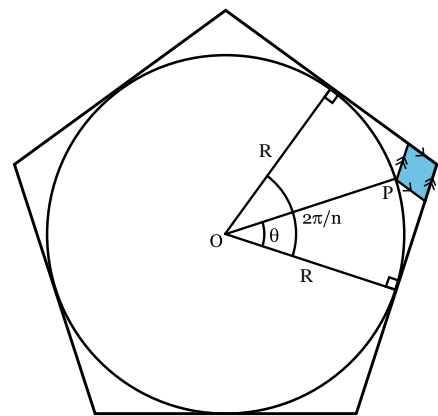

Puzzle corner

Send problems, solutions, and comments to Allan Gottlieb at New York University, 60 Fifth Ave., Room 316, New York, NY, 10011, or gottlieb@nyu.edu. For other solutions and back issues, visit the Puzzle Corner website at cs.nyu.edu/~gottlieb/tr.

In March, I shared a story about my colleagues' amazement when I told them I was able to get "up close and personal" with a one-terabyte disk at NASA's Langley Research Center when I went to see their massively parallel processor in the early 1980s.

Thomas Keske reports that he experienced a similar situation at the Census Bureau a decade earlier. The bureau's need for storage capacity was one of the largest in the country and they were very proud of their system, which was said to be unique. It used minicomputers as a custom disk controller, allowing the bureau to store a gigabyte of data.

Another illustration of the exponential performance growth in many technology areas. In this example, you wait a decade and get a new prefix.



Problems

S/O 1. Mark Astolfi is interested in a "blockade" variation of chess stalemate in which the side to move has no moves at all, not even a move that would be illegal because it is moving into check. Among such positions he favors those with the fewest total number of pieces (including pawns).

S/O 2. Ermanno Signorelli has four specially marked dice. Their faces are 1-1-1-5-5-5, 2-2-2-2-6-6, 3-3-3-3-3-3, and 4-4-4-4-0-0. You first select one die and then your opponent selects one of the remaining three dice. Finally, each of you rolls your die and the higher number wins. Which die should you choose to maximize your chances of winning? Consider both an opponent who chooses among the remaining dice randomly and one who does a complete analysis.

S/O 3. Larry Stabile sent us the following generalization to 2016 S/O 2, which is illustrated by the figure at the top of the next column for $n = 5$:

Given an n -sided regular polygon with the radius of the inscribed circle = R , draw radii to two adjacent points of tangency between the polygon and the inscribed circle. Find the area of the shaded region, as given by the boundary formed by the edges of the polygon and parallel lines from the point P intersecting the edges, over the domain $\theta \in [0, 2\pi/n]$. I don't as yet have a proposed solution.

Speed department

This one, from Eric Schonblom, might be pushing the limit for "Speed" problems. What are the next three entries in the following finite sequence? Note that they are the final entries in the sequence.

0, 4, 4, 3, 2, 1, 2, 6, 3, 6, 1, 1, 5, 2, 7, 4, 6, __, __, __.

Solutions

M/J 1. Larry Kells wonders: What is the most high-card points declarer can hold and still not be certain of making any contract?

John Chandler writes: "I think the highest high-card count that can't be sure of making any contract is 32: AKQJ, AKQJ, AKQ, QJ (in any order of suits, but for simplicity, call them spades, hearts, clubs, and diamonds, respectively). If West has AKxxxx of diamonds, then West can lay down seven tricks off the top to beat a diamond or no-trump contract. In a spade contract, if East and West have corresponding voids in hearts and clubs, they can cross-ruff seven tricks off the top, and similar bad distributions would defeat contracts in hearts or clubs. On the other hand (no pun intended), with 33 points—i.e., with KJ of diamonds instead of QJ—declarer can forestall a run on diamonds and make at least 5 no-trump."

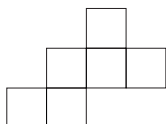
M/J 2. Nob Yashigahara sent us a cryptarithmic problem from Kyoko Ohnishi. You are to substitute a digit for each letter in the following multiplication problem (shown at left). When a letter is repeated, each occurrence must become the same digit. There appears to be agreement with Norman Derby on the solution shown at right.

$$\begin{array}{r} \text{PEN} \\ \times \text{INK} \\ \hline \text{LETTER} \end{array} \qquad \begin{array}{r} 615 \\ \times 354 \\ \hline 217,710 \end{array}$$

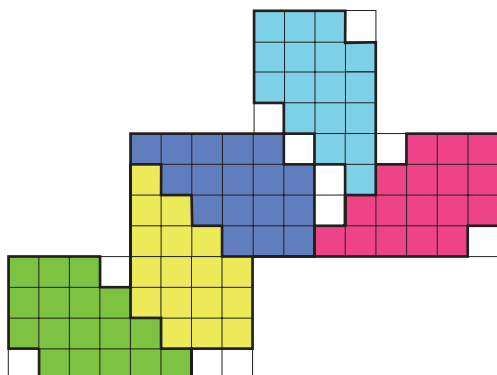
Many of the solutions included computer programs to perform an exhaustive search. David Micheletti did it by hand using some eliminations: e.g. **P, I, N, K** cannot equal 0 and **N, K** cannot equal 1.

I should have mentioned the convention in cryptarithmic problems that different letters must correspond to different digits. If you do not make this requirement, Jay Macro found 237 solutions.

M/J 3. Another of the popular Modest Hexominoes problems from Richard Hess and Robert Wainwright. In these problems you must design a connected tile so that n of them cover the maximum area of a hexomino. The tiles are identical in size and shape and may be turned over so that some are mirror images of the others. They must not overlap each other. For the problem below you are to cover at least 88% of the figure using five tiles.



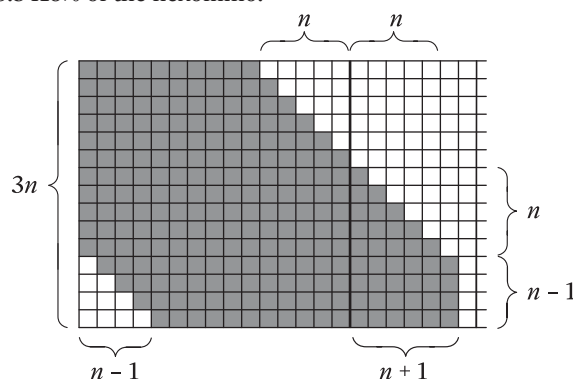
Panagiotis Chatzitsakyris sent us a clear diagram that divides each of the six squares into 16 subsquares. His five tiles include 85 of the 96 subsquares, so his coverage is 85/96, which exceeds 88% as required.



Frank Marcoline sent a parameterized solution, which at its optimal value also gives 85/96 coverage.

Subdivide the unit square into $3n$ by $3n$ squares for positive integer n . Remove a triangle of squares of side length $(n - 1)$ from one corner of the unit square. From the opposite corner, remove a triangle of side length n , rotate it 180° , and attach it to the edge

of the unit square so that it extends the staircase of squares it was detached from. Add an $(n - 1)$ by $(n + 1)$ rectangle adjacent to both the rotated triangle and the unit square. Let $A(n)$ be the area of the tile: $A(n) = (19n^2 + n - 2) = (18n^2)$. For $3 \leq n \leq 122$, the area of the hexomino covered by five tiles is greater than 88%, with the maximum tile area being $A(4) = 17 = 16$, covering $85/96 = 88.5416\%$ of the hexomino.



A different approach came from Dale Walton. I have placed both solutions on the Puzzle Corner website: [//cs.nyu.edu/~gottlieb/tr](http://cs.nyu.edu/~gottlieb/tr).

Better late than never

2009 J/F 2. Tom Terwillinger notes that this problem has been solved. See the Puzzle Corner website for references.

Y2018. E. Soderstrom remarks that the formula for 3 also uses the digits in order.

M/A SD. Ermanno Signorelli notes that the solution given has nine digits of accuracy, not just eight.

Other responders

Responses have also been received from M. Branicky, E. Campbell, P. Campbell, G. Coss, S. Feldman, M. Gasser, K. Gasser, T. Hafer, S. Korb, J. Larsen, G. Lesieutre, Z. Levine, D. Mayhew, N. Mazer, E. Miller, R. Morgan, G. Muldowney, D. Stork, and B. Wake.

Solution to speed problem

7, 5, 7. Write the given numbers in three-bit binary (000, 100, 100, ...) and regroup as four bits (0001, 0010, ...). This gives 1, 2, 3, ..., 12. Write the missing last numbers (13, 14, 15) with four bits and regroup back to three bits.