

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

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, carry out a sensitivity analysis of the initial price as follows: 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 , $K = 95, 100, 105$).

You may also do plots in 3-D also (by considering two parameters at a time).

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