The Black-Scholes model is a commonly used method to calculate the price of options for securities such as stocks at different strike prices and expiration dates. This project shows how it is used and compares its results to popular pricing websites such as Yahoo Finance.

You can find how we calculated our option prices, in addition to where we found our data, using our Black-Scholes function in the jupyter notebook.

Our function is defined by these equations found in the class packet:

$$\rightarrow c = x_0\phi(\sigma\sqrt{T} + b) - Ke^{-aT}\phi(b)$$

$$\text{where } b = \frac{\ln(x_0/K) + (a - \sigma^2/2)T}{\sigma\sqrt{T}} \text{ and } \phi(t) \text{ is the standard normal cdf at t (so } \phi(t) = P(Z \leq t).)$$

Stocks Used:

- DAL: Delta Airlines
- AAPL: Apple Inc

Current Price:
We used the closing price of 4/22/2024 for every stock:

- DAL: 49.02
- AAPL: 165.84

Volatility:
Volatility was measured using the standard deviation of the **daily stock price change** of the last 60 business days. These are the volatilities of each stock used for the project:

- DAL: approximately 0.015
- AAPL: approximately 0.013

Interest Rate:
For the interest rate, we used the one year risk free treasury rate, which is currently around 5.17%. We found this online on CNBC (https://www.cnbc.com/quotes/US1Y)

Results:
These are the predictions of our Black-Scholes model vs Yahoo Finance, based on different strike prices and expiration dates:

Stock	Current Price	Strike Price	Expiration Date	**Our Prediction**	**Yahoo Finance Price (Ask Price)**
DAL	49.02	40	4/26/24	9.04	9.10
DAL	49.02	54	4/26/24	0.00	0.01
DAL	49.02	45	4/26/24	4.05	4.15
DAL	49.02	40	5/03/24	9.08	9.25
DAL	49.02	40	5/10/24	9.12	10.75
DAL	49.02	40	5/24/24	9.20	9.70
AAPL	165.84	100	4/26/24	65.90	66.80
AAPL	165.84	150	4/26/24	15.92	16.60
AAPL	165.84	180	4/26/24	0	0.03
AAPL	165.84	100	5/03/24	66.00	66.20
AAPL	165.84	100	5/10/24	66.09	66.55
AAPL	165.84	100	5/17/24	66.19	66.35

Looking at the results, our predictions are very close to the actual prices found on Yahoo Finance. Some reasons for the difference could be that Yahoo Finance may use more data, or that we may not have the correct window to calculate the volatility of the stock. Overall, however, our Black-Scholes model performs reasonably well.