A SWE's Guide to Quant

How I transitioned to a trader in one summer

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Contents

1 Motivation

At least from the subset of people that I know who are also doing quantitative trading, my background is atypical. I have zero competitive math or programming experience, and my prior projects/work is all software engineering related. When I decided to try quant trading, there were a few problems with the content that I found readily available:

- The materials assumed a probability and statistical intuition that I lacked
- Some resources focused on numerically-heavy topics (markov chains, SVD, tons of integration), but these did not show up in interviews
- Many PDFs and books felt bloated with unimportant content

Although I'm aiming to write a guide that is useful to everybody, as I'm writing from my experience, it is mostly targeted toward those that have my background (software engineering, little to no competitive math experience). As I frequently felt that a lot of online resources were bloated, I'll do my best to aim for brevity in every section. Use the section headers to bounce around to whichever sections seem most useful for you.

Most guides I have read include a section describing companies to apply to, why quant, etc. But I feel if you're reading this document you've probably already come to your own conclusions as to why you're shooting for a quant internship. If you haven't thought about *why* you want to do quant, I would strongly recommend formulating those reasons for yourself. Whether it's exploring a new profession, passion for finance, or ludicrous salaries, it's easier to chase something when you know why you're chasing it in the first place.

With all that being said, best of luck! An exciting journey waits ahead of you :)

2 Prepping for Quant and SWE at the same time

Not that I don't think others can do it, but I tried to prep for quant and SWE at the same time and found zero success. I thought that there was a low likelihood that I would land a quant internship, so to protect myself, I prepped for SWE concurrently, where I thought I had higher odds. However, I trapped myself in a self-fulfilling prophecy: because my attention was divided between learning how to think like a quant and remembering how to think like a SWE, I performed abysmally on my first few quant interviews, making me believe that I should spend more time preparing for SWE since it seemed futile that I would get a quant internship this cycle.

After I switched to just prepping for quant, I found it a lot easier to make progress. In addition to the extra time that I had to prep for quant, I found it incredibly helpful to have my head space only thinking about quant problems rather than being split into two different modes. Since my idle thoughts switched to understanding probability concepts rather than memorizing how DFS works, I started to develop a much better intuition around probability.

I'm now a big believer in full sending for the role that you want. If you are still considering jointly prepping for SWE, I'd just make sure to ask yourself if you would consider it a win to spend another summer doing SWE. There's probably a reason that you're wanting to move away from SWE, so wouldn't you rather boost your odds of trying something new by devoting all your effort to it?

3 Activities that helped me on interviews

There were a few activities that turned out to be very helpful during the interviews. Each of the following activities shifted the way I thought about chance occurrences or worked through problems, and I found myself repeatedly trying to mentally reconfigure interview problems in the context of them. None of the activities are a substitute for actual interview prep, but I viewed these as hobbies that I would do when I was not actively studying and saw improvements from them. Of course, if you

don't find a particular activity enjoyable, don't do it. Activities are only helpful if they are a fun way to get better.

3.1 Get good at poker

Surprisingly helpful for interviews. A large chunk of interview questions boil down to some variant of "Given the following information about your opponent, would you put more money into this game?". Unfortunately, given the pace of the games, approximate calculations and correct gut feelings were necessary for me in the interviews, both of which were repeatedly exercised in poker. Hopefully, google can help out with any unknown terms below:

- Play a lot, ideally with people better than you who are willing to take your $5-$20 buy-in repeatedly and explain why you're bad at poker (I'm not speaking from experience ... I swear)
- Learn how to calculate **pot-odds**
- Learn how to construct a **hand ranges** for your opponent
- Improve your foresight (if I raise here, what will I do if re-raised? What probability will I get re-raised? Is raising still worth it? I don't know the term for this but I hope this example captures the gist of the skill to learn)
- Learn good **bankroll management**. Give yourself x amount of money to play with each week. Consider this your entire net worth. How much should you be willing to play for such that you don't lose all the money?
- Learn the **kelly-criterion** in the context of managing risk in poker. Intuitive understanding is probably more helpful than a concrete mathematical understanding.
- Finding Equilibrium Is a good YouTube channel for explaining this stuff. Need a decent familiarity with poker before his content makes sense but I have found his videos to generally be one of the best resources on the internet for using poker as a skill to get better at statistical decision-making risk. The videos are also mad funny.

3.2 Brainteaser content

The information density of this stuff is kind of low, but if you have no energy to actually study and are just mindlessly perusing the internet (guilty as charged), the following content is interesting to think about. Solving them first before seeing the answer would be helpful, but I usually spent a couple of minutes thinking about an answer before seeing the whole solution. Used this as a chill way to see solutions to problems that were occasionally very clever and thus stuck in my brain:

- Can You Solve this Riddle? (TED-ed)
- The Puzzle Toad These questions were lowkey pretty hard and I honestly don't remember a lot from them, but there were a couple of cool solutions nested in there.

4 Study materials

If I had to do my study process over again, I would first make sure that I had a sound probability intuition before moving on to the more common guide materials that are out there. At the end of the day, seeing a ton of different problems and memorizing the tools that are necessary to solve each problem is probably the most time-effective way to study for the interviews. Most of the questions asked in the interviews didn't require much originality conditional on seeing problems of the same type before. Kind of like doing a bunch of LeetCode problems, most problems end up getting solved by muscle memory.

4.1 Probability Intuition

I highly recommend going through some of the content that Art of Problem Solving (AoPS) puts out on counting and probability. Skip around to only be working on problems and concepts that are challenging to you

- Probability classes I'm assuming that if you're interested in quant you have an inkling for math (and as such have taken some probability courses). If not, I think going through this course would be relevant. Everything up to midterm 2 is good to review.
- Discrete Mathematics Chapter 1 covers a lot of good counting stuff. Might be a good first resource to go through as well as something to reference if ever stuck on a particular counting concept
- AoPS probability
- AoPS combinatorics ignore Olympiad questions
- Competition math for middle schoolers I got quite humbled when my friend handed this book to me when I was about to be a junior in college, but chapters 2 and 3 are definitely worth going through. Idk if a free edition of this book exists somewhere

4.2 Essential interview question prep

You want to reach a level of familiarity with these questions such that upon seeing any question, you immediately know the tools and tricks required to solve the problem. I believe that if you have memorized how to solve all these problems and understand the intuition behind them, that suffices for any technical non-finance question I received.

- A Practical Guide to Quantitative Finance Chapters 2 and 4. Some of the problems get really involved in Chapter 4. For instance, I got zero markov chains in any interviews but I remember a few problems being computationally heavy markov chains in this section
- Callum McDougall's Guide Covers a lot of core concepts that show up, gives a good overview of the field of quantitative trading. Overall, I found this super helpful and can't thank him enough for creating it.
- Heard on the Street Chapters 1 and 4 have some good problems. I would prioritize the two resources above over this one but more problems never hurt.

4.3 Extra interview questions

If you have time and want to get exposed to more questions, that would never be detrimental. I believe that the more questions one sees the better, but unlike the resources above, some of the questions in these books are not what would be asked in interviews. Rule of thumb, if it seems like a calculator or heavy computation will be needed, that question will probably not be asked.

- 50 Challenging Problems in Probability I was on the fence about including it in the essential or extra interview prep. For the most part, the questions are pretty good and I found that my probability intuition was enhanced/challenged by this book.
- A Collection of Dice Problems The title pretty much covers it. A ton of dice problems. Reinforces a lot of concepts that are brought up in earlier books, but also has a bunch of computationally heavy problems that I doubt will be asked.

4.4 Arithmetic Speed

Even if a company does not specifically have a numeric test, being able to comfortably do mental arithmetic makes it much easier to focus on the content of the problem at hand rather than worrying about carrying out the calculations correctly. With a little bit of diligent training on any of the sites mentioned below, people can usually drastically improve their score from their base level. After you feel your improvement starting to plateau, I would focus on maintaining your arithmetic speed at that level and predominantly focusing your efforts on probability or interview questions.

- Zetamac easier questions for the most part, I've seen some people get to 90+, but I was never one of them
- Rank Your Brain I would take the expert test and screenshot any problems that I would have trouble solving. Once the time ran out, I would go back and work through the problems that stumped me at a slower pace.
- RFQ Jobs Math Practice has a bunch of math tests that you can take, with one being a specialized Optiver test. The test on the site was markedly harder than the actual numeric Optiver test from what I remember.

5 Market intuition

Final rounds at many firms usually have scenarios (games, questions, etc.) that focus on market intuition. Even if the scenarios are posed as non-market games, having a good gut feel for what is *supposed* to happen based on market intuitions can usually guide you to a good starting strategy that can then be iterated on further following what your interviewer says.

I honestly felt that the market sections of interviews were intuitive for the most part. I did not spend that much time understanding the intricacies of financial markets as it did not seem to be the focus of the interviews, but doing the following gave me a high level understanding of what was going on:

- Akuna Capital Options 101 A great course for covering the finance fundamentals. A good test for understanding after completing the course is if you can explain to yourself in the mirror start to finish how a market maker will make a profit on a transaction and mitigate all their risk. I found framing interview questions in the context of what was shown in this course usually allowed me to give a sufficient answer to any market question.
- **Programming Project:** Program an exchange that will trade stocks A, B, C and implement matching algorithms to fill users' orders in a fair way. Also, make sure to update the price of the stocks appropriately. If you are programming inclined, I have found that building highlights the holes in my understanding, helping me pinpoint what I need to spend more time on. Also, something quite similar came up on one of my quant dev final rounds.

6 Before an Interview

The advice in the sections above are general advice to keep your skills sharp, but you should of course tailor your preparation if you have an interview with a particular company coming up. **Glassdoor** is quite helpful for seeing past interview questions, but I have found that getting friends to mock interview me has been by far the most helpful to me. If you have an interview at firm XYZ coming up, I would highly recommend tapping your network of friends or people at university to see if anyone has interviewed there before, and asking them if they would be comfortable mocking you. From my experience, while some people will say no, most people were generally open to giving me a mock interview.