVincentis solved Luc Kumps rolling cube maze: N-W-SSS-EE-N-E-N-E-S WW-S-E-NNN-WW-S-E-S EE-N-W-W-S-EE-NN E-S-W-S-W-N-WW-S-E E-N-WW-N-E-S-W-S Click on the image for a larger version.




From Erich Friedman: What's the smallest square that can be tiled with (more than 1) integer sided squares so that equal sized square don't touch? I think it's the 16x16 square, but i'm not sure. What's the smallest rectangle? is it 11x15? 16x18 is also possible. This was solved by Joseph DeVincentis, who agrees with these numbers.

| | |
|---|---|
| 666666444455555<br>666666444455555<br>666666444455555<br>666666444455555<br>666666333155555<br>666666333666666<br>555551333666666<br>555554444666666<br>555554444666666<br>555554444666666<br>555554444666666 | 4444333555554444<br>4444333555554444<br>4444333555554444<br>4444122555554444<br>5555522555551333<br>5555566666622333<br>5555566666622333<br>5555566666655555<br>5555566666655555<br>3332266666655555<br>3332266666655555<br>3331555552255555<br>4444555552214444<br>4444555553334444<br>4444555553334444<br>4444555553334444 |

A hard puzzle type is the German Sausage. This puzzle is somewhat like anagrams, but each letter has to be used three times. The letters of the answers to the clues in the left list, when added together as indicated and transposed, give the answers to the clues in the right list.

| | |
|---|---|
| 1. Computer in *2001* (3) | 1+2. Vandals (9) |
| 2. Figure with equal angles (6) | 2+3. Remark on time (3 2 2 4) |
| 3. Palm fruits (5) | 3+4. Does something in honor of (9) |
| 4. What I discuss here (4) | 4+5. State of excessive wear (11) |
| 5. Blew one's top (7) | 5+6. Pay offs (12) |
| 6. Cancels (5) | 6+7. Use links to organize back and forth (5 5) |
| 7. Made of nylon or bungee (5) | 7+8. Those who do the organizing (12) |
| 8. City in Toronto (7) | 8+9. Place and facing (11) |
| 9. Type of lite (4) | 9+10. Serum, sometimes (8) |
| 10. Warty one (4) | 10+11. What Colorado gained in 1876 (9) |
| 11. Set of beliefs (5) | 11+12. Like Inspector Gadget's arms (11) |
| 12. What actors follow (6) | 12+13. Gets in the way of (10) |
| 13. Transitional age (4) | 13+1. Like the river of forgetfulness (7) |

This is much harder than simple anagrams. Basically, you just need to find unusual words and scramble them. Histec, icansob, durtless, eliotas, ocatfed, nyetpagi, enasaim, patedon, unmobis, zerohite, zionrho, latheon, eurotin. Very easy. Anagrams can actually be something of an art form if you rearrange the letters so that they mean the same thing as the original phrase. One of my favorites is DATE'S UP! (past due), by David Ellis Dickerson. Contrary to popular belief, a short anagram is much harder to make than a long anagram. Some good examples are here.

Number sequences (done here), simple word searches, and stuff from the FAQ are all easy to do. Regular mazes are borderline - you can see many computer generated mazes here. Crosswords, logic problems, and double-crostics require more skill, especially to do them well. But even simple puzzles become more interesting if they hide something else.

Here is a puzzle from the last NPL convention, by George Groth. In each of the following lists, one word does not belong. Actually, every word in each list has a reason for not belonging, and your job is to find the reason for each entry. The name after each entry is the constructor of that particular set. Can you construct such a foursome? Can anyone make a fivesome, or longer? Answers.

1. Kennedy, Jefferson, Hamilton, Garfield. (by XEIPON)
2. Canada, Chile, Cuba, Nicaragua. (by Wrybosh)
3. sew, too, knew, mew. (by Wombat)
4. Lou, loo, lieu, gnu. (by Ulk)
5. ample, quick, music, homesick. (by Ucaoimhu)
6. Fargo, Atlantic City, Armageddon, Atlanta. (by Trazom)
7. carrot, endive, coffee, lettuce. (by Saxifrage)
8. first, fourth, fifth, sixth. (by Rebel)
9. Edgar Allan Poe, Maya Angelou, Neil Simon, Dylan Thomas. (by Quip)
10. copper, mercury, arsenic, pewter. (by Poi)
11. cloud, sable, cat, camel. (by Philana)
12. tyrannosaurus, great white shark, raccoon, elephant. (by Earl E. Byrd)
13. DeGeneres, Heston, Milk, McKellen. (by Bartok)
14. Stephen King, Ace Frehely, Queen Latifah, The Artist Formerly Known as Prince. (by Anomaly)
15. Florida, New York City, Newfoundland, New Mexico. (by Alf)

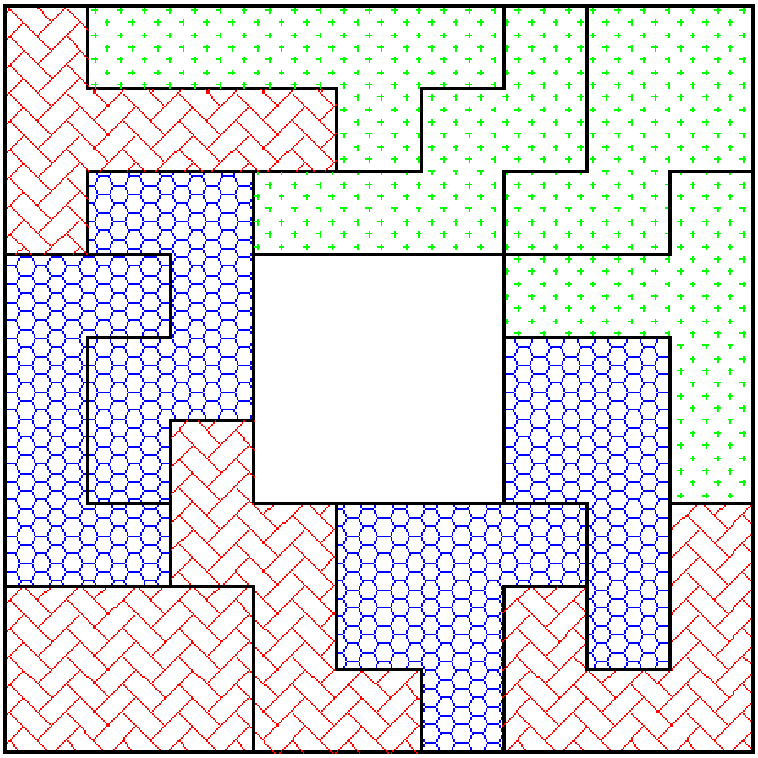
Two interesting problems from the 1999 Colorado Math Olympiad.

1. Construct an equilateral heptagon so that the vertices are all on the intersections of a square grid.
2. Construct a regular octagon so that the vertices are all on the intersections of a square grid.

Solvers and answers (both proofs are easy and cute!)

There are 2 trominoes, 5 tetrominoes, 12 pentominoes, 35 hexominoes, 108 heptominoes, and 369 octominoes. Kadon Enterprises sells all of these sets. Diagrams of everything are available at their site. See more here.

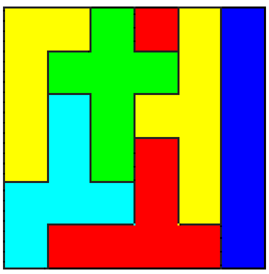
The first puzzle of the week is by John Gowland -- HEXOMINO PRIMES. It was solved by Patrick M Hamlyn and Timothy Firman, and is very hard. The next puzzle might be harder:



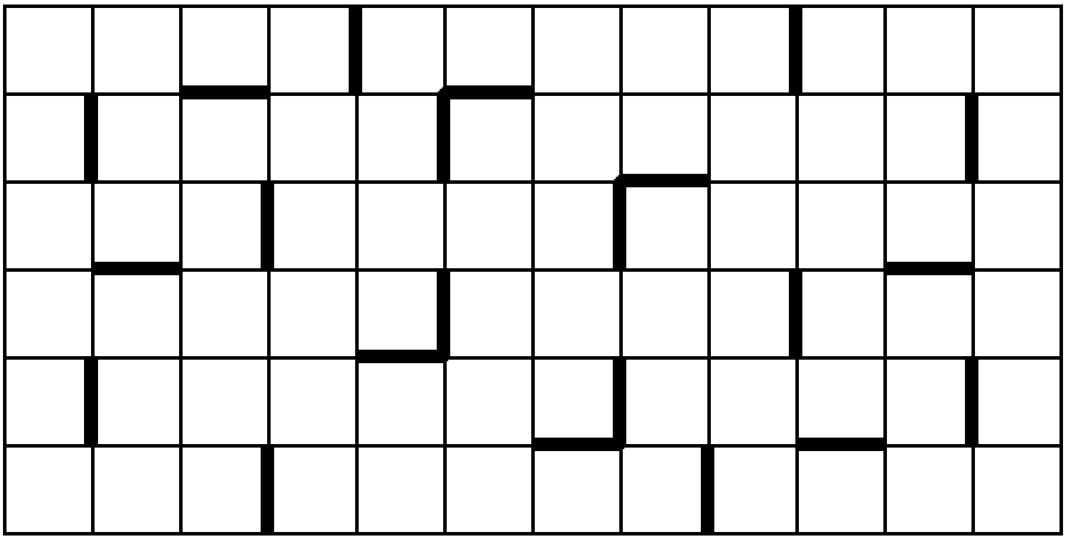
Print out the above, and cut it apart into the 12 component hexominoes. Make an 8x9 rectangle with these hexominoes so that no *two pieces of the same color touch each other*. Three pieces need to be flipped over. So far, it has only been solved by Patrick M Hamlyn's powerful computer programs. Send answer.

Clive Tooth has been trying to pack the 108 heptominoes into a box. He finally has a solution, it's here.

Six simultaneous 6x6 squares are possible with the hexominoes + trominoes, see it here.



And even harder, also by Patrick M Hamlyn. The above figure shows 5 hexominoes, a pentomino, and a monomino arranged to make a 6x6 square. Arrange the othe 30 hexominoes to make 5 more 6x6 squares. The answer is unique.



4 5 6 7 8 9 12 14 15 18 22 23 25 26 29 35 36 38 54 62 66 67
75 81 85 92 111 172 204 235 237 306 442 482 521 619 668 715

Part I: Square or Cube all but six of the numbers above and enter them correctly in the grid. It will look something like the following grids, which are filled with squares and cubes.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 | 4 | 9 | 4 | 2 | 2 | 5 | 4 | 9 | 1 | 3 | 1 | 3 | 3 | 1 |
| 7 | 7 | 8 | 6 | 7 | 6 | 9 | 4 | 5 | 2 | 9 | 2 | 7 | 4 | 8 | 4 |
| 4 | 8 | 4 | 6 | 4 | 7 | 8 | 4 | 6 | 6 | 1 | 1 | 5 | 2 | 4 | 5 |
| 5 | 7 | 6 | 2 | 7 | 2 | 1 | 6 | 5 | 1 | 8 | 4 | 6 | 2 | 4 | 1 |
| 4 | 8 | 4 | 8 | 2 | 4 | 1 | 4 | 3 | 2 | 4 | 8 | 1 | 2 | 5 | 6 |
| 4 | 4 | 8 | 9 | 1 | 7 | 6 | 4 | 3 | 2 | 4 | 9 | 6 | 5 | 6 | 1 |

Part II: The six unused numbers, in sequence, form a perfect square. Take the square root of this number. The result is the final answer. Solvers and a hint. A larger question: How well can powers be packed?

Two related items. 3 + (1 - (9 - 8 ^ -5) ^ -6)/(7 + 2 ^ -4) = ?? and a story.

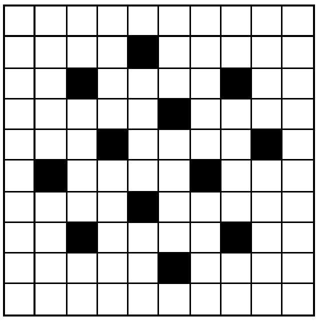
## Rolling Block Mazefest

| | By | Description | |
|---|---|---|---|
| 1 (Other Side Up) | Robert Abbott | Two cubes taped together (1x1x2), with one end marked. You must start in the Start square, and roll the block around until it gets back to the starting space with the Other End Up. The walls are obstacles. | Get Maze |
| 2 (Chasm) | Adrian Fisher | Three cubes are taped together (1x1x3). You are a construction worker for Stonehenge, and must manuever your block from end-up on S to end-up on F. The dark areas are boggy patches. If either end of the column lands on a boggy patch, the column will slip in and be lost. The column can *span* a boggy patch, though. | Get Maze |
| 3. (Slab1) | Adrian Fisher | Four cubes are taped together (2x2x1). Roll the slab from SS to FF. The walls are obstacles. | Get Maze |
| 4. (Slab2) | Erich Friedman | Four cubes are taped together (2x2x1). Roll the slab from SS to FF. The walls are obstacles. | Get Maze |
| 5 (Centering) | Tim Firman | Two cubes are taped together (1x1x2). Roll the slab from the corner to the center. | Get Maze |

Solutions and solvers.
Don O'Brien has created a Non-Euclidean Three Dimensional Maze.
For more info on Rolling block mazes, visit either my page, or Robert Abbott's page.

**QUEENS ON ROLLER SKATES** by Scott Purdy

A chess queen can move any number squares vertically, horizontally, or diagonally. A Queen On Roller Skates (QORS) must keep moving until she encounters a wall or other obstruction. Scott



Purdy asks the question "What is the minimal number of obstructions that allow a QORS to stop on any square?" The best answer we found for the 8x8 square is 6 obstructions, the best for the 9x9 is 10 obstructions, and the best for the 10x10 is 12 obstructions (shown to the left, b5 c3 c8 d6 e4 e9 f2 f7 g5 h3 h8 i6). Can you match or beat our solutions for the 8x8 and 9x9? What is the answer for the 11x11 and beyond? See Answers. A related question: What is the maximal number of moves required for a QORS to travel from one square to another on an *nxn* grid? On the grid shown, the answer seems to be 7 moves.

Last week's poker puzzle was solved only by Tim Firman. Next week, I'll be showing some new multistate mazes by Robert Abbott, Adrian Fisher, Erich Friedman, and Tim Firman.

Here are some interesting "quickie" puzzles. If you can solve them all, you're a genius!

**1**. Arrange 24 dominoes so that every domino touches 4 others on an edge. By Erich Friedman.

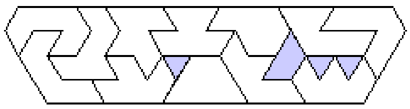
**2**. A Triamond is three equilateral triangles ( ). Cut a side-11 Triamond into 9 smaller triamonds. By Mark Thompson.

**3**. The answers to the clues in the first list, when combined and transposed as indicated, give the second list. By Ed Pegg Jr.

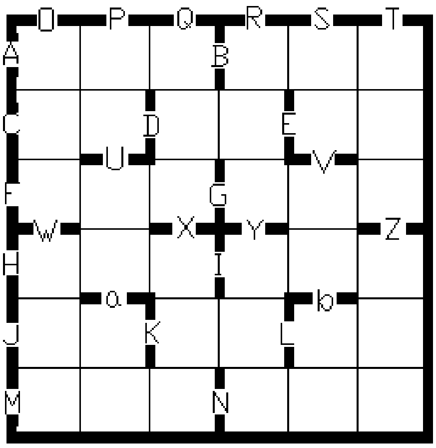
| | |
|---|---|
| 1. Anchor (3 6) | 1+2. Michael Crichton novel and movie (3 9 6) |
| 2. Rules (9) | 2+3. Ragamuffins (13) |
| 3. Of 1 or 2, Rules (6) | 3+4. It lead the Russian Revolution (12) |
| 4. City in Illinois (6) | 4+5. It ended the Russian Revolution (11) |
| 5. Trips, to Shatner (5) | 5+6. Often held over the head at Wimbleton (6 6) |
| 6. Venerable (7) | 6+7. The process of learning (13) |
| 7. Ruler (6) | 7+8. Sauciness (12) |
| 8. Port in Italy (6) | 8+9. Table seasoning (4 3 6) |
| 9. Confined (7) | 9+10. Redford, Moore movie (8 8) |
| 10. Enamel decoration (9) | 10+11. Kissing disease (13) |
| 11. Type of wrestler (4) | 11+12. Chip components (14) |
| 12. Embarrass (10) | 12+13. Like many websites (5 17) |
| 13. Sign (2 1 4) | 13+14. Infelicitous (11) |
| 14. Destiny (4) | 1+14. A punishment (3 3 7) |

**4**. You have 13 gold coins. One of them is heavier or lighter than the others. Find it in 3 weighings. By Dean Sturtevant.

**5**. The 12 octiamonds below have been arranged to make a convex figure, but it has some holes. Can you make a convex figure with these pieces that has no holes? By Ed Pegg Jr.



See Answers.




**Poker Numbers** by Ed Pegg Jr.
Based on the original concept by John Gowland

In this cross number puzzle, multiplying two entries together can produce a number which can be viewed as a poker hand. Straights (84657 or 23465), Full Houses (22828 or 33113), and Four of a Kind (77177, 29999) are possible. Hands are ordered in their value as poker hands. None of the entries contain zeroes. None of the poker hands contain zeroes. The first number is always the lowest of the pair. See Solution. See data.

Straight
bQ VM QH JI LA QB JO JB HZ QX HG
Full House
DT DG KB EA JG JT QT SB CA WG WT HN HB LB SO aA HH HO
Four of a Kind
KM UY VF PR SM LM

**Playing With Blocks by Alexander Soifer** (1993 Colorado Math Olympiad)

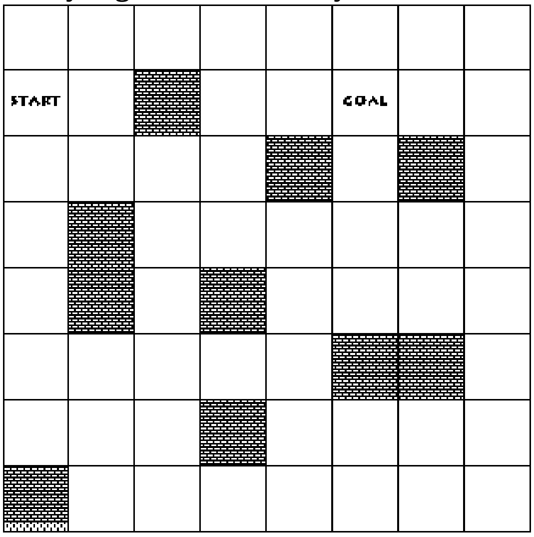
(*) Every square has common sides with an even number of oppositely colored squares.

Each of the *n* unit squares of the initial 1 x *n* strip (*n* is a positive integer) is colored either red or green. We want the above condition (*) to by satisfied. Accordingly, we put a second 1 x *n* strip on top (so a 2 x *n* rectangle is formed), and color its squares in such a way that the condition (*) is satisfied for the initial strip. If it so happens that the condition (*) is satisfied for all the squares of the second strip, then we stop. Otherwise, we put the third strip on top of the second and color it in such a way that (*) is satisfied for all the squares in the second strip, and so on. **Q**: Is there a coloring of the initial strip such that this process of adding and coloring consectutive strips will never stop? **A**: See it here, along with solvers.

I was one of the judges at this Olympiad, and I solved the problem before we started grading the solutions. It wasn't until almost 3 hours later that Dr. Soifer and I realized just how beautiful this problem is. You can see some of Dr. Soifer's books at his website.

I like his books a lot -- they are filled with intriguing, approachable problems that I've seen nowhere else.

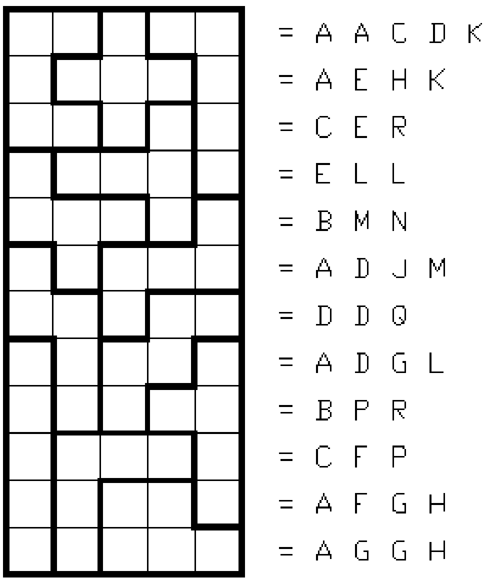
**The Hayling Islands Maze by Richard Tucker**




Click on the above image for a larger, printable version.

This puzzle is by Richard Tucker, with help from Robert Abbott. It's the fourth Double Cube Maze. Tape two cubes together, and put it end up on the square marked Start. Roll the double cube around until it lands end up on the square marked Goal. At no time may the doubled cube land on brick. Solution.

Robert Abbott has made a javascript maze! This link is still valid. A number of people solved it, see solvers.




An alternate puzzle for this week is from John Gowland, who lives in Africa (jgowland@mhs17.tns.co.za). His Pentomino Primes Puzzle is just one of several puzzles he's sent to me.

PENTOMINO PRIMES

by John Gowland

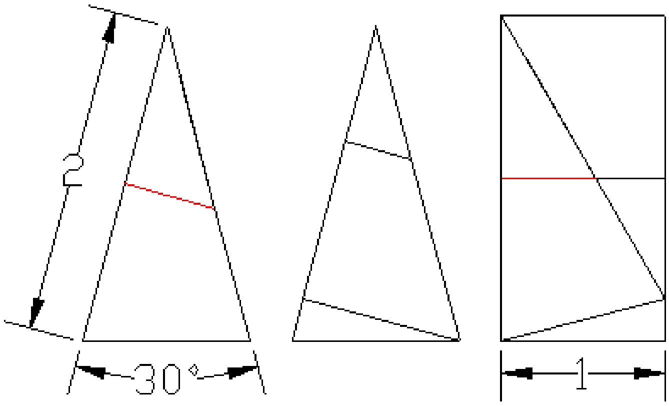
1. The puzzle consists of interlocking pentominoes in a 5 x 12 arrangement.
2. Each pentomino contains the digits 1, 2, 3, 4 and 5.
3. Each row is a five digit number found by multiplying the unknowns together.
4. Each unknown is a prime number less than 100.
5. R > Q > P > N > ... > C > B > A

I liked this puzzle a lot. See Solution. John has composed a much harder Hexomino Primes puzzle.

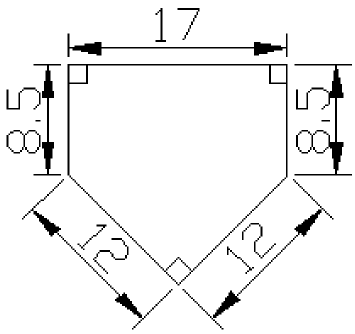
Martin Gardner once posed the problem of arranging 20 pennies (or any circular coin) so that each coin touches exactly 3 other coins. Recently, Tatsuo Kondo found a related solution that involves 14 squares of the same size. **Arrange 14 identical squares so that each square shares a border with exactly 3 other squares.** The problem was originally sent to me by Richard Hess. Solution.

A puzzle from the website of Torsten Sillke. **Put 28 dominoes into an 8x8 square so that none of the dominoes can slide.** The solution is **unique**. There are 28 dominoes in a standard 0-6 set, so I have an extension question, if you solve the above. Arrange a set of dominoes to satisfy the above puzzle so that there are 21 pips on each row, column, and main diagonal. Solution.

A double cube maze by Robert Abbott is at Robert Abbott's multistate maze site, several solvers sent solutions.




I realized that an isoceles triangle with side 2 and angles of 75, 30, and 75 has an area of 1. So I tried to find a dissection of one triangle to make one square. I wasn't able to find one. I did find a simple way to cut two such triangles to make two squares, though. Others found three piece and four piece solutions of this problem. Solutions. If you like this problem, you will like Eric Weisstein's writeup on dissections for the CRC Encyclopedia, and notes about Dissections: Plane and Fancy by Greg Frederickson.




According to the *Little League's Official How-to-Play Baseball Book* by Kreutzer and Kerley, the above is a diagram of Home Plate. What is wrong with this picture, solvers and solution. This problem was originally published by M J Bradley in *Mathematics Magazine*, 44-45, 1996. I found the problem in the *CRC Concise Encyclopedia of Mathematics*. I didn't know how extensive the site was until I bought the book. The 1969 pages of the book are very much worth the 79.95 cost. Almost everything from Martin Gardner's *Scientific American* columns is in this book, along with much more. Certain letters are blocked from the site each day, but try looking up Apery's Constant, Birthday Problem, Calabi's Triangle, Dissection (!), Epicycloid, Franklin Magic Square, Golden Ratio, Hadamard Matrix, Icosahedron Stellations, Johnson Solid, Knot, Link, Magic Square, Newton's Method, Orchard Planting Problem, Pi, Queen's Problem, Ramanujan Constant, Spirograph, Trigonometry, Uniform Polyhedron (!), VR Number, Whirl, and Zermelo-Fraenkel Axioms.

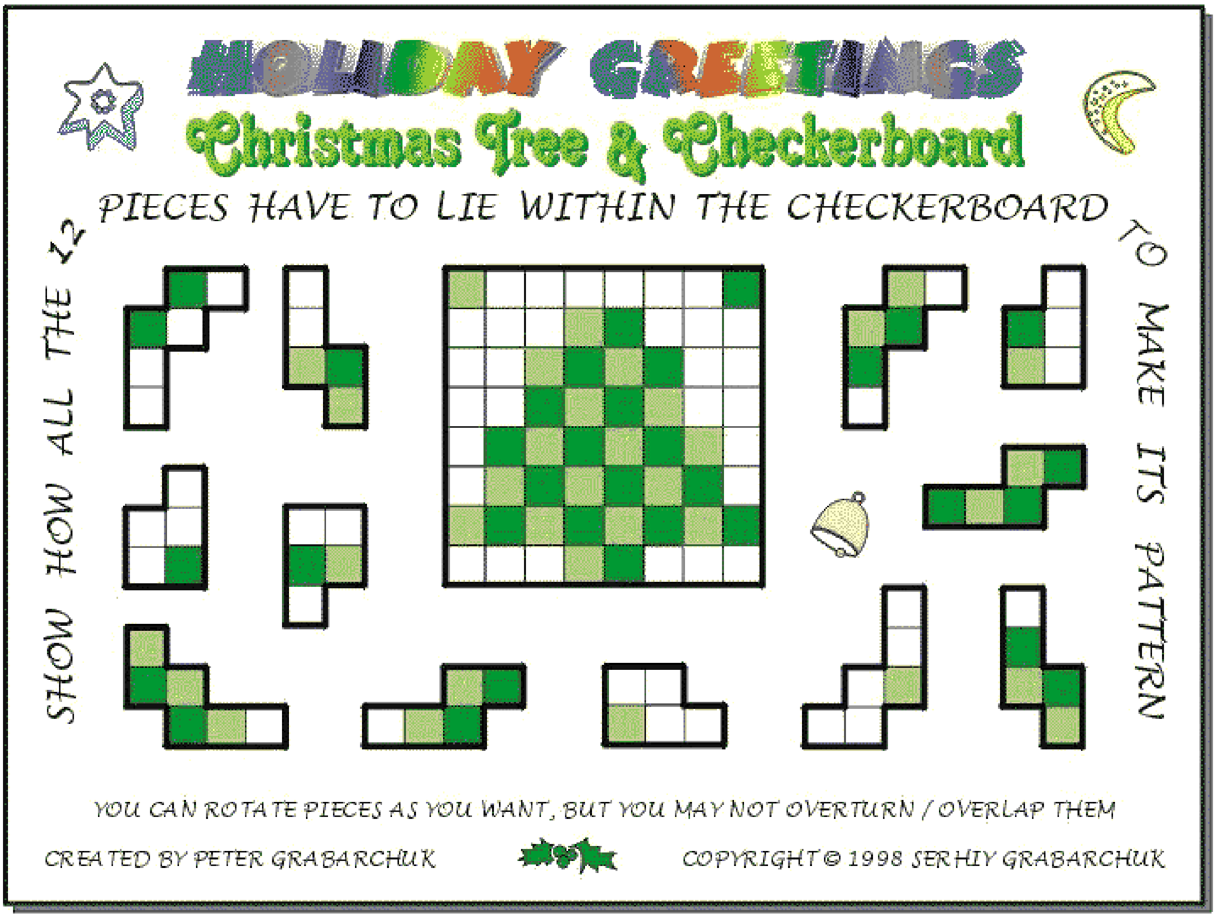
**Divide a triangle with sides 21, 42, and 42 into 6 similar triangles with different sizes.**

This amazing little puzzle is by myself and Erich Friedman. SOLUTION. The puzzle came out of Erich's Math Magic, in particular his question from last month about dividing squares. There are many other excellent pages at Erich's site, including his balance beam problems.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | G | H | C | H | H | D | H | H | E | F |
| A | B | I | I | C | I | I | D | I | J | E | F |
| K | K | G | K | K | L | K | L | L | J | L | L |
| A | B | G | M | C | M | M | D | M | M | E | F |
| A | B | N | N | C | N | N | D | N | J | E | F |
| O | O | G | O | O | P | O | P | P | J | P | P |
| A | B | G | Q | C | Q | Q | D | Q | Q | E | F |
| R | R | S | R | R | T | R | T | T | J | T | T |
| U | V | 1 | 1 | W | 1 | 1 | X | 1 | 3 | Y | Z |
| 2 | 2 | S | 2 | 2 | 4 | 2 | 4 | 4 | 3 | 4 | 4 |
| U | V | S | 5 | W | 5 | 5 | X | 5 | 5 | Y | Z |
| U | V | 6 | 6 | W | 6 | 6 | X | 6 | 3 | Y | Z |
| 7 | 7 | S | 7 | 7 | 8 | 7 | 8 | 8 | 3 | 8 | 8 |
| U | V | S | 9 | W | 9 | 9 | X | 9 | 9 | Y | Z |
| U | V | 0 | 0 | W | 0 | 0 | X | 0 | 3 | Y | Z |

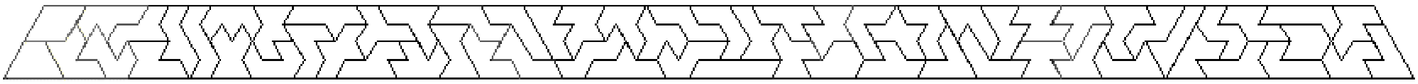
Problem # 47 on p.488 of Richard K. Guy, "Unsolved Problems in Combinatorial Games," in Richard J. Nowakowski (editor), *Games of No Chance*, Proceedings of a Workshop in Combinatorial Games, MSRI, 1994, Cambridge Univ. Press, 1996, pp.475-491. The problem asks if a rectangle can be tiled by the disconnected pentomino XX XX X. The problem has been solved by frequent contributor Juha Saukkola of Finland. Disconnected polyomino XX XX was also solved. I highly recommend *Games of No Chance*, by the way.

A word puzzle by Jeffrey Harris. The word 'bittersweet' can be split into two words which are opposites. Find a word that can be split into two *prefixes* which are opposites. The second puzzle was sent by Serhiy from Uzhgorod, Ukraine. It's a nice logic exercise. SOLUTION




Here are my favorite puzzles of the year, in no particular order:

1. The New York Times Crossword, edited by Will Shortz. All of the records in crossword-making have been broken. (One of mine will be published on Christmas)
2. Octiamond Ring, by Kadon Enterprises. Here is a solution by Michael D Dowle. I originally got them to play with the subset of tetradiamonds, but I quickly got hooked by them. After almost a year, they still fascinate me. Kadon has dozens of quality products.

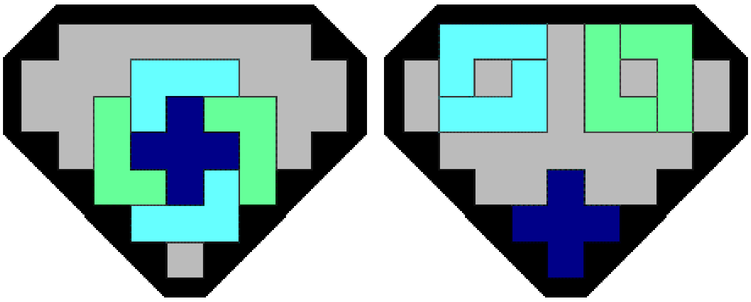


3. Nick Baxter's Sliding Block Puzzle Page. Dozens of great little puzzle applets are here. Junk Kato's Tower of Hanoi inspired SBP is a new one. Michael McKee has discovered some ingenious puzzles based on the Pentominoes.
4. Robert Abbott's Multistate Mazes. His two books have inspired a whole new catagory of puzzles, so I recommend them highly. My arrow cube maze and the Double Cube mazes were an outgrowth of Robert's creations.
5. The Scrabble Challenge by Kevin Cowtan It's a daily competition.
6. The Enigma, monthly magazine of the National Puzzler's League, edited by Francis Heaney. A book describing the first 115 years of the NPL has recently been published. If figuring out which movie is a transposal of the letters OTHER MAILING LISTS appeals to you, try out the online minisample.
7. Tilings by Adrian Fisher. He's discovered some spectular new tiling designs, useful for mazes or paving projects.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 18 | 04 | 04 | 15 | 19 | 20 | 09 | 16 | 06 | 11 |
| 20 | 10 | 11 | 06 | 11 | 00 | 03 | 12 | 17 | 19 |
| 14 | 11 | 01 | 03 | 12 | 13 | 00 | 10 | 24 | 22 |
| 11 | 13 | 16 | 13 | 00 | 24 | 23 | 18 | 16 | 23 |
| 22 | 13 | 17 | 17 | 18 | 16 | 19 | 14 | 21 | 18 |
| 23 | 09 | 12 | 24 | 09 | 14 | 23 | 02 | 17 | 03 |
| 20 | 04 | 04 | 06 | 20 | 16 | 18 | 22 | 09 | 08 |
| 12 | 09 | 16 | 19 | 19 | 16 | 17 | 00 | 08 | 23 |
| 22 | 15 | 15 | 01 | 11 | 00 | 15 | 13 | 01 | 05 |
| 15 | 20 | 11 | 07 | 14 | 03 | 15 | 10 | 14 | 08 |

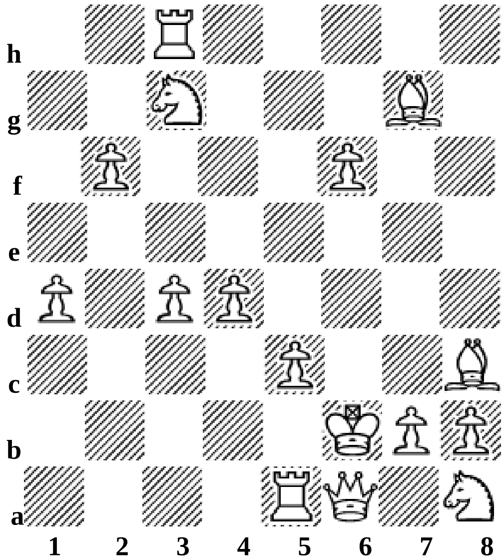
The second puzzle is by Jukka-Pekka Ikaheimonen of Finland. You need to find a path that winds from the upper left corner (number 18) to the lower right corner (number 08) where no number in the path is repeated. The path must be continuous, and you can move in the four main directions, not diagonally. The search for the path starts by crossing all other instances of 18 and 08, since they are already used by the path. You can deduce your whole way through, brute force methods are not needed. Solutions.

Next week, I'll list my picks for Internet puzzles, books, and products of the year. If you'd like suggest something, write me. I'll definitely be recommending the Octiamonds.



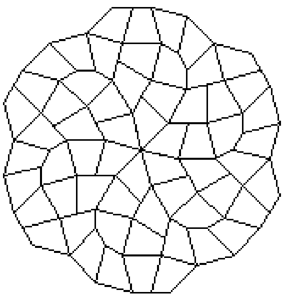
CENTRIFUGE is at Nick Baxter's Sliding Block Puzzle page (use IE 4). If you can't solve it, Taniguchi has an *fantastic* sliding block puzzle solver at his website, free. No-one managed to solve it, yet.

Last week's puzzle is now at Robert Abbott's multistate maze site. The double cube maze by Richard Tucker was very popular. If you're still looking for a good gift, I recommend Robert's two books. The double cube maze was solved by knsharpe, Mythman, Ken Duisenberg, Jukka-Pekka Ikaheimonen, Ray Ruppert, Erich Friedman, Juha Saukkola, Kory Heath, Mentor Hoxha, Adrian Fisher, Robert Abbott, and Joseph W. DeVincentis.




PEACE by F. S. Bondarenko, November 1985 *Problemist*

White and Black agree to play a game without making any captures. They manage to reach a position where no piece on the board can capture any other piece. The position above shows the White pieces. Where are the Black pieces? See Solution and Solvers.

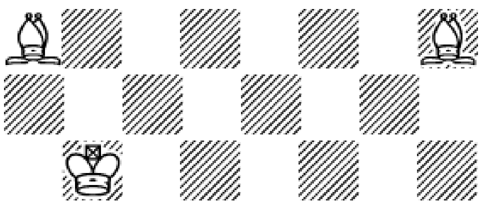


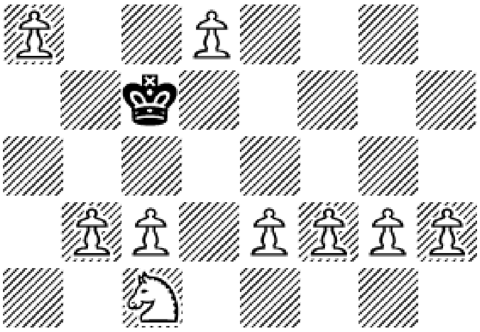
What is remarkable about http://www.liss.olm.net/loahp.html and http://www.geocities.com/CapitolHill/7179/ as a pair? Answer: LITTLE ORPHAN ANNIE and HELP INTERNATIONAL are anagrams. Serge Elnitski introduced me to sites by the incomparable PETER JOHNSON and JOHN PETERSON. Juha Saukkola found that Annie (Haslam) wrote and recorded the single "Lily's in the Field" with Yes' Steve Howe as a tribute to the orphans in war-torn BOSNIA-HERCEGOVINA. Other solvers were Neil "Fred" Picciotto, Phil Cohen, Ed Rice, Simon Brault, Jeffrey Harris, Dave Tuller and Mike Keith.

At Nick Baxter's Sliding Block puzzle page, I particularly liked Heart-In by Minoru Abe. Try it out!

A final puzzle. Each cell in the figure to the right has Short and Long edges. Enter at a Short edge. Follow the sequence Short Long Long Short Long Long ... and exit through the short edge on the opposite side. These tiles are part of a system developed by Adrian Fisher. See his tesselation site at http://www.mazemaker.com/Tiling.htm.

The original town maze is back at Robert Abbott's Multistate Maze Site. Many people sent solutions, including Joseph W. DeVincentis, Ray Ruppert, Warren Porter, T Szczepanski, Dmitri Apresian, Juha Saukkola, Vivek Rudrapatna, Meghan and David Yamanishi, Andre Luis Dantas & Sylvia Montenegro. Here is a solution by knsharpe.

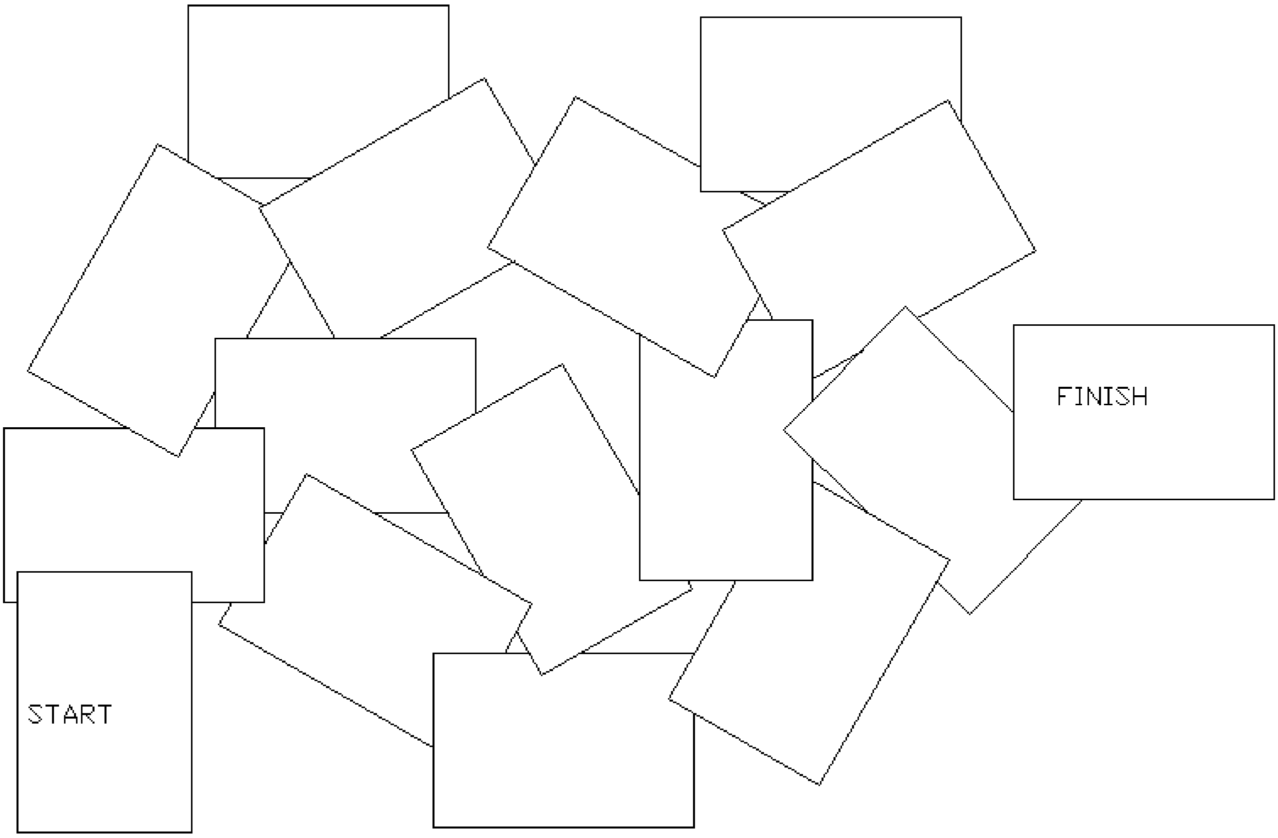




Mate in how many moves??

Mannis Charosh, Fairy Chess Review III:7 August 1937

This puzzle was later published in Nostalgia by Philip Cohen. The NOST is a chess club devoted to postal chess play, postal Go, and postal chess varients. Their magazine, and website, is a treasure trove of fascinating studies. If want the answer, see solution.

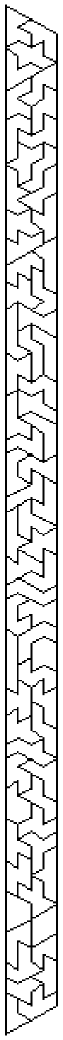



Start at START, and go DOWN to the next card. Follow by going UP, to the only card on top of that card. Continue going D, U, D, U until you get to the finish. This is an example of a multistate maze, since there are several cards which you will visit twice. In total, how many times do you go up and down? See Solution and solvers. For a more challenging maze, follow the sequence DDUU DDUU ... I'm not sure this has a solution, but if not, then the diagram can be corrected so that it does. Would anyone like to help make a harder multistate maze? With DDUU, it should be possible for a card to require 4 visits. If you can put that together, I'd love to see it.

At Erich's Combinatorial Geometry Page, the minimal number of circles that go through a grid of n^2 points is explored. What is the minimum number of circles needed to go through a square grid of 49 points? Solution by Joseph W. DeVincentis (which beat the solution I had). As an alternate problem, the four dimensional polytopes, the 24-cell and 600-cell, were supplied to a colleague. Eric Swab's Hyperspace is the source. My colleague needs to extract the faces and 3D solids from this data for a 4D visualization program. Does anyone have an algorithm for extracting this data?

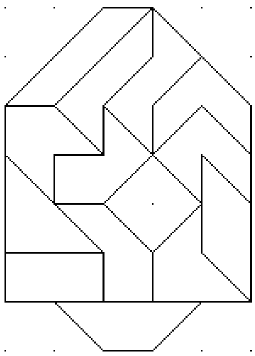
This week's puzzle comes from Juha Saukkola, who helped me tremendously with my Leaper's page. 3x37=111, 4*25=100, 6*185=1110, 1999*5502751375687899 = 11000000000000110101. Is any integer *n* a perfect divisor of a larger integer *N* which consists entirely of ones and zeroes? If so, prove it ( Send Proof). Rick Heylen has calculated n = 1 to 2000, it's here. Does anyone see any patterns or revalations? Various Solutions

It turns out that a regular 18-gon can be divided into 18 identical pentagons. Mike Hirschhorn discovered this in 1976. Here is an image which has 18 copies of the particular pentagon. Print the image, cut out the pentagons, and make the 18-gon. I've been playing around with this pentagon and another lately, using my new toy: Autocad LT. Once you have solved the above puzzle, you might want to look at the new chaotic tiling system I've been investigating. If you look at it, please write me, and let me know. I plan to write up a large article about what these shapes can do if there is enough interest. ENORMOUS interest! Many thanks to Adrian Fisher, Branko Grunbaum, Michael Hirschhorn, Bernie Cosell, William I Johnson, Douglas Heller, Juha Saukkola, Eric Swab, Chris Dueker, Rick Rubenstein, Kiran Kedlaya, Peter Beck, Roger Phillips, Bill Pegg, John Bailey, Scot Rhoads, Ken Sample, Rick Rubenstein, Darren Rigby, and David Eppstein for suggestions, ideas, and commentary. There will be more to come.



The Octiamonds. Can you find the major flaw? The flaw is at the very bottom of the figure. There are four pieces that use only SIX triangles, instead of EIGHT triangles. Can anyone fix this flaw, just using the 66 octiamonds?

The word inCLINaTiON conceals CLINTON in left to right order. Each word or phrase in the following list conceals the name of an American President, in left to right order. Find each president.
BREATHALYZERS THE WORLD ACCORDING TO GARP
DIAMONDS ARE FOREVER TRANSFIXION PUBLIC SERVICE
CATHY LEE CROSBY MISADMINISTRATION STAGE FRIGHT
PAR FOR THE COURSE CHARACTERISATION WHOMSOEVER
LIEUTENANT COLONEL NOSTRADAMUS STRIKE A BARGAIN
HAPPY GO LUCKY PAINTBRUSH BOARD GAMES
One of the above hides *two* presidents. (Solved by Phil Cohen, Salvatore Giordano, and Greg Collins)



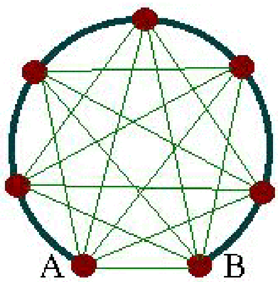
These fourteen pieces are called the **TETRATANS**. They have other names, like the tetraboloes. Martin Gardner proved that they cannot make a symmetric shape. Henri Picciotto showed that this proof was partially wrong. Figures with bilateral symmetry are possible. Figures with point symmetry are impossible. (Do you see the proof?) For this week's problem, construct a convex figure with the 14 tetratans. I know of at least two solutions, both with bilateral symmetry. Is it possible to fit these into a 5x6 rectangle with a single hole? (No solutions received.)

**UNIT HEXAGONS:** An equiangular hexagon has sides of 1, X, 3, 4, 5, and 6, going clockwise. What is X? Hint: it isn't 2. Related problem: An equiangular hexagon has sides of 1, 2, 3, 4, 5, and 6. What order are these sides in? Larger problem: Equiangular hexagons with unit sides are sorted by their area in unit triangles. What is the largest area not represented by a hexagon? Partial solution by Dave Tuller

From Erich Friedman: 1224832246482424321688812626486464 82... This number is obtained by multiplying the first two digits (12) and tacking them on the end. Then the result of multiplying the next two digits is tacked onto the end. The number grows as follows: (12, 122, 1224, 12248, 1224832, 122483224, 1224832246, 12248322464, ...). Prove: (a) The numbers 0, 5, 7, and 9 never appear. (b) Arbitrarily long sequences of 8's appear. Full solution by Martin I Eiger

From Francis Heaney: Examining the differences between square numbers, if you keep going until a constant value results, you'll get 2. (1 4 9 16 25 36 .... 1 3 5 7 9 11 .... 2 2 2 2 2...) What constant value ultimately results if you examine the differences between tenth powers? Full solution by Isaac Newton & Martin I Eiger

The first puzzle this week is by Scott Purdy. The thick path travels from A to B, visiting every dot. Can you remove 7 of the thin lines so that this is the *only* path from A to B that visits each dot? In more mathematical terms, for K(n), what is the minimal number of edges that needs to be removed for a unique Hamiltonean path between two given points? The case for K(8) is unsolved (as far as I know). Partial solution to the general case by Scott Purdy and Erich Friedman




The second puzzle this week is by Denis Borris. **JANE AND JUNE MEET JACK**
Jane and June, who do not know each other, just moved to the same street, and do not know anybody on this street. The street is consecutively numbered from 1 to N. They both notice an eligible bachelor taking walks and separately decide to try and date him.

Jane sees him in a restaurant, goes over, meets him, his name is Jack, he agrees unenthusiastically to a drive-in movie date, has no car, Jane agrees to pick him up, he lives on same street, and what's Jack's address:
Jane: Is your address greater than 60? Jack: Yes.
Jane: Is your address fibonacci? Jack: Yes.
Jane is now sure of Jack's address; however, when she gets there to pick him up, it's not Jack's address.

June later meets Jack, similarly agrees to pick him up.
June: Is your address greater than 200? Jack: Yes.
June: Is your address triangular? Jack: Yes.

June is now sure of jack's address; well, you guessed it, it's not Jack's address.

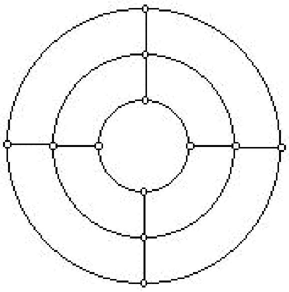
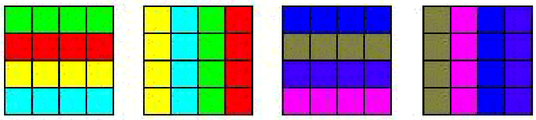
Well:
- Jack told one lie to each of the girls - Jack lives on same side of street as Janee, and his address is smaller than Jane's
- Jane's, June's and Jack's addresses, as wwell as N, are all at MAXIMUM possible
Find the 3 addresses, also N. ANSWER: Jack=136, Jane=144, June=231, N=232

Can the 160 enneiamonds be arranged into 4 triangles of side 19, each with one hole? (This is a very hard question). I'd like to hear from anyone who has interesting solutions for Iamonds of any size. (Especially the Octiamonds)

The word puzzle of the week is by myself and Will Shortz: The names of two famous people contains the letters HIJKLMNO ... H to O. One of them is a singer, the other is an actor. Name these two people. As an example, if the letters were ABCDE, instead, Buddy Hackett would be an acceptable answer. ANSWER: John Malkovich and Michael Jackson.

**TOUCHING CUBES**. I can divide a 2x3x3 block, along the cubes, into five pieces that all touch each other. I can divide a 2x3x5 block, along the cubes, into six pieces that all touch each other. I can divide a 4x4x4 block, along the cubes, into 8 pieces that all touch each other. Are any of these cuttings minimal? This is an unsolved problem, so far as I know.
ROMAN HOLIDAY can be split into MARYLAND and OHIO.

Steve Stadnicki found an excellent proof that 2x3x3 is minimal for 5 colors. 1 x m x n is planar, and 5 touching colors cannot be done with a planar graph. 2 x 2 x n is also planar... see the circular graph below. 2x3x3 is the smallest size that is non-planar. 8 colors seems to be the chromatic number of the 4x4x4 cube. As shown, it can be divided into 8 identical pieces which all touch each other. I am still not sure of the chromatic number of other 3D figures. Would anyone like to tackle this?
Erich Friedman (of Packing Page fame) has tackled this problem. He has started a website devoted to this problem. (Thanks, Erich!) If you can narrow any of the bounds for the larger boxes, please write to him or me. This looks like a great problem... even a proof that the 4x4x4 has a chromatic number of 8 seems very difficult.

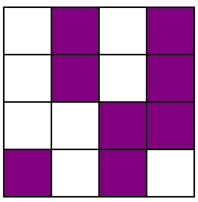



**FIVE WEIGHTS**. With weights of 1, 3, 9, 27, and 81 grams, you can weigh any integral amount up to 121 grams by putting the weights on either side of the set of scale. I have a different set of five weights, and can weigh any integral amount up to 56 grams. *None of these weighings requires more than two weights on either side* (two weights on each side would be permissible). What are the five weights?
This problem was solved by Denis Borris and Tom Turrittin. The weights that work up to 56 grams are either **4, 5, 7, 34,** and **51** or (second solution) **10, 12, 13, 17,** and**51**(Both by Denis Borris). This was a beautiful, unexpected solution, so I applaud them for finding it. Tom suggested that multiple weighings could be used. The set of weights 8, 10, 14, 68, and 102 could thus measure any integral amount up to 112 with multiple weighings. I leave this as a bunch of open questions. Is 56 grams the best result for 5 weights? What is the best result for 6 weights? Denis and Tom both sent **1, 3, 8,** and **23** as the best solution for 4 weights (unique). What is the best result for multiple weighings (i.e. no gaps of more than 2)? Denis Borris found the sequence **2, 3, 9, 25, 67, 167, 427** gives distinct values. The sequence for the number of combinations when limited to two weights per pan is **1, 4, 12, 31, 70, 141, 259, 442, 711**, ... with generating function $\frac{n^4 - 2n^3 + 7n^2 + 2n}{8}$ (Discovered by Tom Turrittin) Both of the sequences here have been accepted and added by the Encyclopedia of Integer Sequences. (congrats, Tom and Denis!)

CYNDI LAUPER is a letter bank of PERPENDICULARLY.

Divide and Conquer:

ELEANOR RIGBY + V = OVERBEARINGLY



Put the letters of LINES into the white squares so that a chess knight can make a series of consectutive moves that spells out LESLIE NIELSEN.

I*E*
I*E*
LL**

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*N*S
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