PuzzleCorner

Since this is the first issue of a new academic year, I once more review the ground rules under which this department is conducted.

In each issue I present three regular problems (the first of which is chess, bridge, go, or computer-related) and one "speed" problem. Readers are invited to submit solutions to the regular problems, and three issues later, one submitted solution is printed for each problem; I also list other readers who responded. For example, solutions to the problems you see below will appear in the February/March issue and the current issue contains solutions to the problems posed in May/June. Since I must submit the February/March column in November, you should send your solutions to me during the next few weeks. Late solutions, as well as comments on published solutions, are acknowledged in subsequent issues in the "Other Respondents" section. Major corrections or additions to published solutions are sometimes printed in the "Better Late Than Never" section, as are solutions to previously unsolved problems.

For speed problems, the procedure is quite different. Often whimsical, these problems should not be taken too seriously. If the proposer submits a solution with the problem, that solution appears at the end of the same column in which the problem is published. For example, the solution to this issue's speed problem is given below. Only rarely are comments on speed problems published.

There is also an annual problem, published in the January issue of each year; and sometimes I go back into history to republish problems that remained unsolved after their first appearance.

In response to my comment about our son David's then-upcoming Bar Mitzvah, Edgar Rose writes that, as the father of two daughters and no sons, he, unlike me, "was spared the trauma of a social Bar Mitzvah but had to contend with two equally traumatic weddings. Fathers cannot win!" While I cannot not dispute his conclusion, David's Bar Mitzvah was fairly enjoyable for his parents. The only (mild) trauma came in paying the bills. Moreover, nowadays, at least in our neighborhood, having only daughters has little effect: Bat Mitzvahs are equally big deals. Weddings I cannot speak about for (hopefully) quite a few years.

SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO: ALLAN GOTTLIEB
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Problems

OCT 1. We begin with a chess problem from Richard Freedman.

White to move and mate in 2.

							BP
					wp		BK
					wk	BP	wp
	wp		wb	wb			
	wr	BB					

OCT 2. Here is a pair from Nob Yoshigahara. Consider a number factored into primes.

$$a = b \cdot c \cdot d \cdots$$

The first goal is to find an example where the equation contains all nine digits 1–9, exactly once each. The second goal is similar but involves the ten digits 0–9.

OCT 3. Bob High first had this problem appear in *New Scientist*. Uncle Fibo is on a brief, enforced vacation from the racetrack. Missing the excitement of the turf, he has come up with a substitute: he and his associates Earl, Garth, and Hal have among them a single coin. They flip this coin repeatedly, producing a sequence of heads and tails. Each man has a "horse"—a sequence of three heads or tails—and the one whose horse appears first wins the "race."

For example, suppose Uncle Fibo chose HTH and Earl chose THT, and these two had a race. If the coin produced the sequence,

H H T T H T . . .

then Earl would win.

On the particular day of interest to us, the men have chosen the following horses: Earl, HTT; Uncle Fibo, HHT; Garth, THH; and Hal, TTH. They run four separate races: Earl against Uncle Fibo; Uncle Fibo against Garth; Garth against Hal; and Hal against Earl. Assuming their coin is fair, who would you expect to win each race?

Speed Department

Sidney Shapiro has a box containing P dollars, a value known to the owner but not to you. For B dollars the owner will give you the box plus a bonus of P/2 dollars provided that B>P. You can make only one bid. What should B be?

Solutions

M/J 1. We begin with a Bridge Problem from Jorgen Harmes, who wants you to make 6 spades when West leads the 10 of clubs.

North
♠ A K Q J
♥ K J 8 6 5 3 2
♦ 7
♣ Q

West
♠ 6 3
♥
♦ K Q J 9 5
♣ T 9 7 4 3 2

East
♠ 4
♥ A Q T 9 7 4
♦ 8 3
♣ J 8 6 5

South
♠ T 9 8 7 5 2
♥
♦ A T 6 4 2
♣ A K

Rick Wasserman has found two successful lines of play. He writes:

South should take two club tricks, then the ace of diamonds, then ruff three diamonds in dummy, returning to hand twice with hearts ruffed high. At trick 9, with the lead in dummy, there are two possible lines. The intended answer is: ruff another heart high back to hand, then ruff the last diamond in dummy leaving

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although Stacey Reeves was not sure of the date.—Mari Madsen, secretary, 85 Alberta Rd., Brookline, MA 02167; e-mail: <mari_madsen@macmailgw.dfci.harvard.edu>

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Hello again. Various circumstances conspired to make me miss the last month's column. Sorry. Meanwhile, keep your class news coming!

Our first news comes from Patti Dunlavey who is attending graduate school at the University of Washington in Seattle. Patti writes: "I absolutely LOVE it here! I spent spring break skiing at Whistler/Blackcomb in British Columbia, and I'll be spending the summer in Boston and next quarter in Rome, so life is good. There are a lot of MIT grads in the department here, so I don't ever feel lonely for MIT company. With me are Shanna Kovalchick, '91, Michele Wang, '92, Kim Sykes, '93, Noah Greenberg, and Pedro Hernandez. Kevin Karnes is also out here in the music department."

Patti also notes that has been staying in touch with quite a few Class of '94ers: "Sita Venkataraman is finishing up her second degree at MIT and will be going to Harvard for a master's in landscape architecture in the fall. Shilpa Gadkari is working in New York City for Deloitte and Touche, and is enjoying herself in her nonstudent life. Ginger Hanson is working in Philadelphia; she is really getting into her job and making herself invaluable. Jennifer Sun is in medical school at Dartmouth. Duane Ludwig is having a blast in Japan (Who'd have thought it? From Omaha to Tokyo?), where he'll be working for another eight months or so. Ann Guy is at Berkeley studying for her master's in environmental engineering. Rahul Saha and Tara Shivone are still engaged and both are studying at Georgia Tech. Phil Barker is happily working in Philadelphia. Mike Markmiller is engaged, as well as Jason Ribando."

Meanwhile, back at the 'Tute, Ping-Shun Huang writes: "I decided to go work full time for Silicon Graphics after flying 30,000 miles on various interview trips—unfortunately, every trip took several days away from my master's in engineering thesis, so I should really stop punting now."... Yevgeny Gurevich, writes "I'm finishing a master's in engineering this summer and am moving down to the D.C. area to work for MIL 3. I'm currently rooming with Hugh Morgenbesser, '94, who is also finishing an MNG this summer, and staying in the Boston area to work for BBN." Yevgeny has been in touch with a few '94ers including including Barbara Kennedy and Ted Ko. "Barbara is attending dental school at UPenn. Ted completed an MNG degree this June, is headed for Taiwan for a couple of months, and then going to work on the West Coast."

Mike Feng writes, "I'm in the MS/PhD mechanical engineering program at Cornell and probably have another three or four years in exciting Ithaca, N.Y. I'm in the process of setting up an alumni/ae club there, so if others are interested they can contact me at <mf29@cornell.edu>."

What's new with you? Setting up an alumni/ae club? Met up with some '94ers? Completed another degree? Send me a brief note.—Jeff Van Dyke, secretary, 6360 N. 31st, Richland, MI 49083; e-mail: <jvandyke@mit.edu>

Puzzle

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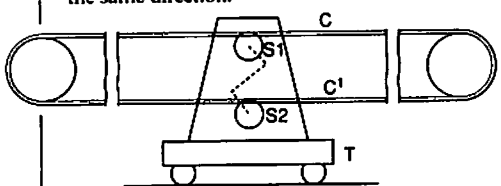
dummy with three immaterial hearts and South with the 10, 5, 2 of spades. On the lead of a heart from dummy, South must ruff with the 2 of spades (if East does not ruff the heart); West is free to take his trump but South then has the rest. If South mistakenly ruffs with the 5, West overruffs and leads a club for East to ruff; South can overruff but this promotes another trump trick for West. A pretty trap. However, at trick 9 South can simply cash a high trump, ruff a heart high back to hand, pull the remaining trump and surrender a diamond at the end. Prosaic but effective!

M/J 2. James Abbott likes to play with trains, gear trains that is, and offers us the following challenge.

A traveling carriage T is connected to an endless chain CC^1, which engages identical sprockets S1 and S2. The sprockets are connected to each other by a gear train whose ratio is defined by the number of revolutions of S2 for one revolution of S1. The sign of this ratio is considered positive when S1 and S2 rotate in the same direction.



By suitably altering the gear train, a variety of motions can be imparted to the carriage.

Letting C refer to the *upper* run of the chain, determine the gear ratio (magnitude and sign) for the following six conditions:

1. T moves in the same direction as C, at half the speed of C.
2. Same, but at twice the speed of C.
3. T moves in a direction opposite to that of C, at half the speed of C.
4. Same but at twice the speed of C.
5. T remains motionless regardless of the speed of C.
6. T can be moved freely in either direction (by separate forces) but the chain cannot be budged.

The following solution is from Mark Seidel.

I solved this one in reverse. Let x be the distance that the upper chain moves to the right, and y be the distance that the cart moves to the right. Then the upper gear moves through a clockwise angle of a1=(x-y)/R, and the lower gear moves through a counterclockwise angle of a2=(x+y)/R. If our gear ratio is r, then we have a2 = -r*a1. This expression leads to the general relation x+y = -r*x+r*y, which reduces to r = (y+x)/(y-x). The following cases are solved separately.

Case 1. 2y = x ==> r = -3
Case 2. y = 2x ==> r = +3
Case 3. 2y = -x ==> r = -1/3
Case 4. y = -2x ==> r = +1/3
Case 5. y = 0 ==> r = -1
Case 6. x = 0 ==> r = +1

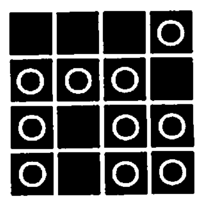
M/J 3. How's your geometry? Gordon Rice asks how many primitive Pythagorean triangles are there whose inscribed circle has diameter 1992. Recall that 6,8,10 is not a primitive Pythagorean triangle since it is simply a multiple of 3,4,5.

Matthew Fountain writes: There are four. Let the sides of the triangle be X, Y, and Z and note that the triangle can be divided into three triangles by drawing lines from its vertices to the center of the inscribed circle. As the center is 996 units from each side, the area of the original triangle is (1/2) (996) (X+Y+Z). It is also (1/2)XY. Because X, Y and Z are sides of a right triangle we may set X = 2ab, Y= $a^2 - b^2$, and Z = $a^2 + b^2$. To assure the triangle is primitive we demand a and b to be co-prime with one odd and one even. Equating the two expressions for the area of the original triangle, and substituting for X, Y, and Z yields the equation S(1/2) (996)($2ab + 2a^2$) = (1/2)($2ab$)($a^2 - b^2$) which simplifies to 996 = (b)(a-b). Noting that a-b is odd and 996 = (2)(2)(3)(83), b is restricted to 4, 12, 332, and 996. Therefore there are four primitive right triangles circumscribing the circle.

Although not required, the values of a and b are the pairs 253, 4; 95, 12; 335, 332; and 997, 996. The sides X, Y and Z are 2024, 63993, and 64025; 2280, 8881 and 9169; 222440, 2001, and 222449; and 1986024, 1993, 1986025, respectively.

Better Late Than Never

Jan 1. Mathew Fountain found the following example which has an odd number of circles in all 4 rows, all 4 columns, and all 8 diagonals. To boot, he points out that all knight-move paths contain either one or three circles.



Jan 2. Bill Bruno notes that the published solution shows sixteen players not fourteen. Indeed, this is correct. The proposer has a solution with 4 second pairing, which is believed to be minimal. This solution is available from the editors of *Technology Review* upon request.

M/J SD. Perhaps we should have reminded readers that on computers x + y will give x even when y is not zero. One just needs y to be MUCH smaller than x. It takes a while but 1/*i* does becomes sufficiently small.

Other Responders

Responses have also been received from G. Blondin, M. Buote, R. deMarrais, S. Feld, J. Grossman, W. Hartford, R. Hess, P. Kramer, J. Landau, G. Leibowitz, M. Lindenberg, S. Maley, A. Ornstein, G. Perry, D. Peterson, F. Powsner, K. Rosato, E. Sard, L. Schaider, R. Sinclair, D. VanPatter, and A. Wasserman.

Proposer's Solution to Speed Problem

Don't bid. Since P is less than B, the expected value of the box is less than B/2 and your expected return is only 1.5 x B/2 = .75B.