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

- *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 once only.*
- *Put down all your observations and outputs of the questions asked in a single Word/LaTeX document. Finally create a pdf file from the Word/LaTeX file.*
- *The file names should be your roll numeber and name seprated by "_". If your roll number is 100 and your name is xyz then file names should be 100_xyz for output files (in pdf) and 100_xyz_q1 and 100_xyz_q2 etc for programs. Write your full name and roll number at the top of the output file.*
- *All your programs (executable) and output files (in pdf format) must be submitted as Microsoft Teams assignment.*
- *Each question carries 10 marks.*

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 :

$$S(0) = 100; K = 105; T = 5; r = 0.05; \sigma = 0.3.$$

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.
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.