BRAIN TEASERS

**Students pick 3 classes in different majors. There are 36 HASS classes, 15 math classes, and 5 cooking classes. How many schedules are possible total?**

36 \* 15 \* 5 = 9 \* 4 \* 75 = 9 \* 300 = 2700

**What is the probability of drawing two sevens in a card deck?**

You can multiply the individual probabilities to get the cumulative probability. There are four 7s in a deck of 52 cards. Therefore, the probability of drawing the first 7 is 4/52 or 1/13. On the second draw, there are only three 7s in a deck of 51 cards, yielding a probability of 3/51 or 1/17. So 1/13 multiplied by 1/17 equals a cumulative probability of 1/221. (Don’t expect to be able to use paper or a calculator for 13 times 17. You can just simplify the math in your head by saying 17 times 10 is 170, plus 3 times 17 which is 51, and yields 221.)

**You play a game of dice where you are paid the equivalent amount of dollars to the number you roll (i.e., if a 4 is rolled then you get $4). You roll one fair six-sided die. How much are you willing to pay for this roll?**

The expected return is every possibility multiplied by the probability of the possibility. The average of all the potential die rolls, which each have equal probabilities, is $3.50, the midpoint between 1 and 6.

**How much would you pay to play the same game, but with the option to roll again? If you only roll once you get that score; if you choose to roll again, you get the score of the second roll.**

Intuitively, you know the price should be higher since you’re given the option to roll again if you’re dissatisfied with your first roll. You should only roll a second time if the first roll is less than 3.5, the expected value. Thus, you have the following six scenarios: rolling 4, 5, 6 and stopping, or rolling 1, 2, 3, and rolling again. Again, the expected roll is 3.5, so the latter three outcomes have expected returns of 3.5. Therefore, a game of two rolls’ expected return is (4 + 5 + 6 + 3.5 + 3.5 + 3.5)/6 = $4.25.

**Again, same games, option for a third roll now. How much will you pay?**

Follow the same logic as before; two rolls have an expected return of 4.25 so you will only roll a third time if you get above that. You have an expected return of (4.25 + 4.25 + 4.25 + 4.25 + 5 + 6)/6 = $4.67. As the number of rolls approaches infinity, the price you pay gets closer to $6.00.

**You have stacks of quarters, dimes, nickels, and pennies. The number of coins in the stacks is irrelevant. You can take coins from a stack in any amount, any order, and place them in your hand. What is the greatest dollar value in coins you can have in your hands without being able to make change for a dollar with the coins in your hand?**

Start adding the highest coin to your hand, the quarter. Four quarters make a dollar, so you can only have three quarters: $0.75. Five dimes would bring it to a dollar, so you can only have four dimes: $1.15 = 0.75 + .40. You can’t add a nickel because three quarters, two dimes, and the additional nickel would create a dollar. But you can add four pennies for a maximum total of $1.19 = 1.15 + .04.

**A closet has three light bulbs inside. Next to the door (outside) are three switches for each light bulb. If you can only enter the closet one time, how do you determine which switch controls which light bulb?**

Turn on two switches, A and B, and leave them on for a few minutes. Then turn off switch B and enter the room. The bulb that is lit is controlled by switch A. Touch the other two bulbs, which are off. The one that is still warm is controlled by switch B. The third bulb, off and cold, is controlled by switch C.

**What is the square root of 7,000,000 (approximately)?**

You know that 2 \* 2 = 4 and that 3 \* 3 = 9, and that 1,000 \* 1,000 = 1,000,000 so the answer has to be between 2,000 and 3,000. Edge closer in, 2.5 \* 2.5 = 6.25 and 2.7 \* 2.7 = 7.29 so the answer is approximately 2,600.

**You are given a length of rope, which can be lit to burn for an hour. However, the rope burns unevenly (meaning half of it burnt does not indicate a half-hour has passed). How would you burn the rope to know that a half-hour has passed?**

To measure a half-hour, burn both ends at once. One side will burn faster than the other, but the opposite side will burn slower such that when they meet, the equivalent of half the time has passed.

**If you were given two ropes, how would you measure 45 minutes?**

For two ropes, take one rope and burn both ends like the previous situation. At the same time, light the second rope on only one end. When the first rope burns out, a half hour has passed. The second rope only has 30 more minutes on it. Immediately burn the opposite end of the second rope. The fire will meet at both ends again, which is fifteen minutes.

**You’ve got a 10 x 10 x 10 cube made up of 1 x 1 x 1 smaller cubes. The outside of the larger cube is completely painted. On how many of the smaller cubes is there any paint?**

First, note that the larger cube is made up of 1000 smaller cubes. Think about how many cubes are NOT painted. 8 x 8 x 8 inner cubes are not painted which equals 512 cubes. Therefore, 1,000 - 512 = 488 cubes that have some paint. Alternatively, you can calculate this by recognizing that two 10 x 10 sides are painted (200) plus two 10 x 8 sides (160) plus two 8 x 8 sides (128): 200 + 160 + 128 = 488.

**A windowless room has 3 light bulbs. You are outside the room with 3 switches, each controlling one of the light bulbs. If you can only enter the room one time, how can you determine which switch controls which light bulb?**

Turn on two switches (call them A and B) and leave them on for a few minutes. Then turn one of them off (switch B) and enter the room.  The bulb that is lit is controlled by switch A.  Touch the other two bulbs (they should be off).  The one that is still warm is controlled by switch B.  The third bulb (off and cold) is controlled by switch C.

**Four investment bankers need to cross a bridge at night to get to a meeting. They have only one flashlight and 17 minutes to get there. The bridge must be crossed with the flashlight and can only support two bankers at a time. The Analyst can cross in 1 minute, the Associate can cross in 2 minutes, the VP can cross in 5 minutes and the MD takes 10 minutes to cross. How can they all make it to the meeting in time?**

First, the Analyst takes the flashlight and crosses the bridge with the Associate. This takes 2 minutes.  The Analyst then returns across the bridge with the flashlight taking 1 more minute (3 minutes passed so far).  The Analyst gives the flashlight to the VP and the VP and MD cross together taking 10 minutes (13 minutes passed so far).  The VP gives the flashlight to the Associate, who recrosses the bridge taking 2 minutes (15 minutes passed so far).  The Analyst and Associate now cross the bridge together taking 2 more minutes.  Now, all are across the bridge at the meeting in exactly 17 minutes.   Note, that instead of investment bankers, you’ll often see the same question using members of musical bands (usually either the Beatles or U2).

**A car travels a distance of 60 miles at an average speed of 30 mph. How fast would the car have to travel the same 60 mile distance home to average 60 mph over the entire trip?**

Most people say 90 mph but this is actually a trick question! The first leg of the trip covers 60 miles at an average speed of 30 mph.  So, this means the car traveled for 2 hours (60/30).  In order for the car to average 60 mph over 120 miles, it would have to travel for exactly 2 hours (120/60).  Since the car has already traveled for 2 hours, it is impossible for it to average 60 mph over the entire trip.

**What is the angle between the hour-hand and minute-hand of a clock at 3:15?**

At quarter past the hour, the minute-hand is exactly at 3:00 but The hour-hand has moved 1/4 of the way between 3:00 and 4:00.  Therefore 1/4 times 1/12 = 1/48 of the clock.  With the clock having 360 degrees, 360/48 = 7.5 degrees.

**You are given a 3-gallon jug and a 5-gallon jug. How do you use them to get 4 gallons of liquid?**

Fill the 5-gallon jug completely. Pour the contents of the 5-gallon jug into the 3-gallon jug, leaving 2 gallons of liquid in the 5-gallon jug.  Next, dump out the contents of the 3-gallon jug and pour the contents of the 5-gallon jug into the 3-gallon jug.  At this point, there are 2 gallons in the 3-gallon jug.  Fill up the 5-gallon jug and then pour the contents of the 5-gallon jug into the 3-gallon jug until the 3-gallon jug is full.  You will have poured 1 gallon, leaving 4 gallons in the 5-gallon jug.

**You are given 12 balls and a scale. Of the 12 balls, 11 are identical and 1 weighs slightly more. How do you find the heavier ball using the scale only three times?**

First, weigh 5 balls against 5 balls (1st Use of Scale). If the scale is equal, then discard those 10 balls and weigh the remaining 2 balls against each other (Second Use of Scale).  The heavier ball is the one you are looking for.

**You are given 12 balls and a scale. Of the 12 balls, 11 are identical and 1 weighs EITHER slightly more or less. How do you find the ball that is different using the scale only three times AND tell if it is heavier or lighter than the others?**

Significantly harder than the last question! Weigh 4 vs 4 (1st Weighing). If they are identical then you know that all of 8 of these are “normal” balls.  Take 3 ”normal” balls and weigh them against 3 of the unweighed balls (2nd Weighing).  If they are identical, then the last ball is “different.”  Take 1 “normal” ball and weigh against the “different” one (3rd Weighing).  Now you know if the “different” ball is heavier or lighter.

If, on the 2nd weighing, the scales are unequal then you now know if the “different” ball is heavier (if the 3 non-normal balls were heavier) or lighter (if the 3 non-normal balls were lighter).  Take the 3 “non-normal” balls and weigh 1 against the other (3rd Weighing).  If they are equal then the third ball not weighed is the “different” one.  If they are not equal then either the heavier or lighter ball is “different” depending on if the 3 “non-normal” balls were heavier or lighter in the 2nd Weighing.

If, on the 1st Weighing, the balls were not equal then at least you know that the 4 balls not weighed are “normal.”  Next, take 3 of the “normal balls” and 1 from the heavier group and weigh against the 1 ball from the lighter group plus the 3 balls you just replaced from the heavier group (2nd Weighing).  If they are equal then you know that the “different” ball is lighter and is 1 of the 3 not weighed.  Of these 3, weigh 1 against 1 (3rd Weighing)  If one is lighter, that is the “different” ball, otherwise, the ball not weighed is “different” and lighter.

If, on the 2nd weighing from the preceding paragraph, the original heavier group (containing 3 “normal” balls) is still heavier, then either one of the two balls that were NOT replaced are ”different.”  Take the one from the heavier side and weigh against a normal ball (3rd Weighing).  If it is heavier, it is “different,” and heavier otherwise the ball not weighed is “different” and lighter.  If, on the 2nd weighing, the original lighter side is now heavier, then we know that one of the 3 balls we replaced is “different.”  Weigh one of these against the other (3rd Weighing).  If they are equal, the ball not weighed is “different” and heavier.  Otherwise, the heavier ball is the “different” one (and is heavier).

[**You have 100 balls (50 black balls and 50 white balls) and 2 buckets. How do you divide the balls into the two buckets so as to maximize the probability of selecting a black ball if 1 ball is chosen from 1 of the buckets at random?**](https://www.ibankingfaq.com/interviewing-brainteasers/you-have-a-100-balls-50-black-balls-and-50-white-balls-and-2-buckets-how-do-you-divide-the-balls-into-the-two-buckets-so-as-maximize-the-probability-of-selecting-a-black-ball-if-1-ball-is-chosen-f/)

Just to be perfectly clear, you are assuming that one of the two buckets is chosen at random and then one of the balls from that bucket is chosen at random.  You want to put 1 black ball in 1 of the buckets and all of the other 99 balls in the other bucket.   This gives you just slightly less than a 75% change of having a black ball chosen.  The math works as follows:  There’s a 50% chance of selecting the bucket containing 1 ball with a 100% chance of selecting a black ball from that bucket.  And a 50% chance of selecting the bucket containing 99 balls with a ~49.5% (49/99) chance of selecting a black ball from that bucket.  Total probability of selecting a black ball is (50% % 100%) + (50% \* 49.5%) = 74.7%.

[**Three envelopes are presented in front of you by an interviewer. One contains a job offer, the other two contain rejection letters. You pick one of the envelopes. The interviewer then shows you the contents of one of the other envelopes, which is a rejection letter. The interviewer now gives you the opportunity to switch envelope choices. Should you switch?**](https://www.ibankingfaq.com/interviewing-brainteasers/three-envelopes-are-presented-in-front-of-you-by-an-interviewer-one-contains-a-job-offer-the-other-two-contain-rejection-letters/)

The answer is yes.  Say your original pick was envelope A.  Originally, you had a 1/3 chance that envelope A contained the offer letter.  There was a 2/3 chance that the offer letter was either in envelope B or C.  If you stick with envelope A, you still have the same 1/3 chance.  Now, the interviewer eliminated one of the envelopes (say, envelope B), which contained a rejection letter.  So, by switching to envelope C, you now have a 2/3 chance of getting the offer and you’ve doubled your chances. Note that you will often get this same question but referring to playing cards (as in 3-Card Monte) or doors (as in Monte Hall/Let’s Make a Deal) instead of envelopes.

[**What is the sum of numbers from 1 to 100?**](https://www.ibankingfaq.com/interviewing-brainteasers/what-is-the-sum-of-numbers-from-1-to-100/)

The trick here is that you have 50 pairs which each sum to 101 (e.g. 1+100, 2+99, 3+98, etc.).  So, 50 times 101 = 5050.

**WHAT IS THE SUM OF THE NUMBERS FROM 1 TO 50?**

Pair up the numbers into groups of 51 (1 + 50 = 51; 2 + 49 = 51; etc). Twenty-five pairs of 51 = 1,275.

**I can roll a die and collect the amount of money on the die, or if I don't like it, I can roll a second time and I have to pick up the die. What is my expected value?**

Answer: Given that the expected value of one roll is 3.5, you would only re-roll for a second round if you roll is below 3.5-- So that is, you would only keep the first roll if it's 4, 5 or 6. Note that you would re-roll 50% of the time. The expected value of your first roll is therefore 5. The expected value of 2nd roll alone is 3.5. Answer: 1/2 (3.5 + 5) = 4.25

**There is a number line 0 to 10. A random number will be randomly generated over that line and you'll get paid that much. Would you rather the numbers be on the real line or all integers?**

Answer: If 0 and 10 are included, the expected value for both is 5.

**I like the numbers 4 and 5. I also like any number that can be added together using 4s and 5s. I.e. 9 = 4+5. 40 = 5 + 5 + 5 + 5 + 5 + 5 + 5 +5. How many number have this property from 1 to 1000?**

**There is a magic island with 85 lions and 1 sheep. what makes the island magical is that all animals could live on the island only by eating grass. however, the lions would like to eat the sheep. However, when one lion eats the sheep, the sheep dies naturally, and then the lion turns into the sheep. If everyone were to act naturally how many animals would there be on the island?**

**You have 100 quarters in a jar. One of the quarters is double sided (heads). You pick out a random quarter and flip it 7 times, and get all heads. what is the probability you picked the double sided quarter? Then, given that you flipped it 7 times with all heads, what is the probability that you'll get heads on the 8th flip?**

**What is 49 x 49?**49^2 = (50-1)^2 = 2500-100+1 = 2401

**If I have a cube which is 10x10x10, and I take off one layer. How many squares are left?**8^3 = 64*8 = 512*

**What is the sum of all numbers between 0-100?**

100(101)/2= 50*101= 5050*

**1111 x 1111?**

11 x 11 = 121  
111 x 111 = 12321  
1111 x 1111 = 1234321  
11111 x 11111 = 123454321

**Or**

1111 x 1111

-------- 1111  
------ 1111  
---- 1111  
---1111

123454321

**Chess board, 8 by 8, how many squares in total?**

Do this by induction. Suppose the chessboard is 1x1. Then there is clearly 1 square in total.  
Now, 2x2. here you have 1 square that has dimension 2x2, and 4 squares that have dimension 1x1. Making 1+4 = 5 in total.

Now 3x3. you have 1square that is 3x3, 4 that are 2x2 and 9 that are 1x1. Making 1+4+9 = 14.

Noticing a pattern?

If you have a nxn chessboard. You will have 1 nxn square, 4 (n-1)x(n-1), 9 (n-2)x(n-2) .....

Or more concisely, for i = 1 to n, you have i^2 squares of size (n+1-i).

So to find the total number of squares in an nxn chessboard, just add the first n squares.

In this case, it's 1^2 + 2^2 ........+ 8^2.

**HOW MANY HERSHEY’S CHOCOLATE BARS WERE SOLD IN THE US LAST YEAR?**

Variants on a theme include: how many gallons of ice cream were sold in the U.S., how many fax machines are in use in NYC…or anything else that requires you to extrapolate from a limited set of information.  One of the many possible approaches is to start by looking at the total U.S. population, dividing the population into the most relevant age groups, estimating the “consuming habit,” etc., and assigning a consuming frequency for each group, before summing to arrive at the total market size.   Start with the fact that the U.S. population is approximately 330 million (the population in Manhattan is 1.6mm; check the figures for the city in which you’re interviewing).  Here, the answer will not matter so much as your thought process.  Include seasonal impacts—more chocolate bars may be bought on Valentine’s Day and Halloween, so add in the fact that consumption is not evenly distributed throughout the year.  Chocolate bars are mostly consumed by people between ages 5  and 70; each of these people may consume approximately 12 to 20 chocolate bars a year…

**YOU ARE PLAYING A CARD GAME AGAINST ONE OPPONENT. THE GAME STARTS WITH 21 CARDS ON A TABLE. YOU AND YOUR OPPONENT ALTERNATE TURNS, AND DURING EACH TURN, A PLAYER MAY PICK UP 1, 2 OR 3 CARDS. THE WINNER IS THE PERSON THAT PICKS UP THE LAST CARD. YOU GO FIRST. WHAT IS YOUR FIRST MOVE, AND WHAT IS THE OPTIMAL STRATEGY TO WIN THIS GAME?**

You pick 1 card first (leaving 20), then you want to respond to all opponent picks by picking a number that totals 4 combined with their last pick. So, you pick 1. Then, if they pick 3, you pick 1…if they pick 2, you pick 2…if they pick 1, you pick 3. This ensures that you’re always leaving them with a multiple of 4 (first 20, then 16, 12, 8, 4), right until the end, when you leave them with exactly 4. When they’re stuck with 4, they are out of luck, because regardless if they pick 1, 2 or 3, you will be able to win in the next turn.

**YOU ARE GIVEN 9 MARBLES THAT LOOK THE SAME, BUT 1 OF THEM WEIGHS SLIGHTLY LESS THAN THE OTHER 8. YOU ARE ALSO GIVEN A BALANCE SCALE. WHAT IS THE LEAST NUMBER OF TIMES YOU COULD USE THE BALANCE TO DETERMINE WHICH OF THE MARBLES IS THE LIGHTER ONE? (ALSO EXPLAIN THE DIFFERENT BALANCE WEIGHTINGS YOU WOULD PERFORM).**

On the first weighing, you would weigh three marbles on each side, leaving three off. If one side of the scale is lighter, you are left with three marbles. Then you would place one marble on each side of scale, and leave one off.  This method will identify the light marble while only performing two weightings in total.

**A COMPANY HAS TEN MACHINES THAT PRODUCE GOLD COINS. ONE OF THE MACHINES IS PRODUCING COINS THAT ARE A GRAM LIGHT EACH. HOW DO YOU TELL WHICH MACHINE IS MAKING THE DEFECTIVE COINS WITH ONLY ONE WEIGHING?**

Every machine will have to produce a sample coin or coins, and you must weigh all these coins together.  How can you indicate which coins came from which machine? If every machine cranks out a different number of coins (machine 1 makes one coin, machine 2 makes two coins, and so on, then taking all the coins and weighing them together against their theoretical weight will give you the answer.  If you’re four grams short, for example, you’ll know that machine 4 is defective.

**YOU HAVE 18 BLUE SOCKS AND 14 BLACK ONES IN A DRAWER. IT IS VERY DARK. HOW MANY DO YOU HAVE TO PULL OUT BEFORE YOU HAVE MATCHING PAIR?**

You need to pick three socks. No color was specified so after choosing three socks, two should be same color.

**SAY YOU ARE DRIVING ON A ONE-MILE TRACK. YOU DO ONE LAP AT 30 MILES AN HOUR. HOW FAST DO YOU HAVE TO GO ON THE SECOND LAP TO AVERAGE 60 MILES AN HOUR?**

The first thought of many people is to say 90 miles an hour, since the average of 30 and 90 is 60, but remember your junior high math: Rate × Time = Distance.  If you’ve completed a lap at 30 miles an hour, then to have driven a mile on the mile-long track, you’ve already taken two minutes. Two minutes is the total amount of time you would have to take in order to average 60 miles an hour. Therefore, you cannot average 60 miles an hour over the two laps.

**YOU AND YOUR FRIEND GO OUT TO DINNER TOGETHER, AND THE BILL IS $25. YOU AND YOUR FRIEND EACH PAY $15 IN CASH WHICH YOUR WAITER GIVES TO THE CASHIER. THE CASHIER HANDS BACK $5 TO THE WAITER. THE WAITER KEEPS $3 AS A TIP AND HANDS BACK $1 TO EACH OF YOU. SO, YOU AND YOUR FRIEND PAID $14 EACH FOR THE MEAL, FOR A TOTAL OF $28. THE WAITER HAS $3, AND THAT MAKES $31. WHERE DID THE EXTRA DOLLAR COME FROM?**

This is one of those brainteasers where if you remember the basics (bill + tip = total meal cost) you’ll be fine.  The bill was $25; you and your friend collectively leave a $3 tip.  The total meal cost is $28.  If you each pay $14, you’re paying $14 for the meal AND the tip. You each paid $12.50 for the meal (half of $25), $1.50 for a tip (half of $3) and each got back $1 in change.  Add it all up and it comes to $15 each, for a total of $30.

**BIRTHDAY PROBLEM: WHAT’S THE PROBABILITY THAT IN A ROOM FULL OF K PEOPLE, AT LEAST 2 PEOPLE WILL HAVE THE SAME BIRTHDAY?**

Each person has 365 “possible” birthdays (ignoring leap years); in a room of k people, the total number of possible birthdays is 365k.

In order for at least 2 people to have the same birthday, this means that 2 or 3 or 4….have the same birthday, which is the “inverse” or complement of none of the k birthdays in the group being the same.  This latter event is a permutation; if John is born on January 1 and Jeff is born on December 31, this is a different outcome than John being born on December 31 and Jeff being born on January 1 (i.e., position matters.)  The total number of ways to choose k different birthdays from 365 elements (with no repetitions) is 365! ÷ (365 – k)!.   So for a room full of k people, the probability that at least 2 have the same birthday is:

1 – [365! ÷ (365 – k)!] ÷ 365k

When k = 15, the probability is 25.3%; when k = 50, the probability rises to 97.0%!

**You call the home of a family w/ two children and a kid "billy" answers the phone. What is the probability that both children are boys?**

It's 1 in 3. Of the possible combinations of two children, BB, BG, GB and GG, we have eliminated one possibility (GG). Of the three remaining possibilities, one of them is two boys. So the probability is 1/3.

**What is the expected value of tosses to get 3 heads in a row?**

14. 2^(n+1)-2 with n denotes number of heads

**What is the expected number of tosses required to achieve 2 heads in an unbiased coin?**

Expected number of steps required to obtain N consecutive heads by tossing a fair coin is given by

                            E\_n = 2^(n+1) -2

For n = 2 ; E2 = 6

For further details see - [http://www.qbyte.org/puzzles/p082s.html](https://protect-za.mimecast.com/s/e1zdCvgwN4fLyYv9hQuWcE?domain=qbyte.org)

**What does a distribution with a maximal variance look like which is only defined between 0 and 1?** Give the proof.

You'd want the values to be at either 0 or 1, since anything in between just brings them closer to the mean (not fully rigorous, but should be obvious enough). let p be the density at 0, so (1-p) is the density at 1. Then mean = (1-p). Variance is: p\*(1-p)^2+(1-p)\*p^2 = p-2p^2+p^3+p^2-p^3 = p-p^2

We want to maximize variance, to take the first derivative and set it to 0:

1-2p = 0

p=1/2

Hence, half the density is at 0, half at 1.

**Consider a random walk on a discrete grid of 11 points  (0 through 10). Supposed you have equal probabilty of stepping up or down. If you reach either 10 or 0 you must stop. If you start at point 6, what is the probability that you arrive at 10 before you arrive at 0?**

The quickest way to solve this problem is to realize that this random walk is a martingale. Therefore, its conditional expectation value is equal to its initial value. Over a long enough time period you will arrive at either 10 or 0 (ergodic hypothesis). Let p be the probability of arriving at 10 before 0. Then 6 = 10\*p + 0\*(1-p). Or p = 6/10.

FINANCE

**Accounting**

* What is EBITDA?
* How is EV calculated?
* Walk me through the major line items of a Cash Flow Statement.
* Say you knew a company’s net income. How would you figure out its cash flows?
* What is the difference between the balance sheet and the income statement?
* What is Goodwill? How does it affect Net Income? *NOTE: there is a basic answer to this question, a complex, tricky one as well.*
* A firm is using LIFO, the COGS start decreasing. What are effects on I/S, BS and CFS?
* What is the difference between Purchase and Pooling accounting? Under what circumstances would you use one or the other?
* What are deferred taxes? How do they arise?
* What is working capital? How would you calculate it?

Derivatives

* **WHAT IS BLACK-SCHOLES (B-S)?  WALK ME THROUGH THE DERIVATION.**
* **WHAT ARE THE ASSUMPTIONS MADE IN BLACK-SCHOLES?**
* **WHAT ARE THE “GREEKS” IN BLACK-SCHOLES?  WHAT ARE VANNA AND VOLGA?**
* **WHAT IS DELTA HEDGING? ARE THERE SCENARIOS WHERE IT’S NOT PROFITABLE?**
* **WHAT IS REALIZED VOLATILITY AND HOW IS IT CALCULATED?**
* **HOW IS REALIZED VOLATILITY DIFFERENT FROM IMPLIED VOLATILITY?**
* **HOW MUCH SHOULD I PAY FOR AN OPTION WHEN THE FUTURE VOLATILITY OF THE UNDERLYING IS ZERO?**
* **WHAT IS A VARIANCE SWAP?**
* **HOW IS A FORWARD FX RATE CALCULATED?**

STATISTICS

**WHAT IS A LOGNORMAL DISTRIBUTION?**

**WHAT IS A CORRELATION COEFFICIENT?  HOW IS IT CALCULATED?**

**WHAT IS THE DIFFERENCE BETWEEN A PERMUTATION AND COMBINATION?**

**WHAT IS THE PROBABILITY THAT I FLIP THIS PENNY 5 TIMES, IT WILL COME UP HEADS AT LEAST 2 TIMES?**

**WHAT IS A MONTE CARLO SIMULATION?**

**WHAT IS BAYES’ THEOREM AND WHEN IS IT USED?**

**WHAT IS AN R2 STATISTIC?**

**WHAT IS A RANDOM WALK? IS IT STATIONARY OR NON-STATIONARY?**

**WHAT HAPPENS IF YOU CREATE A REGRESSION BASED ON 2 VARIABLES THAT EACH ARE CONTINUOUSLY INCREASING WITH TIME?**

**IF I HAVE A REGRESSION BETWEEN X AND Y, WHAT TEST STATISTICS SHOULD I LOOK AT TO DETERMINE WHETHER I HAVE A GOOD MODEL?**

**IF I HAVE DATA FROM 1912-2012, WHAT’S THE DANGER IF I BUILD A MODEL FORECASTING VALUES IN 2012 USING ALL OF THE HISTORICAL DATA?**

**WHY SHOULD I CARE ABOUT RESIDUALS IN A REGRESSION?**

**see here for answers:** <http://www.streetofwalls.com/finance-training-courses/quantitative-hedge-fund-training/important-quant-math-topics/>

OTHER

Counterintuitive Cards -- You have 7 cards: two are red on both sides, two are black on both sides, and three are red/black. You choose a card at random, and one of its sides is red. What is the probability that the other side is also red? (Hint: The answer is not 2/5, though that's what everyone thinks.)

Filling a Bag -- You place some red and some blue marbles in a bag. The probability of drawing two marbles of the same color is 1/2. How many marbles of each color are in the bag? (Hint: The correct answer does NOT have the same number of red and blue marbles.) Note that there are many possible answers. Try to find one. Then try to see if you can find others and identify a pattern.

You will be paid $1 times the number you roll on a six-sided die. You can re-roll the first time or the second time if you want, but must keep the third roll if you do so. How much can you make on average playing this game and what is your re-rolling strategy?

An airport shuttle bus makes 4 scheduled stops for 15 passengers. What is the probability that all of them get off at the same stop and also the probability that atleast one gets off at each stop.

You are told that of the four cards face down on the table two are red and two are black. If you guess all four at random, what is the probability that you get 0,2,and 4 right.

Two people are playing a game:

The first person to roll a 4 on a standard dice wins the game

If player 1 (who goes first) rolls a 4 on his first roll then the game is over instantly

If not, player 2 rolls. If player 2 gets a 4 the game is over. If player 2 doesn't roll a 4 the game continues until someone does

Q1 - Does player 1 have an advantage by going first?  
Q2 - What are the exact odds of player 1 winning the game?

Hint: Answer q2 with a fraction, making a grid of outcomes can help with this brainteaser

I am drinking beer and you are drinking light beer. Your light beer is 1/3 less filling than my regular beer. I drink 3 beers. How many do you have to drink to be equally full?

**Comparing e to the power of pi and pi to the power of e  which one is bigger?**

**Roll two dice for infinite times, what is the prob that you get a sum of 4 before a sum of 2?**

**Write a program output all prime numbers below N.**

**If a person wanted to write a ransom note by cutting letters out of a magazine, how would you decide whether or not the magazine had the letters necessary? Explain in terms of computer algorithms. Q2a: What is the probability of NO collisions given a particular size hash map?**

**Do a Taylor Series expansion for e^{x}.**

**Explain the central limit theorem**

**What makes Gaussian distributions 'special?'**

**If the odds of a company defaulting are 10% for the first 6 mo, and 10% for the second 6 mo, what are the odds of them defaulting over 1 year?**

**What is a virtual constructor in C++?**

**Newtons method.**

**Derive the PDE for Black Scholes, and solve it to derive the commonly known formula.**

**Unbiased estimator**

**If you toss an unbiased coin, what is the expected number of tosses you will make before you toss three tails?**

**How do you create an event with a probability of 1/3 using  an unbiased coin?**

**Given a round table, randomly place three legs under the table, what is probability that the table will fall?**