What is Monte Carlo Simulation?

Monte Carlo simulation is a method used to understand and predict the behavior of complex systems by running many random scenarios. It helps estimate outcomes and assess risks by using random sampling.

Steps of Monte Carlo Simulation

1. **Define the Problem**:
    - Identify what you want to analyze or estimate.
2. **Generate Random Inputs**:
    - Create many random samples based on the possible values that variables can take.
3. **Run the Simulation**:
    - Use these random samples to calculate outcomes repeatedly.
4. **Analyze the Results**:
    - Combine the results to understand the system's behavior, like average results or probabilities.

Example: Estimating an Option Price

Imagine you want to estimate the price of a stock option. Instead of solving it with a formula, you can use Monte Carlo simulation:

1. **Define Inputs**:
    - Current stock price, strike price, time to expiration, risk-free rate, and volatility.
2. **Generate Random Stock Prices**:
    - Simulate many possible future stock prices based on the inputs.
3. **Calculate Payoffs**:
    - For each simulated stock price, calculate the option payoff.
4. **Average the Results**:
    - Average the payoffs to estimate the option price.