

Solutions

2.1 D. There are 11 stars and 3 bars. Choose the 3 bar positions among 14 positions: $C(14,3)=364$. Stars and bars gives $C(14,3)$. Forty-four, 120 and 244 do not count that arrangement; 4 to the eleventh counts distinguishable tokens and therefore a different sample space.

2.2 D. The successive sums are 1,4,9,16. The first sum at least 10 is 16, so the test overshoots rather than declaring 10 square. Nine is the previous sum; ten and eleven are not square partial sums; twenty-five is reached only if the loop continues after its condition becomes false.

2.3 Put $u = a - 2$. Then $u + b + c = 6$ has $\binom{8}{2} = 28$ nonnegative solutions. Requiring b, c positive and subtracting one from each gives total four in three nonnegative variables, counted by $\binom{6}{2} = 15$. The complement count is $28 - 15 = 13$. Directly $b=0$ gives seven, $c=0$ gives seven, and both zero is counted twice, giving $7 + 7 - 1 = 13$.

3.1 After m iterations, $S = m^2$ and $k = 2m+1$. The trace pairs (S, k) are $(0, 1), (1, 3), (4, 5), (9, 7), (16, 9)$. Thus 15 is rejected by overshoot and 16 accepted. The invariant holds initially and is preserved since $m^2 + (2m+1) = (m+1)^2$. The sum grows without bound, so it eventually reaches or exceeds N ; for example $m=N$ suffices when N is positive. For $N=0$ the loop is skipped and equality holds. An invariant alone would not establish termination.

Local four-mark guidance for each written task: choose and justify the method; carry through the reasoning; give every requested result; check the relevant restriction, hypothesis or boundary case. These are classroom marks, not GRE scoring.