MA 374 - Financial Engineering - II

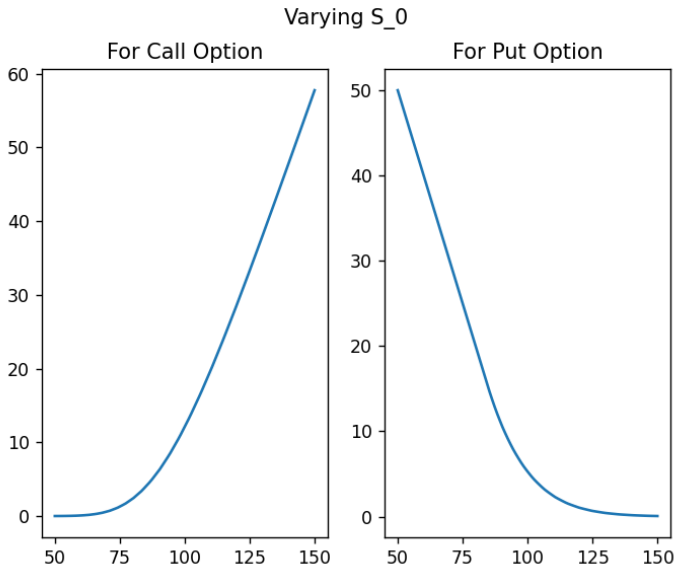
Lab 03

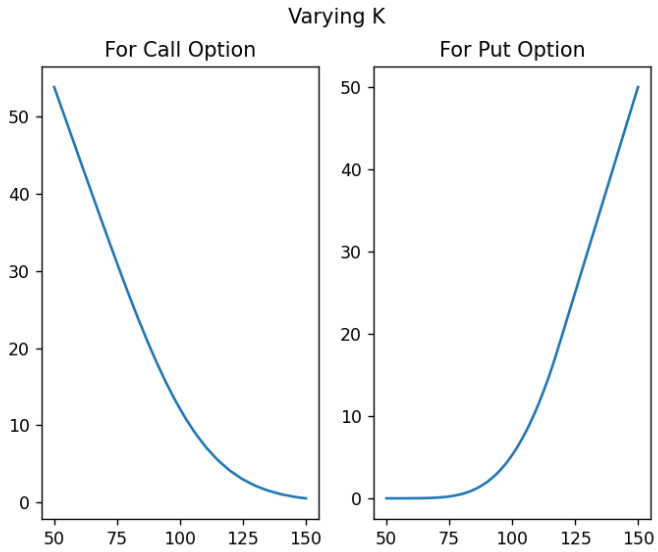
Aman Kumar, 200123007

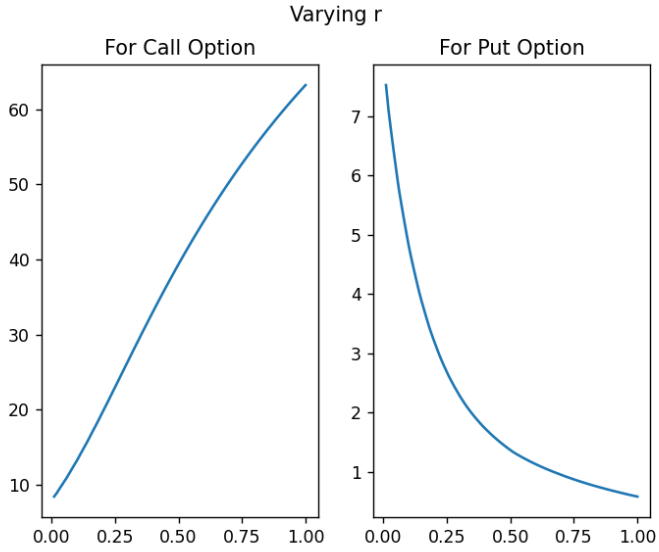
Q1 :

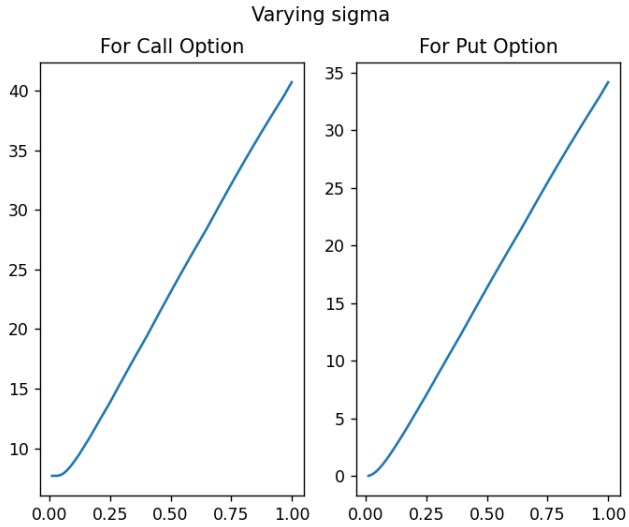
Answer :

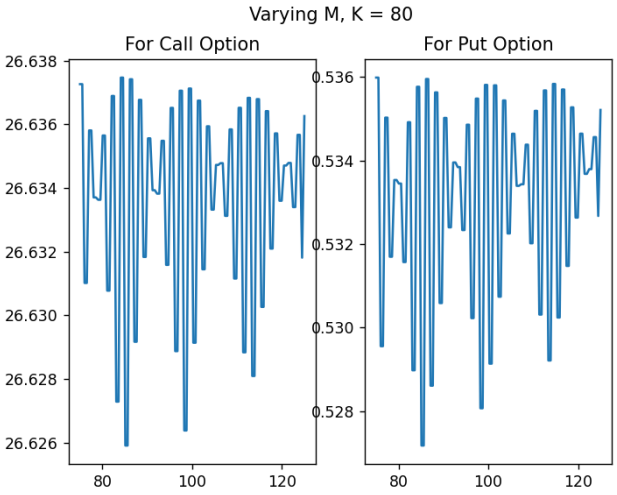
The observed differences are given below -

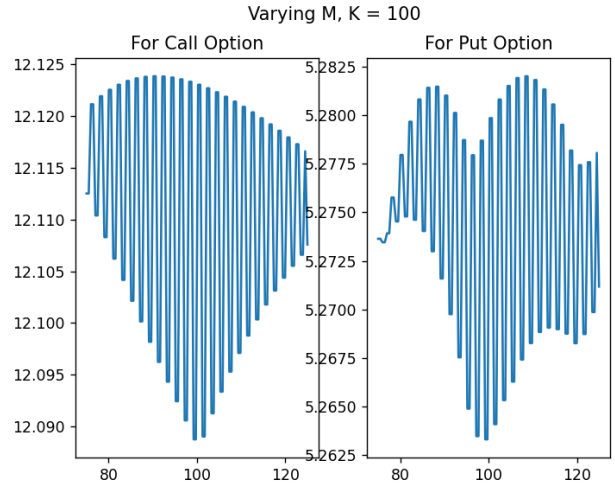


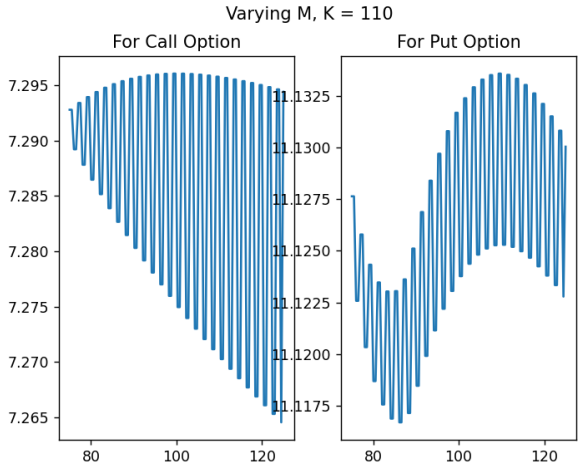

Varying K
For Call Option
For Put Option
50
40
30
20
10
0
50
75
100
125
150


Varying r
For Call Option
For Put Option
60
50
40
30
20
10
7
6
5
4
3
2
1
0.00
0.25
0.50
0.75
1.00


Varying sigma
For Call Option
For Put Option
40
35
30
25
20
15
10
35
30
25
20
15
10
5
0
0.00
0.25
0.50
0.75
1.00
0.00
0.25
0.50
0.75
1.00


Varying M, K = 80
For Call Option
For Put Option
26.638
26.636
26.634
26.632
26.630
26.628
26.626
0.536
0.534
0.532
0.530
0.528
80
100
120
80
100
120


Varying M, K = 100
For Call Option
For Put Option
12.125
12.120
12.115
12.110
12.105
12.100
12.095
12.090
5.2825
5.2800
5.2775
5.2750
5.2725
5.2700
5.2675
5.2650
5.2625
80
100
120
80
100
120

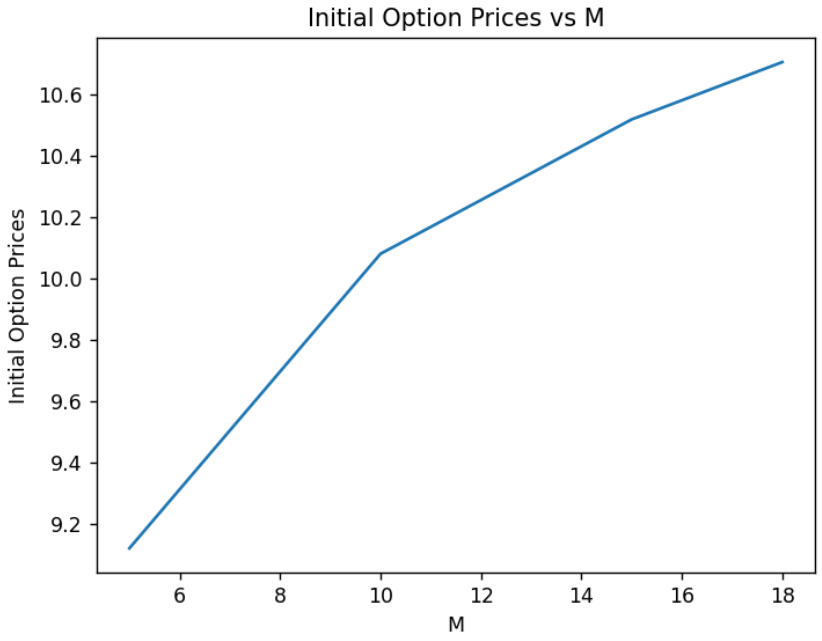


Q 2:

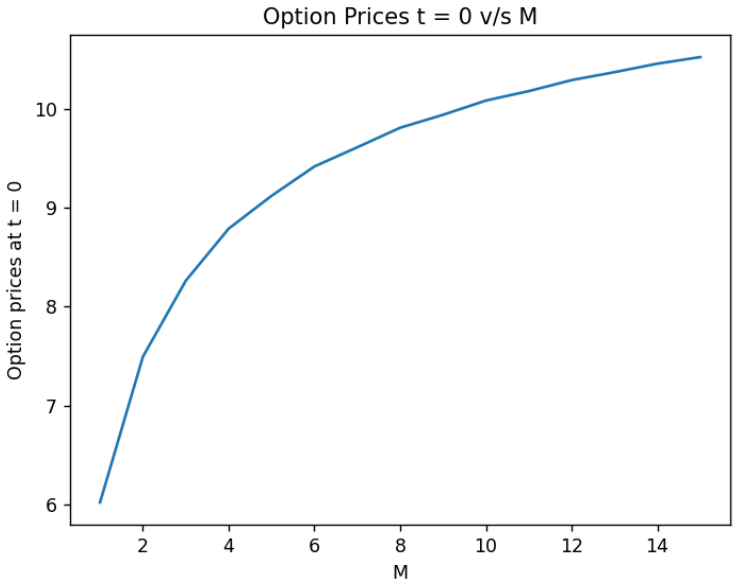
Answer :

[m = 25, 50 took a long time to run (almost 3 mins) hence i have reduced the times.]

a)



b)



c)

For part C the states are -

At t = 0 --->

Index no = 0 Price = 9.119298985864683

At t = 1 --->

Index no = 0 Price = 9.027951165547751

Index no = 1 Price = 9.504839866450853

At t = 2 --->

Index no = 0 Price = 8.548076183576441

Index no = 1 Price = 9.799118753547026

Index no = 2 Price = 7.147915756774744

Index no = 3 Price = 12.168664659721792

At t = 3 --->

Index no = 0 Price = 7.416771005131011

Index no = 1 Price = 9.955271272957816

Index no = 2 Price = 6.201916453882752

Index no = 3 Price = 13.712862965988533

Index no = 4 Price = 6.201916453882752

Index no = 5 Price = 8.32461466963314

Index no = 6 Price = 7.14841820819012

Index no = 7 Price = 17.582062714095418

At t = 4 --->

Index no = 0 Price = 5.501638813873981

Index no = 1 Price = 9.571391531700229

Index no = 2 Price = 4.600479677676438

Index no = 3 Price = 15.631851880479827

Index no = 4 Price = 4.600479677676438

Index no = 5 Price = 8.003613780975444

Index no = 6 Price = 6.6808429992566465

Index no = 7 Price = 21.18808934534565

Index no = 8 Price = 4.600479677676438

Index no = 9 Price = 8.003613780975444

Index no = 10 Price = 3.8469288844156075

Index no = 11 Price = 13.071380970928788

Index no = 12 Price = 3.8469288844156075

Index no = 23 Price = 21.234976911949744

Index no = 24 Price = 0.0

Index no = 25 Price = 7.8184160295867144

Index no = 26 Price = 2.9013504971397026

Index no = 27 Price = 18.805945122887607

Index no = 28 Price = 2.9013504971397026

Index no = 29 Price = 18.805945122887607

Index no = 30 Price = 18.805945122887607

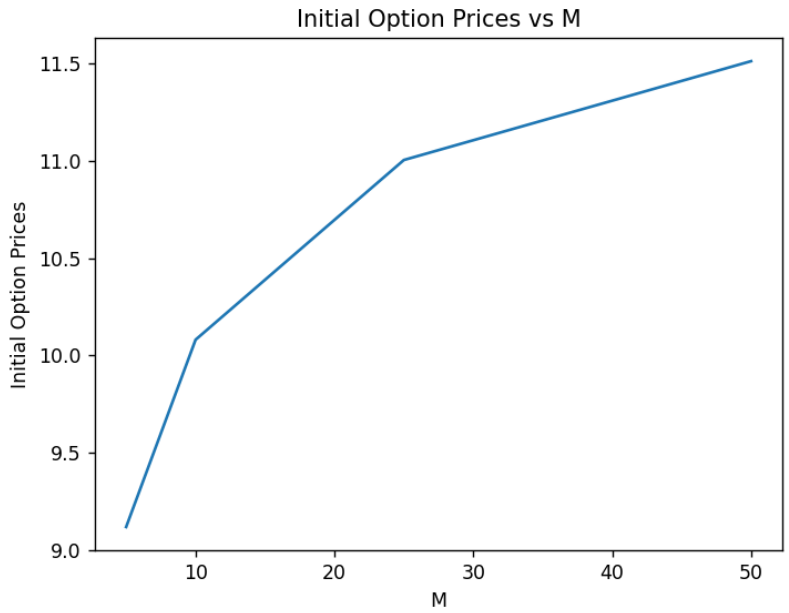
Index no = 31 Price = 32.10539403853048

Q3:

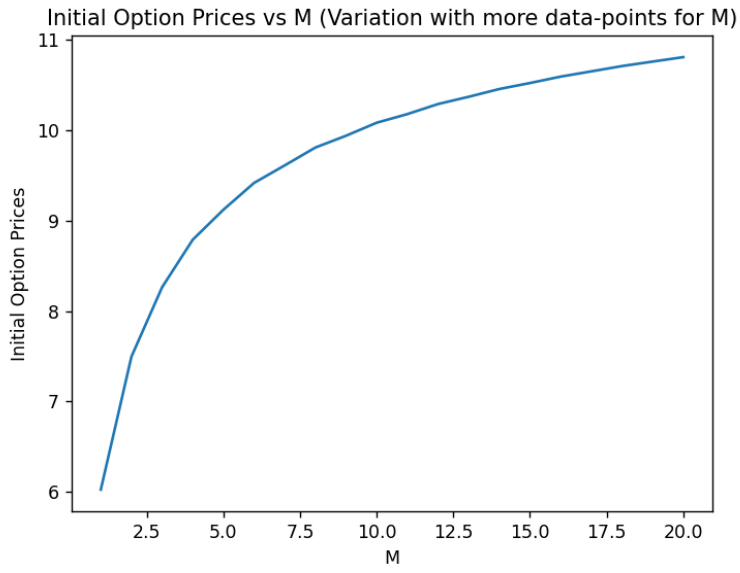
Answer :

The variation of option prices is shown below - >

A)



B)



C)For part C the states are -

At t = 0

Intermediate state = (100, 100) Price = 9.119298985864683

At t = 1

Intermediate state = (110.676651999383, 110.676651999383) Price = 9.027951165547751

Intermediate state = (92.54800352077254, 100) Price = 9.504839866450853

At t = 2

Intermediate state = (122.49321297792528, 122.49321297792528) Price = 8.548076183576441

Intermediate state = (102.42903178906215, 110.676651999383) Price = 9.799118753547026

Intermediate state = (102.42903178906214, 102.42903178906214) Price = 7.147915756774744

Intermediate state = (85.65132955680926, 100) Price = 12.168664659721792

At t = 3

Intermediate state = (135.57138705044142, 135.57138705044142) Price = 7.416771005131011

Intermediate state = (113.3650230595177, 122.49321297792528) Price = 9.955271272957816

Intermediate state = (113.3650230595177, 113.3650230595177) Price = 6.201916453882752

Intermediate state = (94.79602394643446, 110.676651999383) Price = 13.712862965988533

Intermediate state = (113.36502305951768, 113.36502305951768) Price = 6.201916453882752

Intermediate state = (94.79602394643445, 102.42903178906214) Price = 8.32461466963314

Intermediate state = (94.79602394643445, 100) Price = 7.14841820819012

Intermediate state = (79.26859549382432, 100) Price = 17.582062714095418

At t = 4

Intermediate state = (150.04587225655362, 150.04587225655362) Price = 5.501638813873981

Intermediate state = (125.46861206060268, 135.57138705044142) Price = 9.571391531700229

Intermediate state = (125.46861206060268, 125.46861206060268) Price = 4.600479677676438

Intermediate state = (104.91706553244704, 122.49321297792528) Price = 15.631851880479827

Intermediate state = (104.91706553244704, 113.3650230595177) Price = 8.003613780975444

Intermediate state = (104.91706553244704, 110.676651999383) Price = 6.6808429992566465

Intermediate state = (87.73182757949854, 110.676651999383) Price = 21.18808934534565

Intermediate state = (125.46861206060267, 125.46861206060267) Price = 4.600479677676438

Intermediate state = (104.91706553244703, 113.36502305951768) Price = 8.003613780975444

Intermediate state = (104.91706553244701, 104.91706553244701) Price = 3.8469288844156075

Intermediate state = (87.73182757949853, 102.42903178906214) Price = 13.071380970928788

Intermediate state = (87.73182757949853, 100) Price = 10.68090442602997

Intermediate state = (73.36150254849147, 100) Price = 25.051229457037028

At t = 5

Intermediate state = (166.06574787682462, 166.06574787682462) Price = 0.0

Intermediate state = (138.86445913876912, 150.04587225655362) Price = 11.181413117784501

Intermediate state = (138.8644591387691, 138.8644591387691) Price = 0.0

Intermediate state = (116.118695507311, 135.57138705044142) Price = 19.452691543130413

Intermediate state = (116.118695507311, 125.46861206060268) Price = 9.349916553291678

Q 4:

Answer :

The variation of option prices is shown below - >

A)

Unoptimised Binomial Algorithm executing------>

No arbitrage exists for M = 5

European Call Option = 99.99966453737208

Execution Time = 0.0 sec

No arbitrage exists for M = 10

European Call Option = 99.99966453737206

Execution Time = 0.005009651184082031 sec

Efficient Binomial Algorithm executing (Markov Based)------>

No arbitrage exists for M = 5

European Call Option = 12.163185946764584

Execution Time = 0.0 sec

No arbitrage exists for M = 10

European Call Option = 12.277327819222982

Execution Time = 0.0010046958923339844 sec

No arbitrage exists for M = 25

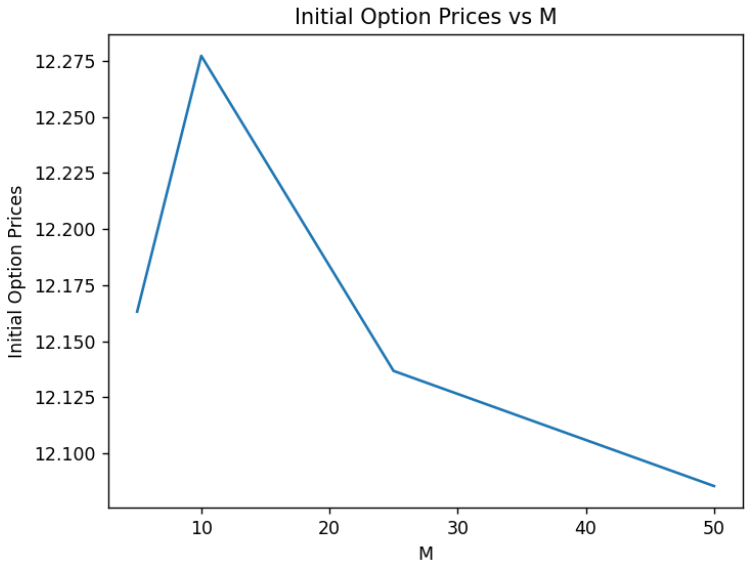
European Call Option = 12.136745963232947

Execution Time = 0.001001596450805664 sec

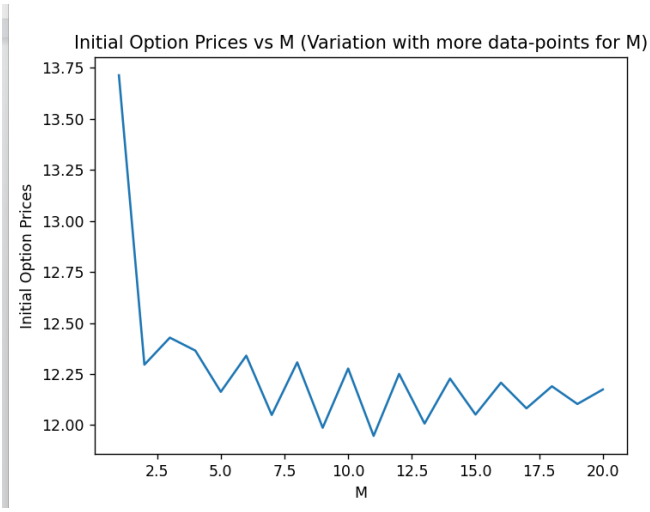
No arbitrage exists for M = 50

European Call Option = 12.0853615100722

Execution Time = 0.001998424530029297 sec



B)



C) The states are given below - >

At t = 0

Index no = 0 Price = 99.99966453737208

At t = 1

Index no = 0 Price = 812.0771361687849

Index no = 1 Price = 135.73856970486713

At t = 2

Index no = 0 Price = 6594.7115074149515

Index no = 1 Price = 1102.3094083171109

Index no = 2 Price = 184.24587408394433

At t = 3

Index no = 0 Price = 53554.27999274426

Index no = 1 Price = 8951.647060109734

Index no = 2 Price = 1496.2477489476753

Index no = 3 Price = 250.06618444619613

At t = 4

Index no = 0 Price = 434903.0822206225

Index no = 1 Price = 72694.55694711716

Index no = 2 Price = 12150.83985535549

Index no = 3 Price = 2030.863588868096

Index no = 4 Price = 339.2938512676302

At t = 5

Index no = 0 Price = 3531756.3609296177

Index no = 1 Price = 590337.7236272497

Index no = 2 Price = 98675.03376980557

Index no = 3 Price = 16492.852174752294

Index no = 4 Price = 2755.972986948593

Index no = 5 Price = 459.8323131693398