Quantitative Trading Interview Summer 2024

A Compilation of Questions

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1 Introduction

This is a compilation of questions I encountered while interviewing for a Quantitative Trader Intern role for Summer 2024. Questions will be sorted first by company and then by round, and I will update this document as I interview with more firms.

2 Citadel Securities - Quantitative Trader

2.1 Round 1 Interview

1. **Coin Sequence Game**. Player A and Player B are playing a game. Each player chooses a sequence of Heads and Tails of length 3, with Player A choosing first. Then, a fair coin is flipped until one of the players' sequences comes up, in which case that player is the winner. 1) Which player do you want to be? and 2) If player A chooses THT and Player B chooses THH, what is the probability player A wins?

   Solution. During an interview, the first part of the question initially requires some intuition, but should quickly be backed up with quantitative reasoning. You should demonstrate that there are some sequences that block other sequences and are therefore sometimes dominant. The second part is a straightforward Markov Chain problem.

2. **4-Card 2-Color Betting Game**. You are playing a game with a deck of four cards, two of which are red and the other two black. You begin with $100 in funds. Each turn, before a card is drawn, you have the option to bet any amount you have on the color of the next card with a 1:1 payout ratio. What is the maximum expected payout you can achieve, and what is the corresponding strategy? What is the strategy for minimizing variance?

   Solution. This is a straightforward question testing an understanding of probability, expected value, and variance.

2.2 Round 2 Interview

1. **Expected Sum of 3 10-Sided Die**. You roll three 10-sided fair die. What is the expected value of the sum of the die?

Solution. This is a straightforward probability and expected value question. During an interview, it is advantageous to take a casework approach and apply engineer's induction.

2. **Removing Rocks**. Player A and Player B are playing a game. There are 100 rocks, and each turn a player can remove either 1, 2, or 3 rocks. The winner is the player who removes the last rock. Player A and B alternate turns with Player A moving first. Which player do you want to be? What if there are 182 rocks instead of 100?

Solution. This is a classic brainteaser. The key is to notice the modular nature of the question.

3. **10-Sided Die Game** You are playing a game with a 10-sided die. You win the dollar amount of the number that you roll. What is the expected payout of one roll? What is the expected payout if you have the option to roll again after the first roll?

Solution. Simple question testing expected value and probability.

4. **Two Player 10-Sided Die Game**. You and another player are both rolling a 10-sided die, and the player that rolls the higher number pockets the difference between the two rolls, paid by the losing player. How much would you pay to play this game? How much would you pay if you had the option to roll again after observing both rolls?

Solution. Intuitively, both the option to re-roll and the information gain from observing both rolls is advantageous to you. To quantify how much value each feature adds is more difficult.

3 IMC Trading - Quantitative Trader