



11 Statistics and Probability Interview Questions for Quants and Traders

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Overview

Here's a secret about quant and finance interview questions: They don't often relate to finance. Instead, the probability questions in trading interviews are framed as quantitative problems, and ask interviewees to make calculations based on provided information.

To do well in these interviews, you need intermediate-to-advanced knowledge of statistics, probability, econometrics, and increasingly, computer science. Although finance-specific knowledge is helpful, you don't need it to pass the interview.

Finance statistics and probability interview questions fall into three categories:

- **Easy quant probability questions** - Basic calculations and simple probability case studies.
- **Medium quant probability questions** - More complex brain teaser type case questions that require knowledge of randomness, counting, and probability outcomes.
- **Hard quant probability questions** - The most difficult probability questions are complex brain teasers based on intermediate-to-advanced stats and probability concepts. With these questions, you aren't necessarily graded on getting the right answer. Interviewers want to see how you think.

How Difficult Are Trading Probability Questions?

Quantitative finance interviews are notorious for their difficulty. In general, you can expect a number of brainteasers and probability puzzles throughout the interview process, and these typically progress in

difficulty into the later interview rounds.

According to Dirk Bester, a PhD finance quant, who has been interviewed dozens of times and wrote a [book on quant interview questions](#), here are some things to remember about the interview process:

- The right answer isn't as important as how you answer.
- You will have about 5-15 minutes to answer questions.
- Practice by doing probability brainteasers, coding puzzles, and statistical proofs.

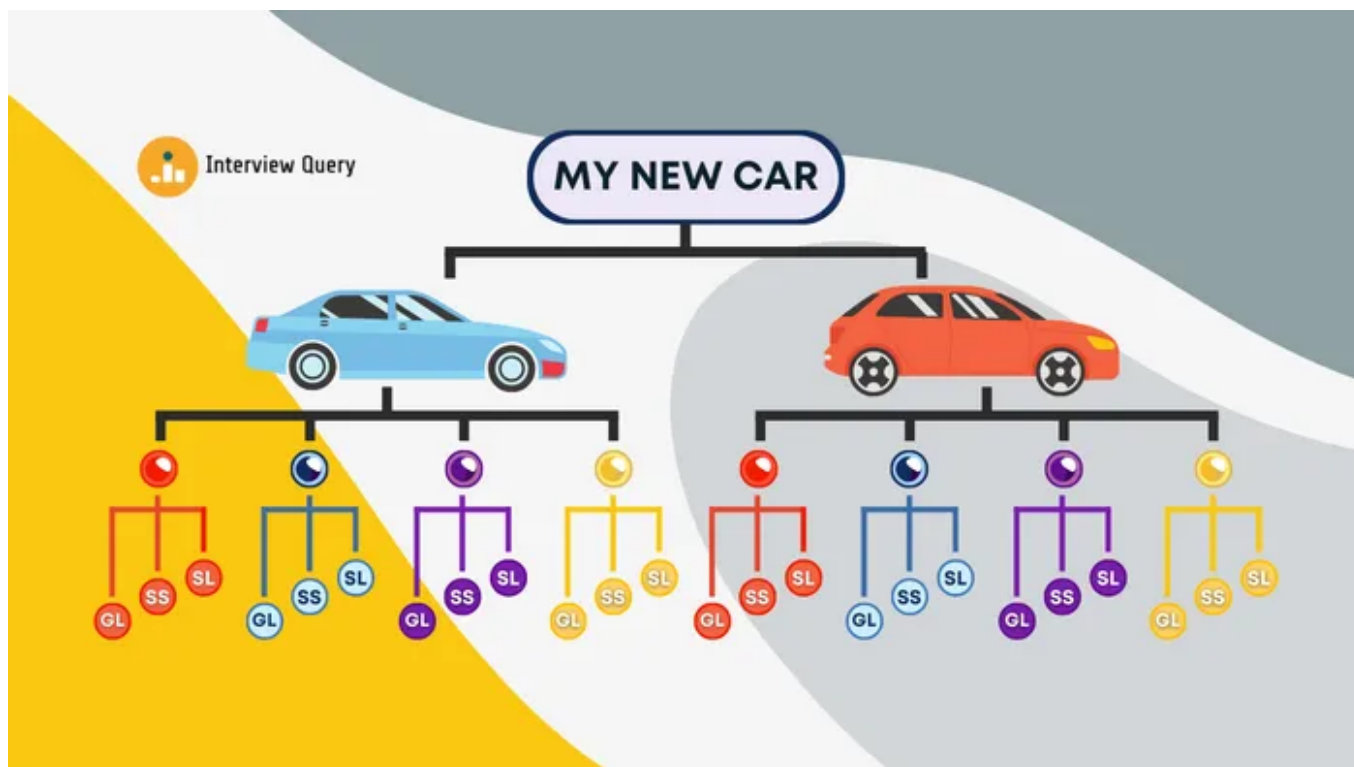
How difficult are questions? Generally, you can expect “easy” to “medium” probability and statistics questions, although the difficulty is somewhat dependent on the role and company. Jane Street, Citadel, and SIG are notorious for highly difficult quant interviews, and with these companies, you shouldn't expect many “easy” questions.

Finance Probability Questions: Topics to Expect

Probability questions in trading interviews cover many different subjects and concepts in statistics, probability, and econometrics, including:

- **Randomness:** Randomness questions are calculations of random events. It's using math to predict events like dice rolls, one-off events, or just specific unknowns.
- **Counting:** Counting is using probability to figure out the number of outcomes possible in a finite situation.
- **Probability outcomes:** This concept involves both distinct outcomes that are mutually exclusive and not exclusive—often involving a sum of probabilities.
- **Independence:** Independence is the study of two outcomes that are unrelated. Calculating the probability of both of them occurring, or the product of their probabilities individually occurring.
- **Expected value:** Expected values are key to probability distributions and are the average random variable.
- **Confidence intervals:** The calculation of not just the specific outcome but the range of outcomes and the expectedness of those outcomes.

How Are Stats & Probability Questions Framed?



Quant interview questions typically take the form of brainteasers or probability case studies. You're provided with a scenario and make a calculation based on the provided information. The most common probability interview question types in quant finance interviews are:

- **Conceptual probability questions** - These questions are definition-based and are generally a lead-in to more difficult case studies.
- **Probability case studies** - With these questions, you're provided with a scenario, and asked to make a calculation of an event occurring. These questions often relate to dice rolls or card draws.
- **Distribution case questions** - These include specific cases that ask you to evaluate the different possible outcomes based on distributions.
- **Statistical analysis questions** - You may be provided with data, and asked to make a statistical analysis based on the given data.

Easy Quant Probability Questions

In quant interviews, easy questions typically involve less complicated mathematical concepts, but will require some statistical analysis.

1. You roll two dice. What's the probability of rolling at least one 3? What's the probability of rolling at least one 3 given N dice?

To solve this conceptual probability problem, it's easiest to find out the probability of never rolling a three.

The probability of not rolling a three is $\frac{5}{6}$. To not roll a three, we can do $1 - \frac{1}{6} = \frac{5}{6}$. How does that change with 2 dice? To not roll a three would be $\frac{5}{6} * \frac{5}{6} = \frac{25}{36}$. So the probability of not rolling a three with two dice is $1 - \frac{25}{36} = \frac{11}{36}$.

$$25/36 = 11/36.$$

What's different when we're using N dice?

2.What's the expected churn rate in March for all customers who bought a product in January?

More context. You notice that of all customers who bought subscriptions in January 2020 about 10% cancel their subscriptions before the next cycle on February 1. Assume that your new customer acquisition is uniform and that customer churn goes down by 20% month-over-month.

This is a statistical analysis case question, and because the 10% is compiling, you need to calculate a new churn rate for February and so on. For example, in February churn rate will be 20% less than initial churn rate of 10%, so the new churn rate will be $.1(1-.2) = .08$, and by March, you need to take the total customer base divided by 2 to get total churn rate.

$$\frac{0.9(1 - 0.08)x + 0.9x}{2x} = \frac{1.728x}{2x} = 0.864$$

3. What's the difference between covariance and correlation?

A definition-based question like this is generally asked early in the interview process. Your goal should be to convey these concepts quickly and in layman's terms.

The key thing to remember: Covariance can take on any numeric value, while correlation can only be between -1 and 1.

Medium Quant Probability Questions



Most of the [probability interview questions](#) for finance roles are medium difficulty. Nearly any statistical or probability concept can come up, so to prepare, start by reviewing basic-to-advanced probability.

4. You have a biased coin that comes up heads 30% of the time. What is the probability of the coining coming up heads 5 times out of 6?

With this probability events question, keep in mind that the biased coin is heads 30% of the time. You will need to use binomial distribution in which there exists n independent experiments.

$$P(X = k) = \binom{n}{k} p^k (1 - p)^{n-k}$$

Then using n choose k principles you can calculate:

$$P(X = 5) = \binom{6}{5} 0.3^5 (1 - 0.3)^{6-5} \approx 0.010206$$

5. Given two standard normal random variables X and Y , what's the probability that $2X > Y$?

You can create a chart to map out the likelihood of each scenario (there are 6 scenarios) - for example $X > Y$: both positive - you then can simulate a random sampling and equate that all six are likely to occur. Therefore, $2x > Y$ is 50% likely.

If you are confused, think about how both X and Y are random variables across the same distribution, and that $2X$ as being on average double positive or double negative the value that Y is.

6. Explain how a probability distribution could not be normal and give an example scenario.

Remember that normal distributions can have any mean or standard deviation (so long as the standard deviation is positive, obviously). Having a certain mean or standard deviation is not enough to make a distribution non-normal.

Although this answer has multiple possible solutions, one solution could be that the data is non-continuous. For example, a plane wreck is a non-continuous data point, there are either 0 or 1 crashes. You can't have .5 crashes.

7. Given N samples from a uniform distribution [0, d] how would you estimate d?

What does a uniform distribution look like? Just a straight line over the range of values from 0 to d, where any value between 0 to d is equally likely to be randomly sampled. So, let's make this easy to understand practically. If we're given N samples and we have to estimate what d is with zero context of statistics and based on intuition, what value would we choose?

For example, if our N sample is 5 and our values are: (1,4,6,2,3), what value would we guess as d? Probably the max value of 6 right?

But, let's look at another example. Let's say our N sample is 5 again and our values are instead: (20,30,28,26,16). Would our estimate still be the max value of 30?

8. What is the percentage chance that a review is actually fake when an algorithm detects it as fake?

More context. Based on the historical data, 98% of reviews are legitimate and 2% are fake. If a review is fake, there is a 95% chance that the machine learning algorithm identifies it as fake. For legitimate reviews, the algorithm correctly identifies it 90% of the time as legitimate.

This question requires knowledge of Bayes' Rule! You'll use L as a legitimate event and I as identified as legitimate.

Recall Bayes' Rule:

$$\mathbb{P}(A|B) = \frac{\mathbb{P}(B|A)\mathbb{P}(A)}{\mathbb{P}(B)} = \frac{\mathbb{P}(B|A)\mathbb{P}(A)}{\mathbb{P}(B|A)\mathbb{P}(A) + \mathbb{P}(B|A^c)\mathbb{P}(A^c)}$$

Thus:

$$\begin{aligned}\mathbb{P}(L^c|I^c) &= \frac{\mathbb{P}(I^c|L^c)\mathbb{P}(L^c)}{\mathbb{P}(I^c|L^c)\mathbb{P}(L^c) + \mathbb{P}(I^c|L)\mathbb{P}(L)} \\ &= \frac{\mathbb{P}(I^c|L^c)\mathbb{P}(L^c)}{\mathbb{P}(I^c|L^c)\mathbb{P}(L^c) + [1 - \mathbb{P}(I|L)]\mathbb{P}(L)} \\ &= \frac{0.95 \cdot 0.02}{0.95 \cdot 0.02 + (1 - 0.9) \cdot 0.98} \\ &= 0.162...\end{aligned}$$

Hard Quant Probability Questions

In quant interviews, hard probability interview questions are highly technical and complex and most likely require advanced math to solve. Depending on interview expectations, it might not be necessary to get these right. Instead, your problem-solving process is what is being assessed.

9.You're given a two-sided coin that could be fair or biased? How would you figure out whether or not the coin is biased?

Follow up question. Design a test and describe which outcome would tell you that the coin is biased?

This question tests a variety of concepts including statistical testing, bias and variance, and binomial distributions. One can design the following test. Flip the coin for $N=100$ times (making sure that every flip is independent of the others) and count the number of heads/tails.

The Null hypothesis is that the coin is fair (Not biased), and the alternative hypothesis is that the coin is biased. Given the number of trials (N), a given level of confidence (typically 95%), we might be able to decide whether the coin is biased or not with 95% confidence.

Here is how we can obtain the confidence interval; We can consider each coin toss as a Bernoulli distribution with probability of head as p . For a fair coin, one may assume $P(T) = H = 0.5$. Also, N trials of a Bernoulli distribution give us a Binomial distribution. The Binomial distribution has a mean of np (=50 for 100 tosses of a fair coin) and standard deviation of the square root of $np(1-p)$ which equals 5 for $n = 100$ and $p = 0.5$.

What else do we need to do?

10. A 5'8" man who doesn't know how to swim is in a lake with an average depth of 5'6" (with a standard deviation of 1'). What's the probability of his survival?

For this question, assume that if the water level exceeds his height, the swimmer will die.

Hint: We aren't given the distribution of the lake depth. What would be a good guess as to what the distribution is? Your answer doesn't need to be formally calculated if doing so wouldn't be feasible in a real-life interview.

11. You toss a random coin 10 times, what is the probability that the coin is double-headed and the probability that the next toss of the coin is also a head?

More context. You select a coin from a jar of 1000 coins. Of all the coins, 999 are fair and 1 is double-sided with two heads. You pick a coin at random.

Here's a hint: We're given 999 fair coins and one biased coin and the question is asking about an *event probability of whether a toss will be heads* based on prior information of *what exists in the jar*. What kind of probability theorem does that insinuate?

More Probability & Finance Interview Resources

Interview Query offers a variety of resources to help you prepare for your finance or trading interview. Start with our list of 31 commonly asked [probability interview questions](#), or our list of 20+ [statistics interview questions](#).

You can also check out our [probability interview course](#) module, which includes a look at how probability interviews are conducted, common types of questions, and the most frequently asked probability concepts.

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