Financial Engineering Lab (MA374)

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Lab - 03

To run the code for q1 type **python3 180123021_Kartikeya_Singh_q1.py** into the terminal (similarly for other questions as well).

Question 1

a) The initial prices of the loopback option are determined for M = 5,10, and 20. Calculating the initial price for M = 25 and 50 takes a lot of time and is not computationally feasible. The values are given in the table below -

M	Initial Price	Time Taken
5	9.119299	0.000195 s
10	10.080583	0.007800 s
20	10.805119	13.998765 s

It can be observed that the **computation time increases exponentially with M.**

b) As we increase the value of M from 5 to 20, the value of **initial price converges to a fixed value.**

c) The value of the loopback options at intermediate time points for M = 5 is tabulated below -

T	0	1	2	3	4
Value of Option	9.119299	9.027951 9.504840	7.147916 8.548076 9.799119 12.168665	6.201916 6.201916 7.148418 7.416771 8.324615 9.955271 13.712863 17.582063	3.846929 3.846929 4.600480 4.600480 4.600480 5.501639 6.680843 8.003614 8.003614 9.571392 10.680904 10.680904 13.071381 15.631852 21.188089 25.051229

Question 2

Now, Markov based efficient binomial algorithm is used and for calculating the initial loopback option price for M = 5, 10, 25, 50. This algorithm can handle all the given values of M, and the time taken by this algorithm is much less than the algorithm used in question 1. It can also be observed that the option price converge to a fixed value on increasing the value of M. The option prices are tabulated below-
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M	Initial Price	Time Taken
5	9.119299	0.000147 s
10	10.080583	0.002427 s
25	11.003495	0.134521 s
50	11.510862	6.931908 s

Question 3

Now a Markov based computationally efficient algorithm is used to calculate the European Call Price Option. This algorithm is quite fast as well and can be used to calculate the option price for M = [5,10,20,25,50,100,400]. The values taken are - S0 = 100, K = 105, T = 1,r = 0.08 and sigma = 0.2. The prices and time taken are tabulated below -

M	Option Price	Time taken (Normal method)	Time taken (Efficient method)
5	9.855137	0.000137 s	0.000081 s
10	9.401484	0.000324 s	0.000218 s
20	9.460231	0.001042 s	0.000733 s
25	9.539896	0.001612 s	0.001056 s
50	9.484183	0.005867 s	0.003943 s
100	9.486060	0.025215 s	0.014910 s
400	9.479193	0.313291 s	0.119068 s