Problem Statement / Objective Statement:

The volatile nature of financial markets imposes various sources of uncertainty on an investor's portfolio. The options market provides a way for investors to combat those uncertainties, by hedging their portfolio against the risk of adverse price movements. We will compare the performance of analytical pricing models with results from various simulation techniques, to determine which pricing method performs the best when compared to actual option prices.

Model Building:

We begin with pricing European call options, using the Black-Scholes model. For this model we assume that the stock price follows a log normal distribution, then we simulate several paths using random number generation. From here we can estimate the price of an option contract by calculating the average of the sum of the difference between the max of 0 and all stock price paths (from the simulation) and the strike price (Stock price minus the Strike price is known as option premium, which is the price that you pay for the option) at the time of expiration. After finding the value at expiration we discount the value using the discount factor , to find the fair value of the option contract today. We can also extend this process for pricing European Put options by calculating the average of the sum of the difference between the max of zero and the **strike price minus the stock price**, then discounting back to today to find the fair value of the put option.

Data Collection:

I have gathered options data

1. We can use indexes such as SPY, IWM,QQQ.
2. We can use popular stocks who are known to have very active option contracts
   1. Apple, Tesla, Amazon, Meta, Netflix, Google
3. The data is continuous, is large dataset.
   1. We can shrink the data set by only including at the money options (those who’s strike prices are close to the stock price)
   2. We can also shrink the data set by looking at the monthly option contracts opposed to the weekly contracts ( the weekly contracts may be harder to predict because volatility from week to week or day to day in some cases is always changing.)