

Actuarial Exams and the Mean CEO

THIS ISSUE'S PUZZLES

In the beginning of the second half of the 21st century, the Society of Actuaries decided to change its education system once again. This time it offered an unlimited number of courses. If a candidate expressed a desire to learn any actuarial topic, he could do so. There were an unlimited number of topics because students were not restricted to a specified number of pages read in actuarial books or articles read on actuarial websites. Each topic was validated by an exam. In such a world, there are no ASA or FSA designations; instead, the number of exams passed determines the level of an actuary.

It is 2075, and this system has been a success—the number of actuaries (those with at least one exam passed) has been increasing every year. A few years ago, however, a downward economic cycle started. Many actuaries lost their jobs, and many companies became bankrupt.

The Insurance Co. of America has an opening for an actuary, and 5,555 actuaries have sent in their résumés (electronically; there is no paper in 2075). Mr. Purple, the hiring manager, has only one goal—to hire the actuary with the largest number of exams passed. He opens a file, reads the number of exams passed, and closes it if he chooses not to hire the first candidate. Mr. Purple then opens the second file, reads it, and, again, closes it if he does not want to hire the second candidate. The process goes on until he decides to hire someone. Once a file is closed, however, it is lost forever, and a rejection letter is e-mailed to the candidate. In addition, if Mr. Purple decides to hire someone but that someone does not have the highest number of exams among all 5,555 candidates, the CEO will fire Mr. Purple upon returning from vacation and reject the candidate. (The CEO knows that number, but he is on vacation and has no means of communication.) Mr. Purple will also get fired if he rejects all the candidates.

Assuming for simplicity that none of the candidates have the same number of exams passed, answer the following questions:

- 1** What is the best strategy for Mr. Purple?
- 2** What is the probability of being fired even if the best strategy is used?
- 3** Does the probability of being fired depend on the number of résumés? Explain one way or the other (not needed to make the solver list).

PREVIOUS ISSUE PUZZLES

Computer Game Thriller: Answers

- 1** If Mr. Orange works in an optimal manner, he will complete the job in a maximum of 50 minutes.
- 2** Yes, although he does not have to work optimally—he has at least 10 extra minutes.
- 3** 1,540 to 1,543 levels.

I would like to thank a few readers, who asked me to clarify the problem, which otherwise may lead to incorrect results. Once Mr. Orange's second life ends exactly at a "culprit" level, he has time to deactivate the virus. If he dies for the second time at another level, then an irreversible process will start and GameShop will lose all its files.

The key to finding the optimal strategy is to realize that 1,024 as the number of levels has nothing to do with 32^2 or anything else magical about the number. However, as several readers indicated, 32^2 could provide a hint.

In fact, Mr. Orange can subdivide his work into 32 steps. For instance, he can test level 32 first. If he loses a life, he will need to start from level 1 with step 1 until he finds the correct level. If he keeps his first life, he can then test level 64. Again, if he loses a life, he will need to start from level 33 with step 1 until he finds the correct level. If he keeps his first life, he can then test level 96 and so on. This procedure would result in possible 63 attempts (the worst case would be if

the virus-infected level is 1,023—Mr. Orange would need to go through levels 32, 64, 96, ..., 1,024 only to lose his first life on level 1,024 and then try levels 993 and up). It will take him 1 hour and 8 minutes to kill the virus—well in excess of the time allowed. It is hard to believe that Mr. Green would go through all this trouble and not leave a chance for the virus tester. There should be another solution.

I have not told you, but Mr. Orange is a trained logician so he has quickly solved the puzzle. Instead of having equal steps, he can work in equal attempts per step. The most optimal way to test the game is to decrease the steps by one each time. If he tests level A and loses a life, he will need to start from level 1 with step 1 until he finds the correct level. This corresponds to a maximum of A attempts. He will then try level 2A-1, in which case upon losing a life Mr. Orange will start from level A+1 up. The total number of attempts so far has a maximum of A again! So the key to the solution is to find minimum A such that it is enough to cover all 1,024 levels with ever reducing steps. This is realized by finding the minimum A such that the sum of an arithmetic progression from 1 to A is greater than or equal to 1,024. A is 45. Mr. Orange will have his work

CHESS PUZZLE							
White to Move and Mate in Three							
8		♖					♔
7							
6		♙	♙	♙			
5							
4				♔	♖	♕	
3						♖	
2			♙				
1	♙						
	A	B	C	D	E	F	G

done in 50 minutes (remember, he still needs to deactivate the virus). GameShop is saved!

Of course, he could start at a higher level, 55, for example, and then use the same strategy, and still be able to save the company.

To answer the third question, one needs to sum up the arithmetic progression from 1 to 55 (again, don't forget five

minutes to deactivate the virus), which equals 1540. This assumes testing of all the levels, which presupposes that Mr. Green could have been lying about putting a virus in the game or that levels 1 and/or 2 could also have been infected. Lifting the restrictions may lead to three other correct answers: 1541, 1542, and 1543.

Chess Puzzle. White to move and mate in three. Initial position:

- ▶ White—Kb1, Rb2, Qa7, pawns c5, d2, g6, h7
- ▶ Black—Kh8, pawns b3, d3.

Answers

Case A

- 1 Ra2! (zugzwang) b2
- 2 Ra1+ bxaQ+
- 3 Qxa1#

Case B

- 1 Ra2! (zugzwang) bxa+
- 2 Kc1 a1Q+
- 3 Qxa1#

Solver lists

Due to an administrative deadline, names of only those people who submitted correct solutions by May 31, 2005, are shown on the lists.

Computer Puzzle: Bob Bartholomew, Francis Bernardi, Geoff Bridges, Bob Byrne, Mike Crooks, Andrew Dean, Mark Evans, Michael Failor, Jerry Francis, Len Helfgott, Albert Kovalyov, Chi Kwok, Lee Michelson, Brian Miller, Philip Morse, Chris Norman, David Oakden, Don Onnen, Stephen Peebles, David Promislow, Noam Segal, Al Spooner, Elnatan Sulimanoff, Tony Torelli, Mark Yu

Chess Puzzle: Jim Beauchamp, Dick Botelli, Geoff Bridges, Jan Brown, Robert Burrell, Bob Byrne, Mike Crooks, Michael Failor, Len Helfgott, Todd Kennedy, Stu Liebeskind, Tim Luker, Raja Malkani, June Meimban, Mark Mercier, Lee Michelson, Philip Morse, Richard Newell, Chris Norman, David Oakden, Don Onnen, John Pauly, Igor Pogrebinsky, Edward Scher, Gregory Scruton, Albert Sekac, Noam Segal, Ron Stokes, Zorast Wadia

Solutions may be e-mailed to cont_puzzles@yahoo.com or mailed to **Puzzles, 25 Sparrow Walk, Newtown, Pa. 18940.**

In order to make the solver lists (separately maintained for the regular and chess puzzles), please submit your answers and solutions by **Aug. 13, 2005.** Depending on the response volume, solver lists may contain only the names of people who solved puzzles on the first attempt.

Please note that I will not be able to respond to e-mails from July 27 through Aug. 8. The deadline is pushed by 13 additional days for this issue only.

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