With one die, suppose in a round, you earn the amount of dollars equal to the value of the upwards face of the die. (eg. you earn $6 if you roll a six.) Now also suppose after your first roll, you are given the opportunity to cancel your first and roll again, taking that value as the final value. What should your strategy be? <https://quantnet.com/threads/jane-street-interview-questions.3039/>

Problem-Solving Approach:

1. Determine the Expected Value of Re-Rolling

Each face of the die has an equal probability of. The expected value of re-rolling is:

2. Set the Decision Threshold

If the first roll result is less than 3.5 (i.e., 1, 2, or 3), re-rolling yields a higher expected value.

If the first roll result is 3.5 or higher (i.e., 4, 5, or 6), keeping the result is optimal.

3. Calculate the Overall Expected Profit

When keeping the result (4, 5, 6): The average value is .

When re-rolling (1, 2, 3): The expected value is 3.5.

The total expected profit becomes:

Optimal Strategy:

If the first roll is 1, 2, or 3 → Re-roll the die.

If the first roll is 4, 5, or 6 → Keep the result.

Validation:

No strategy (always keep the first roll): Expected value = 3.5 dollars.

Optimal strategy: Expected value increases to 4.25 dollars, improving profit by 21.4%.

This strategy maximizes expected profit through dynamic decision-making, highlighting the core application of probabilistic thinking in trading scenarios.