ALLAN J. GOTTLIEB

Dog's Mead and Farmer Dunk's Mother-in-Law

A word on problem backlogs is in order. I have over a one-year supply of both regular and bridge problems. For chess and computer problems the backlog is much smaller—about a half year for each. Finally, a shortage of speed problems has developed.

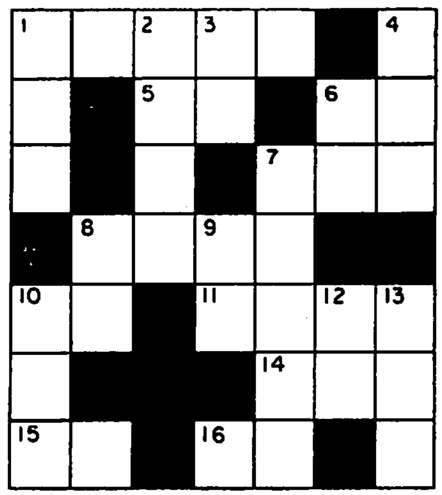
Two personal comments. Today (Christmas eve) is Phelps Meaker's 85th birthday: happy birthday, Mr. Meaker! And I would like to thank everyone for their kind words concerning my receipt of tenure.

Problems

F/M 1. We begin with a bridge problem from Howard Sard who wants you to construct a deal such that North-South can make 7 no-trump against the worst defense with North-South having the minimum number of high-card points. By worst defense we mean that the declarer can specify which (legal) cards the defenders are to play at each trick.

F/M 2. Peter Defoe has sent us a famous old English puzzle called Dog's Mead. The name sounds familiar, and I wouldn't be surprised to find that I published this same problem 10 or 15 years ago. However, repeating good problems every dozen years doesn't sound like a bad idea. Although it relates to a farmer, his family, and his land, Dog's Mead involves a good deal of engineering math and logic:

The problem is to find the age of Mrs. Grooby, Farmer Dunk's mother-in-law. You'll need to know that there are 20 shillings to the pound sterling, that an acre is 4840 square yards, and that a rood is a quarter of an acre. And you must *not* assume the puzzle was invented this year. Also, these hints help: one number in the puzzle is the area of Dog's Mead in roods, but it relates to something in the puzzle quite different from that area. One of the numbers across is the same as one of the numbers down. All numbers are integers, and no number begins with a 'O'. So here you are . . .



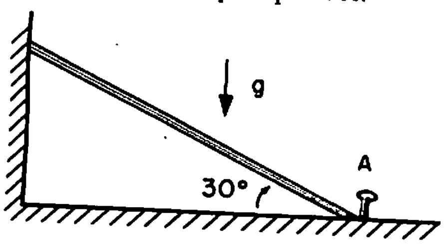
Across
1. Area of Dog's Mead in square yards.
5. Age of Farmer Dunk's daughter, Martha.
6. The difference between the length and breadth of Dog's Mead in yards.
7. Number of roods in Dog's Mead times number nine down.
8. The year when Little Piggly came into occupation by Dunk family.
10. Farmer Dunk's age.
11. The year Farmer Dunk's youngest child, Mary, was born.
14. Perimeter of Dog's Mead in yards.
15. The cube of Farmer Dunk's walking speed in miles per hour.
16. Number fifteen across minus number nine down.

Down
1. The value of Dog's Mead in shillings per acre.
2. The square of Mrs. Grooby's age.
3. The age of Mary.
4. The value of Dog's Mead in pounds sterling.
6. The age of Farmer Dunk's first-born, Edward, who will be twice as old as Mary next year.
7. The square, in yards, of the breadth of Dog's Mead.
8. The number of minutes Farmer Dunk needs to walk one and one third times around Dog's Mead.
9. See number ten down.
10. Ten across times nine down.
12. One more than the sum of the digits in the second column down.
13. Length of tenure, in years, of Little Piggly by the Dunk family.

SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012.

F/M 3. Joe Verducci sent us the following problem, a variation of a problem suggested by Robert Bartoczinski:
N (= 2k + 1) people own a bank. What is the minimum number of different locks that must be put on a safe so that when keys to these locks are distributed to the different people, every majority contains a complete set of keys, but no minority does?

F/M 4. Bruce Calder likes to speak softly and drop a long (meter) stick:
A rigid, uniform stick one meter long is held leaning against a smooth vertical wall at a 30° angle to a smooth horizontal surface. When the stick is released, how fast will its center pass point A?



F/M 5. John Rudy's nine-year-old came home with the following problem:
(1) Choose any four different digits.
(2) Arrange them to make the largest number.
(3) Arrange them to make the smallest number.
(4) Subtract the smaller from the larger.
(5) Take the result and go back to step 2 and see what happens.
John and Joel Shwimer noticed that the procedure always converged to 7641. They ask why and whether there is a similar phenomenon for five-digit numbers.

Speed Department

SD 1. George Byrd asks a problem similar to one mentioned by Ken Thompson in his acceptance of the ACM Turning Award:
Write, in any language, a computer program that makes explicit or implicit reference only to the computer terminal device. When the program executes, its only action should be to cause a listing of itself to appear on the terminal device. A child allegedly proffered the solution to the computer scientists who were pondering the problem.

SD 2. We conclude with an offering from Doug Van Patter:

North:
♠ K 9 3
♥ 6 4 3
♦ A J 9 2
♣ Q 7 4

East
♠ 10 7 6
♥ A K Q 7
♦ Q 7 5
♣ J 10 9

n a rubber bridge game, the bidding has gone: South 1NT, North 3NT. Your partner leads the ♥10, and everyone follows to three rounds of hearts. What is your best chance at setting this game?

Solutions

OCT 1. Consider a duplicate bridge tournament in which every hand was played 20 times. One of these hands produced a strange result. At four of the tables the final contract was one club, played once from each of the four sides. At four of the other tables it was played at one diamond once from each side. At the remaining tables it was played once from each side at one heart, one spade, and one notrump. Every one of these contracts was set. Analysis of the hand proved that none of the declarers made a mistake in play. What hands were originally dealt?

Herb Manning had no trouble setting all the contracts. Indeed, they are all down two. A deal in which each player holds a 4-4-4-1 distribution, with A-K-Q-5 in the suit of the partner's singleton, would allow the defense to take eight tricks off the top, no matter what the contract. For example:

♠ A K Q J
♥ x x x x
♦ x x x x
♣ x

♠ x x x x
♥ x
♦ A K Q J
♣ x x x x

♠ x x x x
♥ A K Q J
♦ x
♣ x x x x

♠ x
♥ x x x x
♦ x x x x
♣ A K Q J

Also solved by Winslow Hartford, Robert Bart, Timothy Maloney, Thomas Chang, Matthew Fountain, Dan Sheingold, Tim Schiller, and the proposer Lawrence Kells.

OCT 2. Twenty-four cards, the 1-6 of each suit, are put face-up on the table. Two players pick up alternately, each keeping track of his pip-total. One wins by hitting *thirty-one* or forcing one's opponent to exceed 31. Does the first or second player have a sure win, and how does he play to insure it?

Several readers asserted that the first player can win by just taking the largest card available. This is refuted by 6,2; 6,2; 6,2; 6,1 and the second player wins. The clearest solution comes from the proposor, Smith D. Turner, *fdt*, who writes:
It is evident that if a player reaches 24, and there is a card of each denomination left, he wins; and with 17 he can reach 24, etc. But as one of each denomination may not be left, this plan requires refinements, as below.
First player can always win if he starts with 1, 2, or 5 and then plays to make 10, 17, 24, except:
10 loses with two of any denomination gone, unless two 2's and one 1 are gone.
17 loses with three of any denomination gone, unless three 2's and two 1's are gone.
24 loses with four of any denomination gone, unless four 2's and three 1's are gone.
While I can't prove above will insure a win, no one has produced an exception. A solution was in the magicians' journal *Sphinx*, page 294, October, 1932, but it omitted the exceptions in the above beginning with the word "unless." There are so many possible situations that a player knowing the above can, with considerable safety, risk playing second or taking other losing positions early in the game to keep a novice from catching on!

Also solved by Winslow Hartford, Allen Wiegner, Robert Bart, Thomas Chang, Matthew Fountain, John Bobbitt, and Jim Rutledge.

OCT 3. A very wise dean wishes to improve the quality of research and education at her university. She believes some of the "fault" is with the department heads, but, being wise, recognizes some of the "fault" may be with herself. For starters, she decided to relocate her office so as to *minimize* the average distance to her department heads. Where should she locate her office? (For simplicity, assume all offices are located in a plane and that the dean cannot co-reside with any department head).

Robert Bart and Harry Zaremba noticed that the dean should be at the centroid of the chairmen [this sounds like a political remark—ed.]. If there is a chairman located at the centroid, no solution is possible [since deans do not share offices with chairmen!—ed.].

OCT 4. An exploring team wants to reach a destination that is six days away. Each explorer can carry enough provisions to sustain one person for four days (and the distance an explorer travels in a day is independent of the amount of provisions he or she is carrying). What is the smallest team that permits at least one explorer to reach the destination and permits all the explorers to return home safely?

The solution depends on how you interpret the conditions. Tim Schiller found two interpretations and thus two solutions. John Bobbitt has all the explorers leave at one time for a third solution and a magnificent punch line. Mr. Schiller writes:
As stated, the obvious answer is one person if he does all of his shuttling. It would take 63 days to complete the task. If you add the requirement that the expedition take only 12 days, then the minimum number of people is 8. The following diagram shows the locations of the people (first number) and the food (second number) at the end of each day:

Day	Base 0	1	2	3	4	5	Goal 6
1		8/24					
2	3	/1	5/15				
3		4/10		4/10			
4	3	/3	3/3	/1	2/5		
5		6/12		1/1		1/3	
6	4		3/6				1/2
7		6/12		1/3		1/1	
8	4		2/6		2/2		
9		5/12	/1	3/3			
10	4	/4	4/4				
11	4	4/4					
12	8						

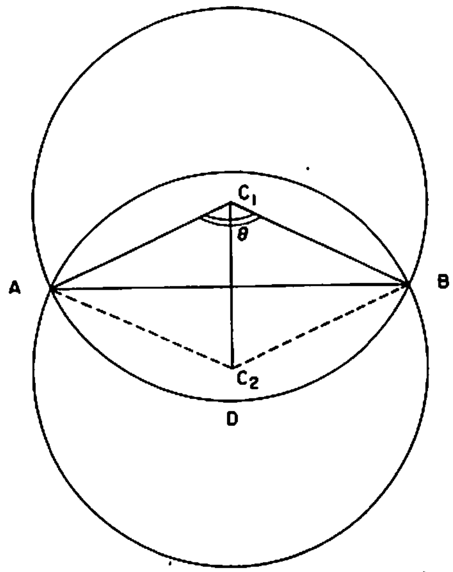
Mr. Bobbit's more fanciful solution follows:
A Star Wars satellite has exploded over Russia, but the bright orange "black box" has survived. Its beacon has pinpointed it in the remote Ural Mountains. A recent snowstorm over the area has made air travel impossible for at least two weeks. But the box must be recovered. Thus, a handpicked group of 16 intrepid explorers set off to recover the black box which is six days away from the starting point. The 16 include 8 East Germans, 4 Hungarians, 2 Albanians, 1 Romanian, and a small Czechoslovakian. Because of the cold-weather equipment needed to keep warm, each of these men is able to carry only four days' supply of food. They head out in good spirits, eager to serve Mother Russia. At the end of the first day, they reach stop point 1. Each of the 16 has eaten the first day's supply of food. The next day, each of the 8 East Germans gives a packet of food to the other eight, they set up 8 caches of food for these 8 to use when they return, and they head back with the other eight packets of food. The other eight bid farewell to the East Germans and head off again with a four days' supply of food each and the comforting knowledge that there is a cache of food for each at stop point 1. The trip continues with the numbers cut in half each night. At stop point 2, the 4 Hungarians return, leaving 4 food caches for the 4 who continue on. At stop point 3, the 2 Albanians return, leaving 2 caches, and the Romanian and

Czech travel on to stop point 4. Arriving at stop point 4, each finishes a day's supply of food, leaving 6 uneaten. Noting the place well, the Czechoslovakian stores a packet out of reach of the wolves and bears, keeps his 4, and leaves the other packet for his Romanian comrade. The next morning the Romanian returns with his packet, and the Czech heads off on his last 2 days. The 4 days' supply will get him to the black box and back again to stop point 4. And from that point on, he knows that every day there will be another cache for a small Czech.

Also solved by Winslow Hartford, Ellen Kranzer, Norman Wickstrand, Allen Wiegner, Dennis White, Robert Bart, Matthew Fountain, Avi Ornstein, Frank Carbin, Charles Sutton, Harry Zaremba, Jim Rutledge, Gardner Perry, Michael Jung, Bill Wold, and the proposer, Yogesh Gupta.

OCT 5. Two cats are fed a single can of cat food. The food comes out of the can as a single intact cylinder, and the can is then used to cut the cylinder into two shares of food. Where should the can be positioned to generate equal shares?

The following solution is from Winslow Hartford.



Assume the two circles have unit radius. Then the area of segment ADB is $\pi/4$.

$\pi/4 = \pi \times \theta/2\pi - \sin\theta/2$

$\theta - \sin\theta = \pi/2$

$\theta = 132.34645°$.

Then C_1C_2, the distance between centers, is

$2\cos\theta/2 = 0.80795$.

The center of the cutting can is therefore 0.80795 radii from the center of the cat food.

Also solved by Ronald Raines, Robert Moeser, Mike Hennessey, Dennis White, Robert Bart, Steve Feldman, Frederic Jelen, Phelps Meaker, Timothy Maloney, Alan Berger, John Prussing, Thomas Chang, Matthew Fountain, Roger Whitman, Ken Rosato, Frank Carbin, Harry Zaremba, Jim Rutledge, Dan Sheingold, Steve Silberberg, and Raymond Gaillard.

Better Late Than Never

M/J 1. Charles Rivers [what a name for an MIT alumnus—ed.] and Michael Krashinsky remark that this problem is considerably more complicated and interesting that the published solution would lead one to believe. They each give detailed descriptions of how the contract can be made against any defense. Mr. Rivers writes:

The five-club contract can be made against *any* lead and any defense! The proposer is to be commended for a most intriguing double-dummy problem and the red herring in the form of an apparent "giveaway" lead. In order of difficulty:

1. If West leads a low heart, Declarer takes three hearts in Dummy (discarding spades) and plays ♦K and ♦A. East must ruff or Declarer makes six! East's black card return is won in Dummy and Declarer now can draw trump (♣K,♣J,♦ ruff and ♣A) and has six trump tricks to go with three hearts, one spade, and one diamond.

2. If West leads *any* minor suit card, Declarer takes ♦K,♣K (or ♣K,♦K if West leads the ♣Q), then plays ♦A:

☐ If East discards, Declarer cashes ♥A,♥K (discarding a spade), ♥ ruff, ♠A, ♦ ruff, ♣K, ♦ ruff, ♣J, ♦ ruff, and ♠A for eleven tricks.

☐ If East ruffs and returns a black card, Declarer cashes Dummy's other black winner, ruffs a diamond and runs all the trumps. Dummy is reduced to three hearts and one diamond and West is strip-squeezed into the same distribution. Now a heart lead forces an honor from West and the last diamond throws him in for another heart lead.

☐ If East ruffs and returns a heart, Declarer cashes ♣J, ruffs a diamond, and runs trumps reducing Dummy to ♠A,♥K,♥10,♦7. Now a spade is led to Dummy. East must hold at least two hearts and is thrown in with the last diamond as before.

3. If West leads a heart honor, the first eight tricks are: ♥A, ♥K (discarding a *diamond*), ♥ ruff, ♦A, ♦ ruff, ♣K, ♦ ruff, and ♠ *ducked*. West is in with the ♠K and must lead a red card which Declarer ruffs in hand. Now ♠A; ♦ ruff with Declarer's last trump, and Dummy's ♣J is the eleventh trick.

4. Finally, if West leads ♠K, Declarer *ducks*:

☐ If West shifts to heart honor (a low heart makes it easy), Declarer takes ♥A, ♥K, (discarding a *diamond*), ♣10 ruffed, ♦A,♦ ruff, ♠A (if West ruffs a low spade lead, Declarer takes the rest on a cross-ruff), ♦ ruff, ♠ conceded. If East returns a spade, it is ruff with ♣J, and ♣K is cashed. Now a diamond is led toward Declarer's ♣10, ♣A. If East returns a trump, the ♣K is taken, ♦ ruff, ♠ ruff, ♣A. And if *West* ruffs the conceded spade trick, West's red suit return allows Declarer to make the rest on a cross-ruff.

☐ If West shifts to a diamond, Declarer takes ♦K,♥A,♥K (discarding a *diamond*), then ♦A. East must ruff or Declarer will easily make 11 tricks. Declarer overruffs, then ♠A (as above, it does West no good to ruff in), ♦ ruff, ♠ conceded. With a spade return, ruff with ♣J, ♥ ruff (if declarer carelessly ruffs Dummy's ♥10 earlier, West can discard all diamonds and prevent cross-ruff), ♣K, ♦ toward the ♣A, ♣9. With a trump or heart return, the play follows the lines as above.

☐ If West shifts to the ♣Q, Declarer takes ♣K,♣J to ♣A,♣9 to East's ♣10 (if East ducks Declarer continues clubs). If East returns a major suit card, Declarer cashes Dummy's major suit winners, enters his hand with the ♦K and runs trumps, squeezing West in the red suits. If East returns a minor suit card, Declarer wins in hand, draws the last trump (if necessary), cashes ♠A and the top diamonds, ruffs a diamond, and runs trumps to squeeze West.

I apologize for the long explanation, but as I said at the start, this is an intriguing hand!

M/J 4. Greg Huber remarks that analogues of octahedrons also exist in all dimensions.

JUL 5. Phelps Meaker has responded.

A/S 4. Jim Rutledge has responded.

A/S 5. Leon Tatevossian and Michael Jung have responded.

OCT SD1. Raymond Kinsley, Richard Heldenfels, Yardley Chittick, and Jim Rutledge noticed that the correct answer is 2:46 2/13.

Proposers' Solutions to Speed Problems

SD 1. A solution: Use the BASIC language, and write the line

10 LIST 10

SD 2. Don't cash your fourth heart! Lead a club and hope that declarer places the last heart in your partner's hand. Then it would be safe to take the diamond finesse into your hand.