**FINN 6216 Homework Assignment #1**

**For these problems, you may use any software and/or hardware that you are familiar with. Calculators, Excel/VBA, Matlab, R, SAS (I don’t know R and SAS, so that may require more explanation on your part) and even Mathematica are all allowed. I would strongly prefer that you submit your actual code (or Excel spreadsheet, with comments, if you use Excel), but most important, please show all your hand calculations, and any assumptions you made, as well as the final answers.**

For each of these problems, we use the same inputs. Suppose that you have a position consisting of 100 shares of the exchange-traded fund SPY, and 400 European put options, **expiring in one year**, on Apple Computer (AAPL). Assume that the business day is January 5, 2018. Use finance.yahoo.com or any other source to retrieve the last 504 closing prices (two years’ worth) of these two stocks, leading up to 1/6 inclusive. Assume that the volatility of AAPL is 25%, strike of the put is 170, US risk-free rate is 1.2%, and AAPL’s annual dividend yield is 1.9% (assume continuous yield). Use Black-Scholes (with dividend yield) pricing for the option.

1. Assuming that the only risk factors are stock prices, and that volatilities and interest rates are static, compute the 1-day 99% historical VaR using the 2-years’ data in the following ways:
2. Delta/Gamma approximation, analytical delta and gamma, absolute shifts.
3. Delta/Gamma approximation, numerical delta and gamma with “optimal” bump size (tell me what that is). Absolute shifts.
4. Grid approximation, using a grid of where S is the most recent AAPL price of 175. Do you need a grid for SPY? Why or why not? Use absolute shifts.
5. Full revaluation, using absolute shifts.
6. Same as (a), but using relative shifts.
7. Same as (b), using relative shifts.
8. Same as (c) using relative shifts. No need to answer the question about the grid for SPY.
9. Same as (d) using relative shifts.
10. Repeat problem (1), this time doing 97% Expected Shortfall instead of 99% VaR. No need to repeat optimal bump size calculation in (b) and (f).

**This assignment is due Thursday, January 18. If you have written notes as part of your submission, you may either write these down on paper and hand it to me in class, or you may scan it or create an electronic document in the format of your choice (Word, LaTeX and LyX are okay), and email it to me, along with spreadsheets or anything else you have. If you do that you must do it before the class starts.**