

1.

Suppose you are a trader on the wheat desk.  
Typically, the daily probability of an outsized rally (when the price of wheat goes up more than 5%) is greater than the probability of an outsized downtick (when the price of wheat goes down more than 5%).  
You can assume that the distribution of returns has positive skew. Suppose the average daily move in wheat is 1%. Which of the following scenarios is most likely to happen tomorrow, given that we have no prior expectation of directional move?

0.5%

2.

After collecting data for an AB test, a trader wants to reduce the standard error to 1/6 of its original value.  
After collecting more data, how much did the sample size increase?

It increased by a factor of 36

3.

Regarding a linear regression, suppose you deleted several of the observations that had small residual values. If you re-estimate the regression using the reduced sample, what would likely happen?

Increase in standard error of the estimates, decrease in R-Squared

4.

A least squares regression between number of beers consumed (x) and blood alcohol content (y) resulted in the equation:  $y = -0.0127 + 0.0180x$ . This equation implies that:

Each beer consumed increases blood alcohol by an average of amount of 1.8%

5.

Which of the following statements about R-squared are True?

- I. R-squared can be negative
- II. R-squared is always positive
- III. R-squared values range from [0,1]
- IV. Increasing the amount of training data can decrease R-squared
- V. Increasing the number of regression variables will not decrease R-squared
- VI. R-squared range between [-1,1]

I, V

6.

Let's say we have a game where a fair coin is flipped four times. You win \$17 if all flips are heads and lose otherwise - the game costs 1 dollar to play. What is the expected value of the outcome of the game?

0.0625
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7.

30 people are at a sleepover and voting on movies to watch. They each vote on one of 12 possible movies randomly. What is the expected number of movies that nobody voted to watch?
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0.88
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8.

There is an infinite staircase with $n$ balls at the top of it. At each step, each ball has a probability $p$ chance of falling to the next step, otherwise stopping at its current step. Each ball falls or stays independently of the other balls. To begin, all balls are pushed off the top (the 0th step) to the first step, what is the expected number of balls that stop at the $i$ th step?
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$n(1-p)p^{i-1}$
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9.

Team A and Team B are competing in a sports game and the score is currently tied 10-10. The first team to win by a margin of 2 points will win the game. Team A has a 65% chance of winning each point and Team B has a 35% chance of winning each point. What is the probability that Team A will win the overall match?
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0.78
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10.

Suppose there is an intersection in a street where crossing diagonally is allowed. The 4 corners form a square and there is a person at each of the four corners. Each person crosses randomly in one of the three possible directions available at the same time. Assuming they all walk at the same speed, what is the probability that no one crosses each other (arriving at the same location as someone doesn't count but crossing in the middle counts)?
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18/27
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11.

A germ population begins with one germ. Then, after each period, the germ can divide into 1, 2, 3, or 0 germs with equal probability, where 0 signifies the death of the germ. What is the approximate probability the population of germs will eventually die out?
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0.41
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12.

A local jeweler is offering a special promotion on old watches. For this promotion, you select a watch and pay a fee upfront, and he will send it to a third party for evaluation.
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Regardless of what the third party says the watch's value is, you then have the ability to buy the watch for \$100. From reviews online, you know that 70% of his watches are worth \$150, 20% are worth \$125, and 10% are worth \$50. How much should you be willing to pay for the fee upfront?

0

13.

You have  $m$  blue balls and  $n$  red balls in a box. You take out 2 balls at a time, if they are same color, you put 1 blue ball into the box; if they are different, you put 1 red ball into the box (the two balls are taken without replacement). You perform the process until there's 1 last ball in the box. In what starting scenario are you sure that your last ball is red?

- I.  $m$  odd,  $n$  odd
- II.  $m$  odd,  $n$  even
- III.  $m$  even,  $n$  odd
- IV.  $m$  even,  $n$  even

I and III

14.

Consider the following game:

You are playing a game where you roll a die and earn \$1 each time you roll higher than 1. For the first roll you get a 4 sided die, and for each subsequent roll you get a die with a number of sides equal to your previous roll. What is the largest amount of dollars you are willing to pay to play this game?

1.83

15.

You and your friend are playing a game where you flip fair coins. You are playing the best of 13 total flips. What is the probability that the 13th flip will decide the winner?

23%

16.

It rains 20% of days in Chicago. If the meteorologist forecasts rain, there is a 30% chance of rain. He uses yesterday's weather to consider forecasting rain. If there was rain, he uses a fair coin toss to decide whether to forecast rain again. What is the probability the meteorologist will make a correct forecast for rain?

0.03