One of my projects for my sabbatical year, which will soon be over, has been to scan in all the issues of this column for which I had no electronic copy of the final version and place them on the Puzzle Corner website at cs.nyu.edu/~gottlieb/tr. I have made real progress: now (mid-April), I am all the way back to 1970 and have only six years to go. I hope by the time you read this the gap will be considerably smaller. Bug reports are welcome.

Problems

J/A 1. Larry Kells is an economical guy, at least when it comes to high-card points. He wonders, what is the lowest number of points a bridge partnership can have and still be able to make 7 no-trump? You choose the cards for declarer and dummy but must succeed against any distribution of the remaining cards between the opponents and best defense. What about 6 or 3 no-trump?

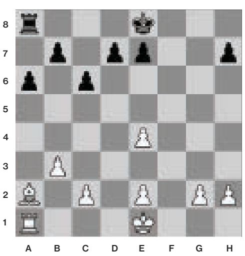
J/A 2. Sorab Vatcha offered a "symbolic problem," which I slightly modified to the following. What is the longest English word consisting entirely of the symbolic names of (possibly repeated) elements in the periodic table? For example, a six-letter solution is "sinner": Si N N Er, or silicon, nitrogen, nitrogen, erbium. For consistency, an English word is one accepted by www.merriam-webster.com.

J/A 3. John Oehrie has a problem that is simple to state mathematically but (to me) looks hard to solve. However, I have often been wrong with such predictions.

Define a shuffle of 52 cards that requires the most consecutive applications to return the deck to its original order. For example, if you numbered the cards in a deck from 1 to 52, a simple shuffle might be: $1 \to 2$, $2 \to 1$, $3 \to 4$, $4 \to 5$, $5 \to 3$, and $n \to n$ for $n > 5$. (In other words, the first two cards swap positions, the second three cards are rotated, and all remaining cards stay put.) This shuffle must be repeated six (the least common multiple—LCM—of 2, 3, and 1) times to return the deck to the original order. Mathematically stated, the problem asks for a partition of 52 having maximal LCM.

Speed Department

Burgess H. Rhodes wants you to identify this (somewhat encrypted) logo: 1367, 1348, 1364, 1364, 1108, 1108.



Solutions

M/A 1. As shown in the diagram, Howard Cohen remembers almost all of a chess position he encountered. The only part missing is that there is another White pawn, but Howard is not sure if it was on f5 or f6 (KB5 or KB6 for old-timers, like me). However, he does remember that White was able to castle from the position. Where was the missing pawn?

This problem generated many interesting responses. I first received a number of claims or at least suggestions of impossibility. Then I received a solution and forwarded it to one of those who suggested impossibility, who refuted it. At this point it looked bad. However, I then received a solution from Jorgen Harmse, which I again forwarded. This time the response was "Cool ... We agree it is indeed a solution!" I subsequently received a few more solutions and several more claims of impossibility.

What follows is most of Harmse's solution. Due to space considerations I omitted his possible move sequence giving the desired position. See the full solution at cs.nyu.edu/~gottlieb/tr.

Harmse writes that this problem is easy to guess: if f5 is possible then f6 is also possible, so by the conventions of retrograde analysis the answer must be f6. Proving that the pawn cannot be on f5 is harder.

The White bishop cannot have started at f1 and must therefore be the result of an underpromotion. Since there had to be a path to the corner, the pawn on b3 must have started at b2 and advanced after the bishop moved to the corner. It follows that the other advanced White pawns started on d2 and f2, so the underpromoted pawn started at a2. Since the exits from a8 and c8 are blocked, the promotion must have happened at e8 or g8. To bypass Black's KP, the pawn must have made six captures. These cannot include Black's QB (which obviously never moved) or the KB (which stayed on black squares) or Black's KKtP (which could at most move diagonally toward a1). That leaves seven pieces that the White pawn could capture:

a) The Black queen
b) Both Black knights
c) Black's KBP, or whatever it was promoted to
d) A Black rook
e) Whatever the Black KKtP was promoted to
f) Another Black rook, but only if a Black pawn was promoted to a rook and moved to a8

Thus the KKtP must have been promoted. (Promoting the KBP doesn't increase the number of captures available to the White pawn.) Passing through d2 or f2 would force the White king to move, so it must have reached b2, making five captures. Since White's KB never moved, the Black pawn must have captured all the other missing White pieces. Moreover, White's QKtP had to move to b3 before the Black pawn could be promoted, so the White bishop was already in the corner, and we can rule out (e). Thus Black promoted a pawn to a rook on b1, but no White piece was available to interpose. (The QR has not moved, and capturing the new Black rook would not allow it to reach a8.) Thus the check was blocked by a Black piece, which can only be the KB. Later the KB was captured by a White pawn, but there is only one pawn capture unaccounted for. Thus the pawn on the KB file must have advanced without capturing, and the pawn on e4 must have started at d2 and captured the bishop on e3.

Finally, we come to the mystery pawn. Since it hasn't captured anything, it must have advanced at least to f4 before White's KR could throw itself in front of Black's KKtP. After b1 = R by Black, most White pieces were already in the positions shown. The bishop could not move except to capture the Black rook, and the QP had to wait on d2 to capture the Black bishop. White's only move is thus to push the KBP. The Black pieces had to leave the corner, but a bishop move would have discovered check and there was still a pawn on d2, so there must have been a sequence like

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1. ... Rb2
2. Bb1 Ra2
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(The Black king and White bishop could dance when the rook is on b2, but the result is the same.) Once again, White's only move is a push, so the pawn must be on f6.

M/A 2. Dick Miekka has two pieces of gnarly rope and a box of matches. Each piece of rope will burn for exactly one hour, but unevenly. How can he measure exactly 45 minutes?

In contrast to M/A 1, this problem was noncontroversial. Derek Truesdale writes that even if a rope burns unevenly, there is a point on the rope with 30 minutes of burning on either side. If you light three of the four ends of the ropes, one rope will be burned up in 30 minutes when the two flames meet at that point. The other rope will have burned for a half-hour. If when the first rope burns up, you then light the fourth end, the remaining two flames will meet in exactly 15 minutes, for a total of 45 minutes.

M/A 3. Arthur Wasserman's eye-color problem boils down to this: 100 logicians with blue eyes and 100 with brown eyes live on an island. Other eye colors are possible but did not occur. Everyone knows the eye color of everyone else. Each day at midnight, everyone who knows the color of his or her own eyes must leave. A guru announces that she can see someone with blue eyes. Who leaves, and when?

Doug Foxvog writes that if there were only one blue-eyed person on the island, s/he would know, once told that someone on the island had blue eyes, that s/he was that person since s/he saw no one else with blue eyes, so s/he would leave that evening. If there were only two blue-eyed people on the island, each would see a blue-eyed person, so neither would know the color of his or her own eyes. But on the second day each of them would realize that the other blue-eyed person was still on the island and thus didn't realize s/he had blue eyes. So they would know that there were at least two people with blue eyes on the island. Since each would see one only such person, both would know that they must themselves have blue eyes. So both would leave on the second evening.

If there were only three blue-eyed people on the island, each would see two blue-eyed people. So they would expect (if they themselves did not have blue eyes) for the two blue-eyed people to leave on the second night. Since this did not happen, each would know that there were at least three blue-eyed people on the island, and thus that they must themselves have blue eyes. So each blue-eyed person would leave on the third evening.

The same reasoning would apply for four, five, six, ... blue-eyed people: all would leave on the fourth, fifth, sixth, ... night. Since there are 100 blue-eyed people, all would leave on the 100th night.

Some readers gave a proof explicitly using mathematical induction. In that case, after solving the problem for one or possibly two blue-eyed people, they assume that for k blue-eyed people all leave after k days and then show that for $k + 1$ blue-eyed people, all leave after $k + 1$ days using wording similar to Foxvog's argument for three blue-eyed people.

John Chandler says the problem should have specified that no one leaves the island without determining his or her eye color.

Efstathios Avgoustiniatos was told a version of this problem while waiting for his bride just before his first wedding and says he was thinking about it throughout the ceremony. I had other thoughts during my wedding. Avgoustiniatos included a smiley after his statement.

Better Late Than Never

2013 N/D 1. Sorab Vatcha notes that "judgment" is not valid since "u" and "g" are in different thirds.

N/D 3. Vatcha notes that the solution figure is not drawn to scale.

Y2013. John Chandler offers four improvements:
11 = 31 – 20, 14 = 2^0 + 13, 15 = 2 + 0 + 13, and 18 = 30 – 12.

Other Responders

Responses have also been received from R. Ascoli, L. Azevedo, W. Bilofsky, D. Boggs, B. Bramley, P. Cassady, L. Cassey, S. Chessin, D. Dudgeon, S. Eddy, D. Ertas, M. Falkof, M. Fineman, A. Forer, D. Foxvog, R. Giovanniello, A. Goel, R. Goldin, S. Gordon, T. Griffin, V. Gutnik, J. Hardis, C. Hibbert, Y. Hinuma, J. Hutchinson, J. Ingersoll, J. Kesselman, W. Kinnaman, S. Kinnas, P. Klein, S. Korb, P. Kramer, D. Kronholm, A. LaVergne, P. Lawes, S. Levitan, F. Lyness, M. Matter, T. Mita, A. Ornstein, M. Perkings, A. Prakash, P. Rauch, K. Rosato, W. Ross, E. Sard, B. Schargel, S. Silberberg, T. Sim, R. Somers, S. Sperry, A. Stark, F. Tahik, A. Trachtenberg, C. Wagner, T. Weiss, and S. Zalkin.

Proposer's Solution to Speed Problem

Convert to binary, then replace *0*s with white squares and *1*s with black squares.

1367	10101010111
1348	10101000100
1364	10101010100
1364	10101010100
1364	10101010100
1108	10001010100
1108	10001010100

Send problems, solutions, and comments to Allan Gottlieb, New York University, 715 Broadway, Room 712, New York, NY 10003, or to gottlieb@nyu.edu. For other solutions and back issues, visit the Puzzle Corner website at cs.nyu.edu/~gottlieb/tr.