

The Susquehanna Problem Solving Assessment

Duration: 1 hour

Test had 17 questions, but you're not expected to solve all of it.

Here I reproduce some of the questions.

Problem 1. Factory A makes 40% red widgets and 60% black widgets. Factory B makes 80% red widgets and 20% black widgets. Two widgets are sampled uniformly at random from one of the companies, also selected uniformly at random. The widgets are both red. Compute the probability they were from Factory A.

Problem 2. You roll a fair 6-sided die two times and get paid the higher of the two rolls in dollars if the rolls are different. If they are the same, you get paid \$0. Compute your expected payoff from this game.

Problem 3. Assume that in a bakery, each customer buys only one item at a time. There is a 70% chance a customer will buy a croissant and a 30% chance a customer will buy a muffin. There are only 2 muffins left and 5 people are still waiting in line. Compute the probability that these two muffins will be sufficient, i.e. no customer will want a muffin and find that there are none left.

Problem 4. You baked 6 indistinguishable snickerdoodle cookies and 8 indistinguishable chocolate chip cookies. Compute the number of ways to arrange 7 of these cookies into a straight line.

Problem 5. Three cats are competing in a jumping contest. The most athletic cat wins with probability $\frac{3}{4}$, the least athletic cat wins with probability $\frac{1}{16}$, and the remaining cat wins with probability $\frac{3}{16}$. I picked a cat uniformly at random to cheer on but it did not win. Compute the probability I picked the most athletic cat.

Problem 6. A spinner has three regions, and the probabilities of landing in each region are $\frac{1}{4}$, $\frac{1}{4}$, and $\frac{1}{2}$. Compute the expected number of spins it would take to land in two distinct regions.

Problem 7. A gardener is eagerly waiting for his two favorite flowers to bloom. The purple flower will blossom at some point uniformly at random in the next 20 days and be in bloom for exactly 4 days. Independent of the purple flower, the red flower will blossom at some point uniformly at random in the next 20 days and be in bloom for exactly 8 days. Compute the probability that both flowers will simultaneously be in bloom at some point in time.

Problem 8. A deck contains eight cards: two 10s, two Js, two Qs, two Ks. You are dealt five cards without replacement from this deck. Compute the expected number of pairs in your hand.

Problem 9. Suppose you have 3 tokens for a betting game and your goal is to bring your fortune up to 5 tokens before running out of tokens. You devised a bold betting strategy where every turn, you will bet as many tokens as possible against the house but not any more than necessary to bring you to 5 tokens. You always have a probability of $\frac{3}{4}$ to win the bet. Compute the probability you reach 5 tokens before running out.

Problem 10. A frog is travelling from point $A(0,0)$ to point $B(5,4)$ but each step can only be 1 unit up or 1 unit to the right. Additionally, the frog refuses to move three steps in the same direction consecutively. Compute the number of ways the frog can move from A to B .

Wall Street Oasis

Here I am randomly selecting problems from [Wall Street Oasis](#) website.

Problem 1. What is the degree difference on the hands of a clock at 3:15?

Problem 2. Suppose you have a $3 \times 3 \times 3$ cube. You paint the outside of the cube before cutting it into $1 \times 1 \times 1$ cubes. I pick a random $1 \times 1 \times 1$ cube from the pile of cubes and roll it. What is the probability that a painted side is face up?

Linearity of expectation

These problems are not from SIG test. They are compiled based on common solution technique.

Problem 1. A spinner has three regions, and the probabilities of landing in each region are $\frac{1}{4}$, $\frac{1}{4}$, and $\frac{1}{2}$. Compute the expected number of spins it would take to land in the same region twice in a row.

Problem 2. Suppose you are rolling a fair, 6-sided die repeatedly.

- (a) What is the expected number of rolls until you get two 3's in a row (counting both 3's)?
- (b) What is the expected number of rolls until you get a 3 followed by either a 3 or a 4?
- (c) What is the expected number of rolls until you get a 3 followed by a 4?