*General Instructions for MA 374 (Applicable for all lab assignments)*

- *Please create a folder with the last two digits of your Roll Number, IITG Email ID and the Lab Assignment Number in maths1 server under your home directory as per the instructions in the following example. For example, if your Roll Number is '210123099', your IITG Email ID is 'x.yz' and the Lab Assignment is 'Lab 01' then you have to create a folder '**99x.yzMA374lab01**' (Note: case-sensitive and without gaps) under your home directory in the maths1 server (172.16.70.1).*
  *This is very important, since files outside this folder will not be collected and will as such be treated as "The student has not submitted the lab assignment".*
- *Your program should be written in such a way that there is only one program for each question and all the outputs for each question should be displayed by running the program only once.*
- *Put down all your observations and outputs of the questions asked in a single word document. Finally create a pdf file from the word file.*
- *All your programs and output files (in word and pdf format) must be put inside the folder that you created as per the instructions above (You may work on the assignment in your local machine, but all the relevant files must finally be put inside the folder on the maths1 server).*

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Write a program, using the binomial pricing algorithm, to determine the price of an European call and an European put option (in the binomial model framework) with the following data :

$$S(0) = 100; K = 105; T = 5; r = 0.05; \sigma = 0.4.$$

Take $u = e^{\sigma\sqrt{\Delta t}+\left(r-\frac{1}{2}\sigma^2\right)\Delta t}$ and $d = e^{-\sigma\sqrt{\Delta t}+\left(r-\frac{1}{2}\sigma^2\right)\Delta t}$, where $\Delta t = \frac{T}{M}$, 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).

1. Run your program for $M = 1, 5, 10, 20, 50, 100, 200, 400$ to get the initial option prices and tabulate them. What do you observe? How large can $M$ be?
2. How do the values of options at time $t = 0$ compare for various values of $M$? Compute and plot graphs (of the initial option prices) varying $M$ in steps of 1 and in steps of 5. What do you observe about the convergence of option prices?
3. Tabulate the values of the options at $t = 0, 0.50, 1, 1.50, 3, 4.5$ for the case $M = 20$.

Note that your program should check for the no-arbitrage condition of the model before proceeding to compute the prices.