Reading Notes from JS's G uide for Job Applications

Hardik Rajpal

November 10, 2023

1 Randomness

- Financial markets involve a lot of uncertainty; predictions are difficult.

- Probability provides a good framework for making decisions when uncertainty is involved.

- One-off future events are more complicated to draw (even probabilistic) predictions about. Said predictions vary on asymmetry of information and personal experiences.

- Probability can and is used to reason about **knowable unknowns**: events that have a deterministic value (ex. events in the past) but said value is not known to anyone (within reach).

- There are "different types" of randomness (random variables):

  1. Discrete
     - Specially, Binary.
  2. Continuous

2 Counting

- With a **finite number of outcomes**, each of which is **equally likely**, evaluating the probability of each event (set of outcomes) is equivalent to figuring out its cardinality.

$$\text{p[criteria is fulfilled]} = \frac{\text{\# outcomes that fulfill criteria}}{\text{total number of possible outcomes}}$$

- Outcomes that are not equally likely can be viewed events consisting of atomic, equally likely outcomes to simplify calculations.

3 Probability, Independence, Random Variables, Expectation

- Same old, same old.

4 Confidence Intervals

- There are a few ways to consider a range of values of a random variable for processing:

  1. Study the literal min,max values of the RV.
  2. Measure $E[(X - \mu)^2]$ or $E[\|X - \mu\|]$
  3. Describe a confidence interval: an interval containing most of the probability mass of the random variable. Its confidence is given by $P(X \in CI)$.

5 Conditional Probability

- A **prior** refers to the initial probability function, before any information is considered.

- On receiving information, we "update" our beliefs.

6 Making Markets

- To effect a trade, we need to specify the following:

  1. The object being traded (often implied by the context).
  2. The direction: buy or sell.
  3. The price of the transaction.
  4. The quantiy or size of the transaction.

- To buy, we indicate bids; to sell, we indicate offers (asks).

- "I'm 2 bid for 10 " $\implies$ I want to buy 10 units for the price of \$2 each.

- "I have 10 at 4 " $\implies$ I want to sell 10 units for the price of \$4 each.

- "I am 2 at 4, 10 up " $\implies$ I want to sell 10 units for the price of \$4 each, buy 10 units at the price of \$2.

- These phrases create orders (irl or on exchange platforms), which stay active and anyone can trade against them until its traded or you say "I'm out."

- To buy someone's bid order, say "sold." To sell to someone's ask order, say "take' em."

- For partial fills, attach the quantity to the comment.

- Once an order is filled, (the entire quantity has been traded), it cannot be traded against again.

6.1 The Strategy

- If you think E[X] is μ, you should be willing to buy for less and to sell for more.

- The factors to consider before hitting the red button:

  - On average, do you stand to profit.
  - Can you lose a lot of money (WCS)? Losing money is bad because it keeps you from participating in great opportunities to trade in the future if your capital is depleted.
  - How much are you making? Bidding too low to maximize the profit in every outcome means there's a low chance of being sold the contract. Bidding right at the mean μ means the profit is limited.

- We want to balance our likelihood of a trade and the expected profit.

- Here's a market on the E[die roll]: "3 at 4, 10 up.". (Buy, bid price first, followed by ask price, followed by quantity.)