Puzzle Corner

INTRODUCTION

Since this is the first issue of a new academic year, let me once again review the ground rules. In each issue I present three regular problems (the first of which is normally Bridge related) and one "speed" problem. Readers are invited to submit solutions to the regular problems, and two columns later (not every issue of *TR* contains a "Puzzle Corner" column) one submitted solution is printed for each regular problem; I also list other readers who responded. For example, solutions to the problems you see below will appear in the February issue, and the current issue contains solutions to the problems posed in May.

I am writing this column in mid-July and anticipate that the February column will be due in early November. Please try to send your solutions early to ensure that they arrive before my submission deadline. 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 first issue of each year, and sometimes I go back into history to republish problems that remained unsolved after their first appearance.

PROBLEMS

Oct. 1. Unfortunately, the May 1 problem had a typo introduced somewhere in the production stream and South was given 14 cards. The corrected problem follows.

We begin with a fairly conventional (for him) Bridge problem from Larry Kells, who writes that this problem was solved at a tournament table by exactly one declarer, to the amazement of onlookers. Kells believes that he would never have solved it at the table, and wonders if you will be able to solve it away from the table assuming that after the opening lead the defenders play perfectly.

North	South.
♠ AQ9	♠ J108542
♥ AQ75	♥ K
♦ A87	♦ 3
♣ 743	♣ AK852

After a 1NT opening by North, the dealer, and a weak 3 Diamond jump overcall by East you have arrived at 6 Spades. Your side is vulnerable and the opening lead is the Diamond King. Plan the play to give yourself the best possible chance of success assuming that East is neither overly cautious nor overly aggressive with his preemptive bids.

Oct. 2. Nob Yoshigahara reports that no less than Don Knuth likes the following problem in which you are to replace each * with a different digit from 1-9 to yield a true equation (each ** is a two digit number).

$$\frac{*}{**} + \frac{*}{**} + \frac{*}{**} = 1$$

Oct. 3. Perhaps Richard Hess has been reading *Charlotte's Web* as he has sent us a two-part problem titled "The Spider and the Fly." (a) A spider sits in the corner of a 1x2x3 box and can only crawl over the walls of the box. Where should a fly position itself to cause the spider the longest crawl and how long is this crawl? (b) Now assume the fly can position both the spider and itself. What should he do to maximize the crawl and how long is it?

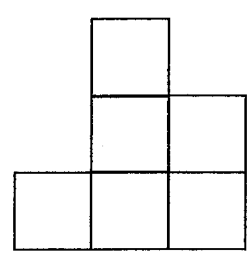
SPEED DEPARTMENT

Two real quick ones from Richard Alpert and Brad Taylor respectively: What is a millihelen? The Red Sox beat the Orioles 9 to 4 in 17 innings. Where was the game played?

SOLUTIONS

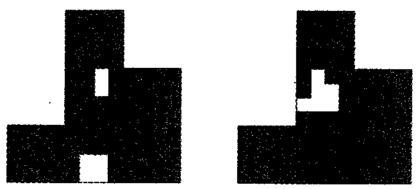
May 1. As mentioned above, the printed version of May 1 gave South 14 cards and the corrected problem is now Oct. 1.

May 2. Richard Hess and Robert Wainwright want you to design a tile so that 5 of them cover at least 93 percent of the hexomino shown below. The 5 tiles must be identical in size and shape, but may be turned over so some are mirror images of the others. They must not overlap each other or the border of the hexomino.



The following solution and diagrams are from Craig Weigert: I approached this problem by dividing each of the squares in the hexomino into an n-by-n grid of n^2 smaller squares and composing the tile out of the smaller squares. For n=2 there are a total of 24 small squares, which means each of the 5 tiles would be made of 4 small squares. Clearly this won't work, as 20/24 is only 83.3 percent coverage. Similarly for n=3, there are 54 small squares, so each tile would consist of 10 small squares for a total of only 50/54 = 92.6 percent coverage.

But n=4 is a good possibility. This gives a total of 96 small squares, so each tile could contain 18 or 19 small squares for a coverage of 93.8 percent or 99.0 percent respectively. I didn't find any solutions for 19 squares, but attached are two solutions using tiles of 18 small squares. As Adrian Childs points out, the second solution is particularly nifty because the leftover space is in the shape of the original hexomino.



May 3. Ken Rosato knows two climbers, Theta and Phi, who specialize in climbing square-based Egyptian-style pyramids. Theta always climbs straight up the middle of one of the pyramid's triangular faces, whereas Phi always climbs up an edge between two faces. For a given pyramid, Theta and Phi experience different angles of accent. For which pyramids is the difference greatest and how great is that difference? Real Egyptian pyramids are constrained in their steepness due to stability considerations, but you should ignore this constraint.

Eugene Sard sent us the following exact solution: Denote the side of the square base and the height of the pyramid by s and h, respectively, and let $x = h/s$. Assuming a right pyramid, the angles of ascent of Theta and Phi are then

$$\arctan(h/(s/2)) = \arctan(2x) \text{ and}$$
$$\arctan(h/(s\sqrt{2}/2)) = \arctan(x\sqrt{2})$$

respectively. Let y be the difference of these angles. Setting

$$0 = dy/dx = 2/(1+4x^2) - \sqrt{2}/(1+2x^2)$$

gives the optimum $x = 2^{-3/4} \approx .595$, and the maximum $y = \arctan(2^{1/4}) - \arctan(2^{-1/4}) \approx 9.88$ degrees.

BETTER LATE THAN NEVER

2000 M/J 3. Thomas Terwilliger believes that the published solution can be improved by tipping the top two cuts of the triangle. He does not know by how much the cuts should be tipped to achieve optimality.

J/A 1. Larry Kells, the author, writes "there apparently was unclear wording in my original statement of the problem. It is not required as a condition of the problem that declarer always wins his tenth trick with the Ace of Spades. It is required that he make 4 Spades against best defense. The comment about winning his ninth trick while still holding the Spade Ace was a hint, based on what (according to my friend) actually happened in the play. It was for dramatic effect only."

J/A 2. The solution given in Nov./Dec. for J/A 2 was actually the solution for J/A 3. The real solution to J/A 2, from Gregory Sahagen, was dropped due to space limitations and is available from the editors of *Technology Review.*

N/D 3. Philip Cassady, a course XVI graduate and hence more knowledgeable than I about aircraft flight, writes the following:

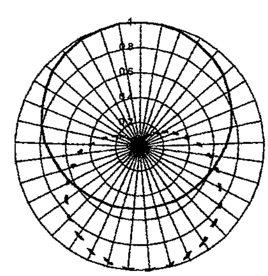
"It appears that you have misled your readers concerning the minimum fuel consumption strategy described in your May column. The problem is that the amount of fuel consumed is proportional to the *cube* of the relative velocity, V_a, rather than the square. In fact, the drag force on the aircraft scales as the square of the relative velocity, and the required power (to which fuel consumption is proportional) thus varies as the cube.

One can show that

$$V_g / V_w = \frac{\cos\theta + \sqrt{\cos^2\theta + 8}}{4}$$

where θ is the angle between the ground velocity V_g and the wind velocity V_w.

Rather than indicating $V_g = V_w$ regardless of θ for minimum fuel consumption, this relation indicates the variation of ground velocity shown by the solid line in the following figure ($\theta = 0$ is at 12 o'clock). The total fuel consumed on a trip is shown by the dotted line."



OTHER RESPONDENTS

Responses have also been received from P. Bierre, R. Bishop, G. Blondin, G. Blum, G. Boyd, N. Bressman, J. Chandler, D. Church, C. Dailey, L. Deahl, R. Dean, D. Diamond, B. Didur, D. Droar, C. Dupin, R. Ellis, E. Foster, M. Fountain, J. Froehlich, F. Grosselfinger, J. Grossman, M. Highlander, H. Ingraham, M. Ionescu, J. Jokinen, M. Lindenberg, S. Merola, R. Miller, A. Ornstein, A. Prasath, J. Prussing, K. Rosato, and D. Wellington.

PROPOSER'S SOLUTION TO SPEED PROBLEM

Enough beauty to launch a single ship. Baltimore (to win by more than 4 in extra innings you must be up first).

Send problems, solutions and comments to Allan Gottlieb, New York University, 715 Broadway, 10th floor, New York, NY 10003, or to gottlieb@nyu.edu.