1. Write a program to determine the initial price of an European call and an European put option in the binomial model with the following data :

$$S(0) = 100; K = 100; T = 1; M = 100; r = 8\%; \sigma = 20\%.$$

Use the following two sets of u and d for your program.

(a) Set 1 : $u = e^{\sigma\sqrt{\Delta t}}$; $d = e^{-\sigma\sqrt{\Delta t}}$.

(b) Set 2 : $u = e^{\sigma\sqrt{\Delta t}+\left(r-\frac{1}{2}\sigma^2\right)\Delta t}$; $d = e^{-\sigma\sqrt{\Delta t}+\left(r-\frac{1}{2}\sigma^2\right)\Delta t}$.

Here $\Delta t = \frac{T}{M}$, with M being the number of subintervals in the time interval $[0, T]$. Use the continuous compounding convention in your calculations (i.e., both in $\tilde{p}$ and in the pricing formula).

Now, plot the initial prices of both call and put options (for both the above sets of u and d) by varying one of the parameters at a time (as given below) while keeping the other parameters fixed (as given above) :

(a) $S(0)$.

(b) K.

(c) r.

(d) σ.

(e) M (Do this for three values of K, $K = 95, 100, 105$).

2. Now take any path-dependent derivative of your choice and do the above exercise for at least one set (of u, d).