# COMP 510 – Computational Finance
# Prof. Steven Skiena
# Fall 2008

Homework 1 – Options Pricing
Due Tuesday, October 28, 2008

We have devoted considerable time this semester to the theory of options pricing. In this assignment, you are asked to price the options from the real world. In particular, we have prepared a data set containing hundreds of put and call options from seven companies with expiration dates ranging from 1 day to 484 days.

You are required to do the following tasks:

1. Calculate the estimated volatility for each option using the historical stock prices. In this step, you are required to give two different methods to calculate the volatilities, one using the standard deviation and the other using EWMA. References can be found on p471 in the Textbook.

2. Write a program using any OOP language you like implementing two different option pricing models, namely the Binomial Tree model and the Black-Scholes model. The language can be C++ or Java, with Matlab not recommended.

3. Experiment with the impact of different volatility estimations, interest rates, and option pricing methods can compare the results with the actual options prices. How accurate are these methods, and what are the causes of mispricing? Write a three page report describing your models, the experiments you performed, your assessment of the accuracy of the models, and any interesting results from your experiments.

### Data Set

The data set of options was constructed on September 19, 2008 for seven prominent companies (JPMorgan, Microsoft, Google, Morgan Stanley, Goldman Sachs, United Airlines and General Electric). We have prepared three files containing the information you need:

- The file options.csv contains all the data about the options which are available to price, including the option name/type, the company name, the current price for the option as of September 19, 2008, the then-current stock price, option expiration dates, strike prices, etc.

- The file interest_rate.csv give a selection of interest rates available on September 19, 2008. You can look up additional rates on the web if necessary.

- The file historical_stock_prices.csv contains the historical stock prices in the 180 days prior to September 19, 2008.

### Rules of the Game

- All data files are available from the course webpage *http://www.cse.ust/hk/ skiena/510*.
- Please submit your assignment through CASS at *https://course.cse.ust.hk/cass/submit.html*. You shall find the submit guides there.
- Submit your program code along with the report, and a spreadsheet file which contains four columns describing the estimated prices(both models) for each option(that you get from your program), together with the original price and the name of the option. In the spreadsheet, draw curves to demonstrate the price differences.
- Please submit only one zipped file, with the format: yourname(stu_id).
- You must write your own code; try to make it as clean as possible. Any cheating will be considered seriously. If you cannot write your own code, just be honest and reference the source of the codes that you use.
- I encourage open-ended exploration. Experiment and have fun!