Finance Lab MA374 Assignment 01

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Ques.1

- Using the initial values given in ques. $S(0) = 100; K = 105; T = 5; r = 0.05; \sigma = 0.3.$
- The values

$$u = e^{\sigma\sqrt{\Delta t} + \left(r - \frac{1}{2}\sigma^2\right)\Delta t} \qquad d = e^{-\sigma\sqrt{\Delta t} + \left(r - \frac{1}{2}\sigma^2\right)\Delta t}$$

- To execute my .py file
  Run **$180123029_NamanGoyal_q1.py** on the terminal. The snapshot is given below
- Continuous compounding convention is been used.

```
naman-ubuntu@naman-ubuntu:~/Desktop/FE Labs/Lab1$ python3 180123029_NamanGoyal_q1.py
For the Put Option Pricing

  Value of M    Initial Option Price
------------  ----------------------
           1                 19.9417
           5                 16.6806
          10                 15.3991
          20                 15.6335
          50                 15.7553
         100                 15.7852
         200                 15.7937
         400                 15.7932
--------------------------------------------------------------------------------
For the Call Option Pricing

  Value of M    Initial Option Price
------------  ----------------------
           1                 38.1676
           5                 34.9065
          10                 33.625
          20                 33.8594
          50                 33.9812
         100                 34.0112
         200                 34.0196
         400                 34.0191
naman-ubuntu@naman-ubuntu:~/Desktop/FE Labs/Lab1$
```

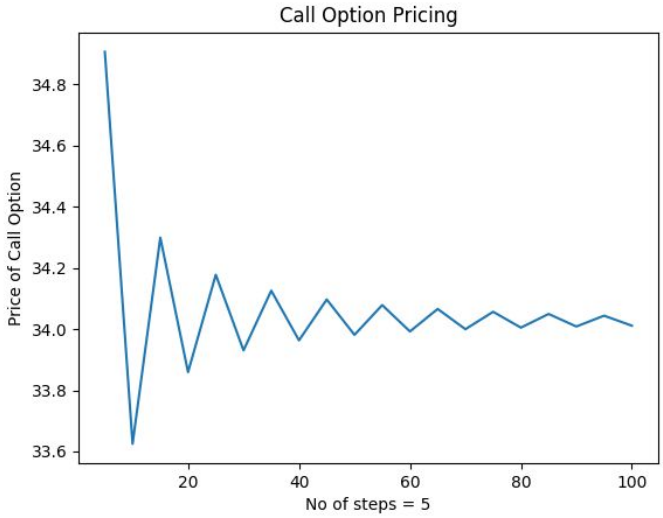
Value of M	**1**	**5**	**10**	**20**	**50**	**100**	**200**	**400**
Call Option	38.1676	34.9065	33.625	33.8594	33.9812	34.0112	34.0196	34.0191
Put Option	19.9417	16.6806	15.3991	15.6335	15.7553	15.7852	15.7937	15.7932

- The initial option prices are as above in the snap for different values of M. Option price at any step is expected discounted value of payoff with respect to a risk-neutral probability measure.

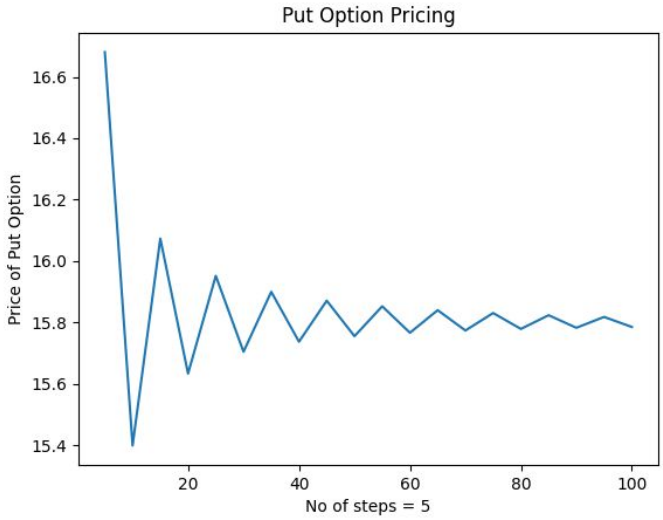
Ques.2

- To execute my .py file
  Run **$180123029_NamanGoyal_q2.py** on the terminal.

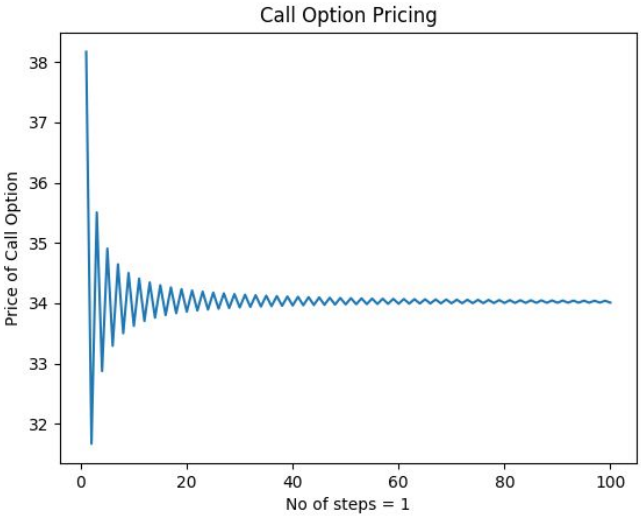
Call Option Price step = 5



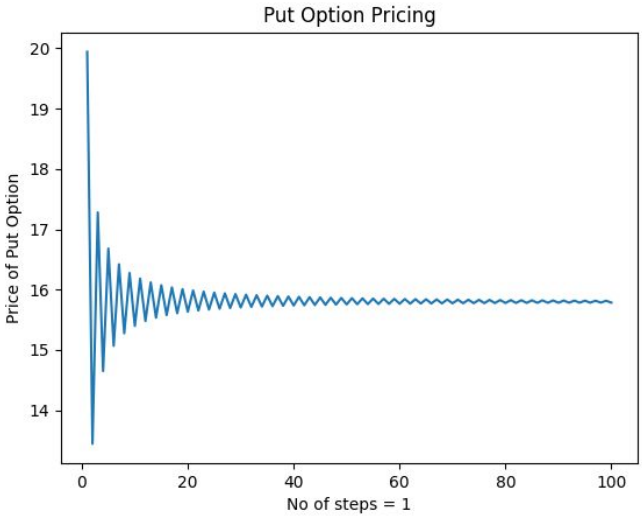
Put Option Price step = 5



Call Option Price step = 1



Put Option Price step = 1



- As the value of M increases and steps decreases, we observe that we are getting a more precise graph, and specifically in the case of step = 1 the option prices converge to a point that is
  Call Option: 34.0191
  Put Option: 15.7932
- We can also see that the convergence here is not so smooth the graph goes to a min pt which is less than the convergence point and fluctuates a lot and only then after it goes to the convergence point.

Ques.3

- To execute my .py file
  Run **$180123029_NamanGoyal_q3.py** on the terminal.
- The values will be obtained for M = 20 and different values of time = [0, 0.5, 1.0, 1.5, 3.0, 4.5].
- For t = 0, only one value of the options is there. For any time we have no of value = 4*t+1, for eg for t = 1 no of values of options possible = 5 (4U, 3U, 2U, 1U, 0U). Similarly, we have other values.

Call Option Values:

Time ->	0.0	0.5	1.0	1.5	3.0	4.5
	33.859449	15.095872	5.154831	1.125003	0.0	0.0
		31.893253	13.469716	4.121404	0.0	0.0
		59.958768	29.803955	11.767496	0.0	0.0
			57.699994	27.573204	0.118330	0.0
			100.662665	55.295355	1.235971	0.0
				98.438869	6.148520	0.0
				160.611387	19.725206	0.0
					46.976187	0.0
					91.193433	0.0
					154.841699	8.1491738
					242.030182	36.251494
					359.934183	83.950576
					519.099688	149.149605
						237.159088
						355.959465
						516.323199
						732.791598
						1024.993372
						1419.424512

Put Option Values:

Time ->	0.0	0.5	1.0	1.5	3.0	4.5
	15.633531	24.672817	35.965303	48.304950	78.228222	95.534063
		15.487143	24.983286	36.970072	72.357694	93.129316
		8.479204	15.269432	25.270959	64.433310	89.883247
			8.004223	14.963371	53.854841	85.501513
			3.504173	7.436262	40.533313	79.586791
				2.998249	25.955023	71.602751
				0.942426	13.221828	60.825424
					4.958185	46.277554
					1.235702	26.639984
					0.172102	8.281211
					0.008705	0.601546
					0.0	0.0
					0.0	0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0