Homework 8. Quantitative Methods for fixed Income Securities

1. Explain the difference between the *value of a forward contract* and the *forward price*.
2. Prove directly (i.e. by integration) that the value of equity put options is given by the formula

$$P_0 = Ke^{-rT}\Phi(-d_2) - S_0\Phi(-d_1).$$

Also show

$$\frac{\partial P_0}{\partial S_0} = -\Phi(-d_1).$$

3. Calculate the value of the so-call ATM call and put options for AAPL. Take the following parameters,

$$S_0 = 171,\ r = 0.8\%,\ \sigma = 47\%,\ T = 1,\ \text{and } K = S_0 = 171.$$

Numerically, verify the call-put parity:

$$\text{Call} - \text{Put} = S_0 - e^{-rT}K.$$

4. Use the Black formula to calculate the values of call and put options across strikes. Let $S_0 = 100,\ \sigma = 47\%,\ T = 1,$ and $K = 50:5:150,$ and the discount factor for one year be $d(0,1) = 0.98$. Plot the option values against the strikes.