MA 374: Financial Engineering Lab
LAB 3 Report
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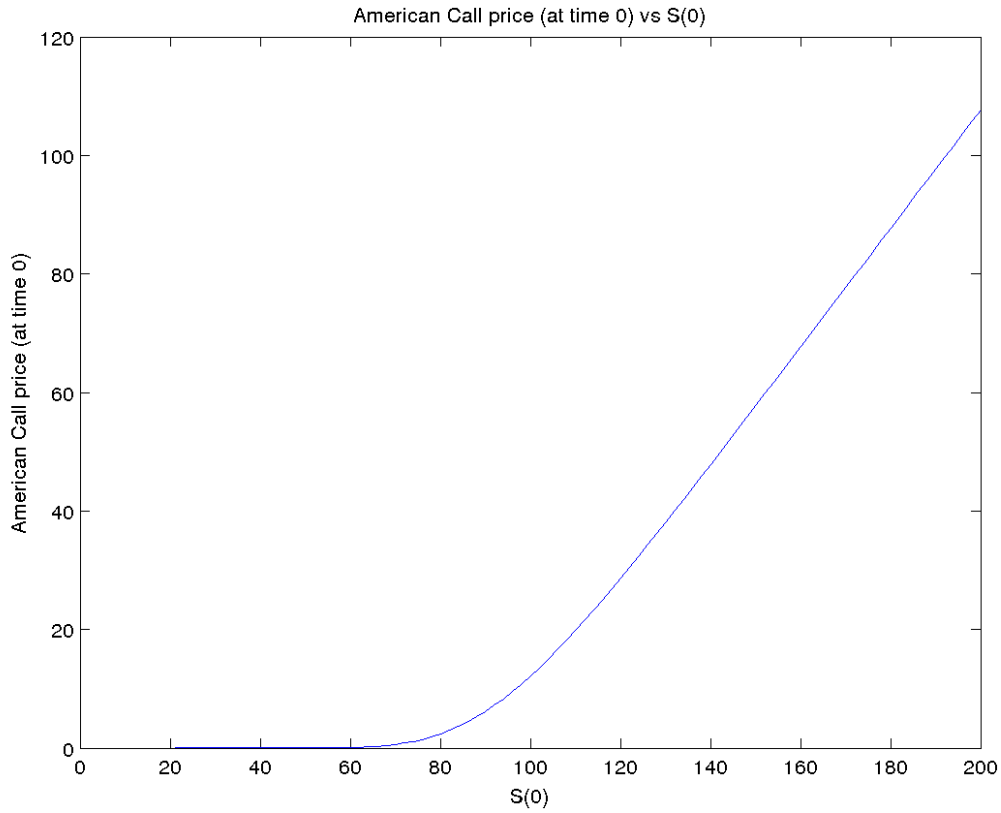
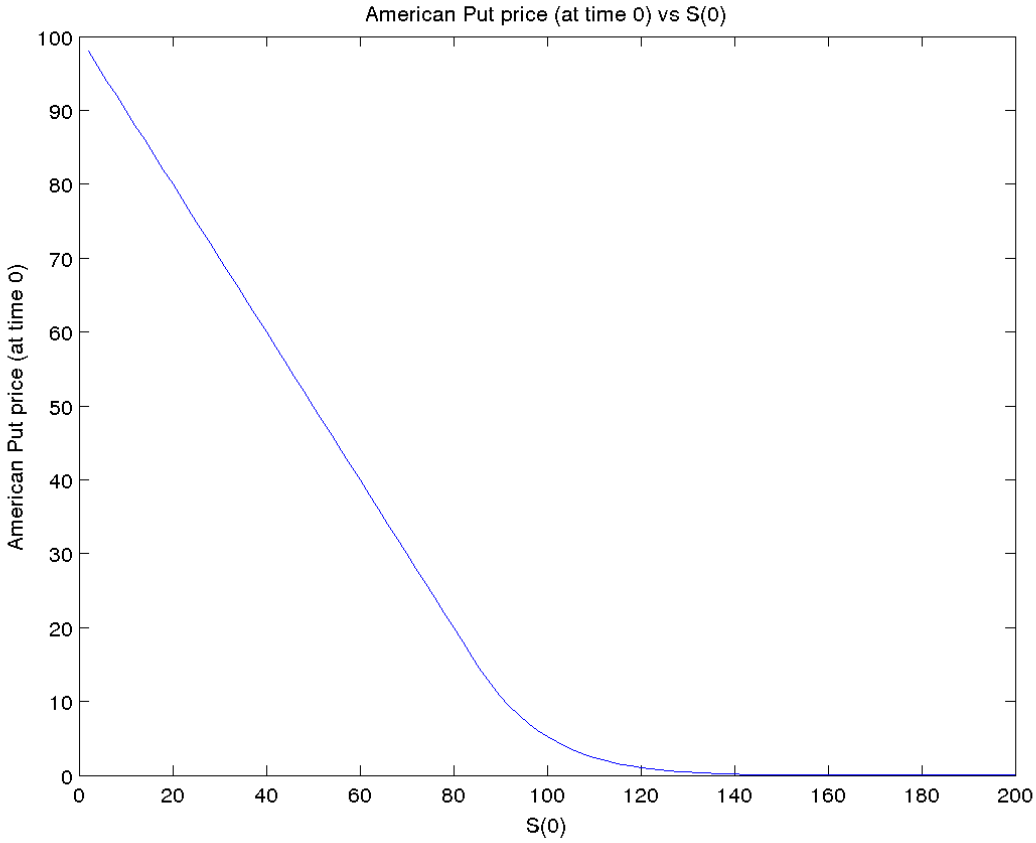
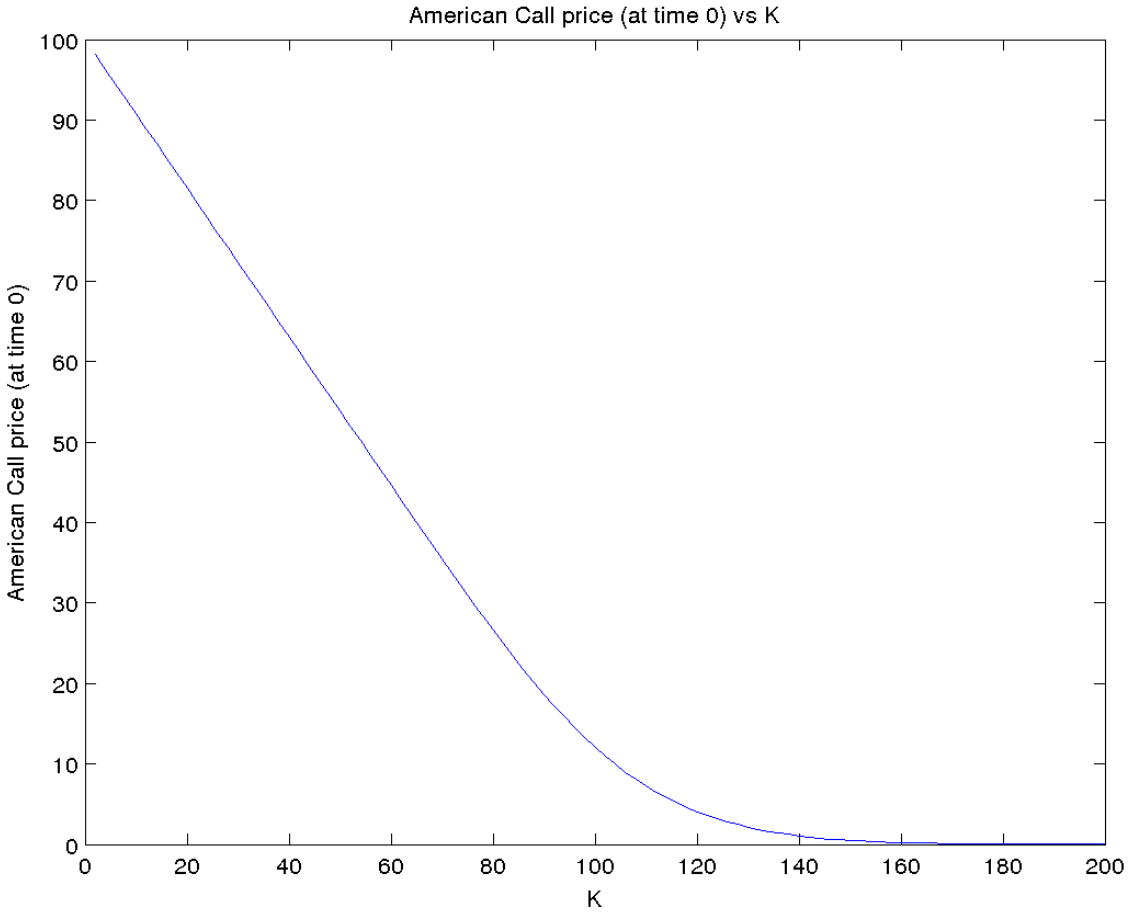
Question 1: American Call and Put Option

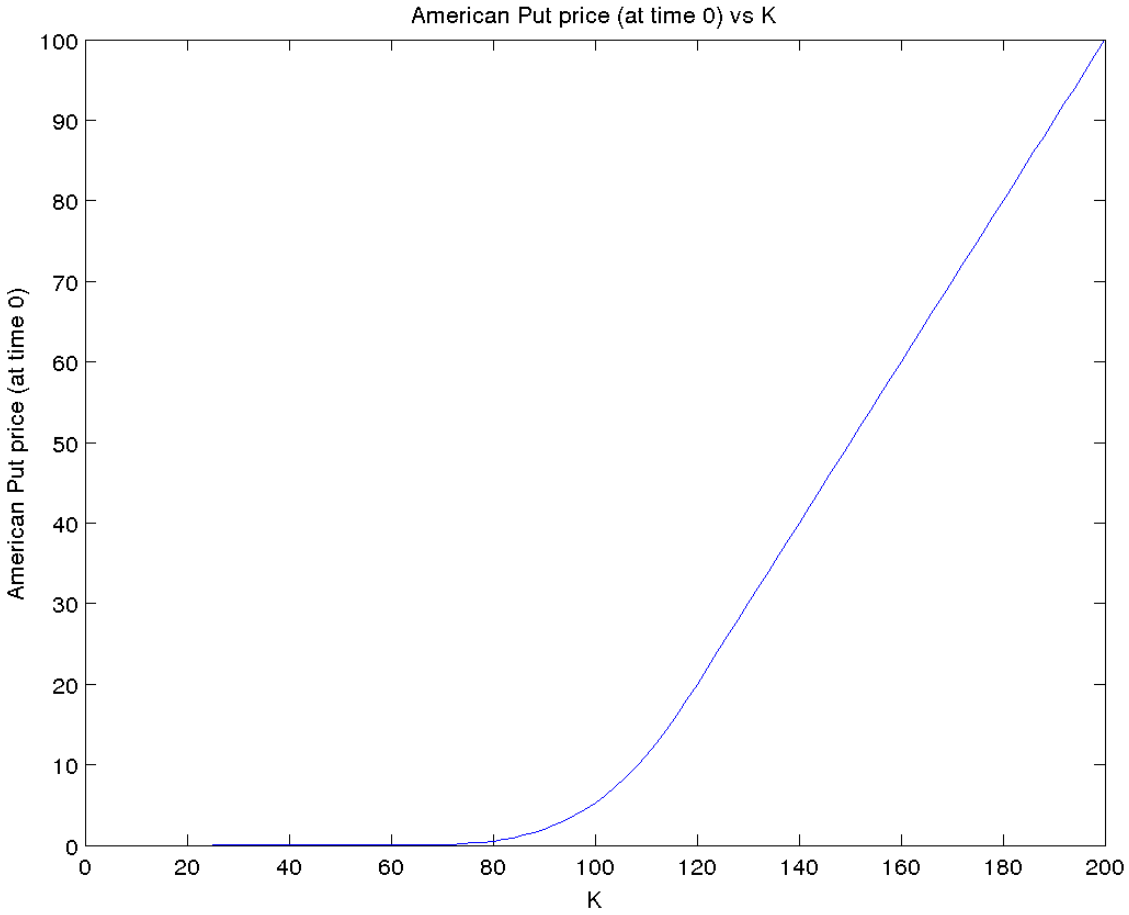
(a) S(0)



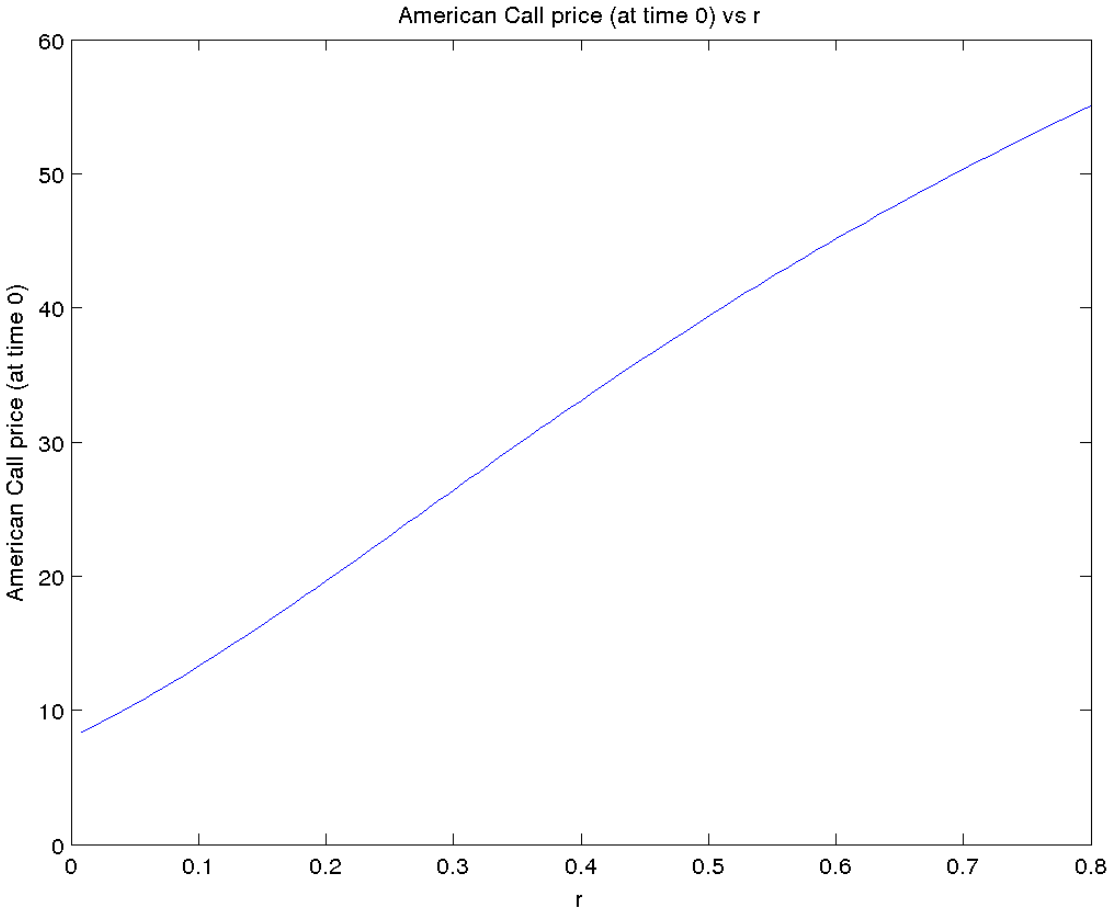


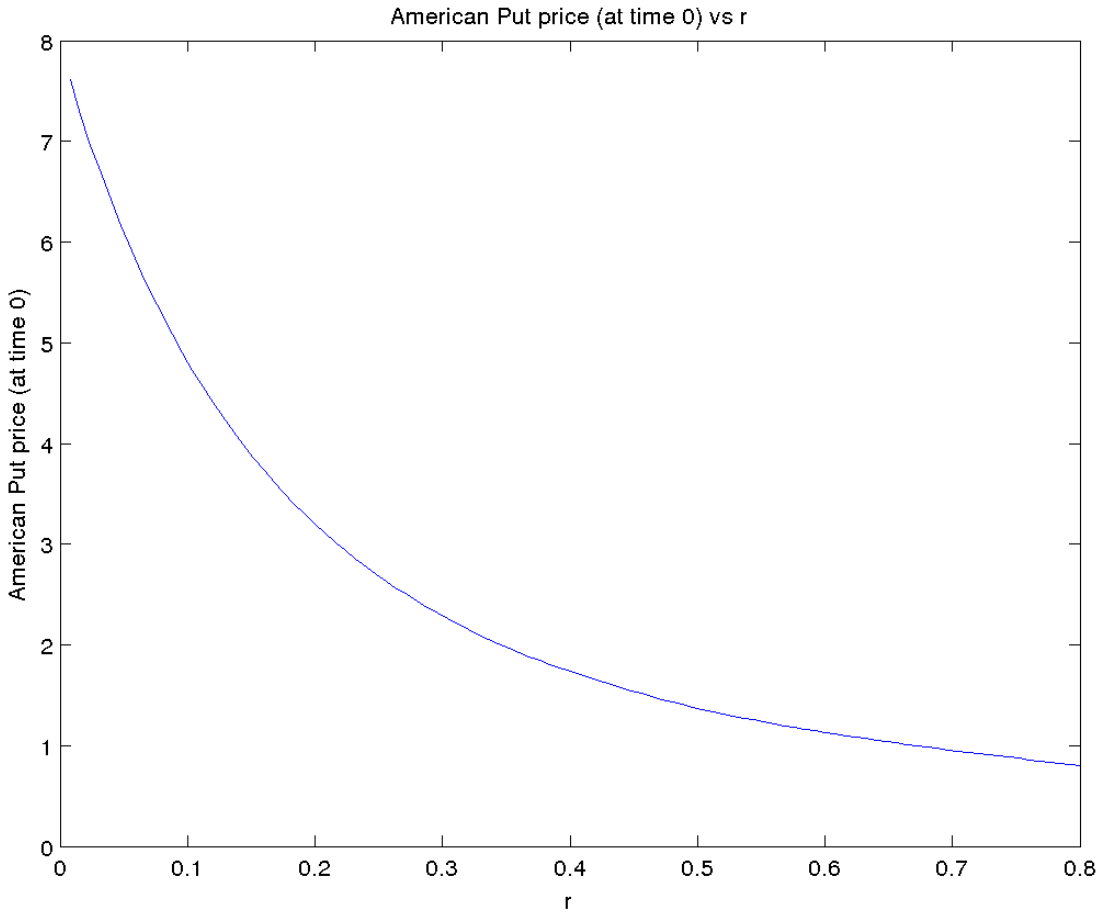
(B)


American Call price (at time 0) vs K
American Call price (at time 0)
K
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
120
140
160
180
200

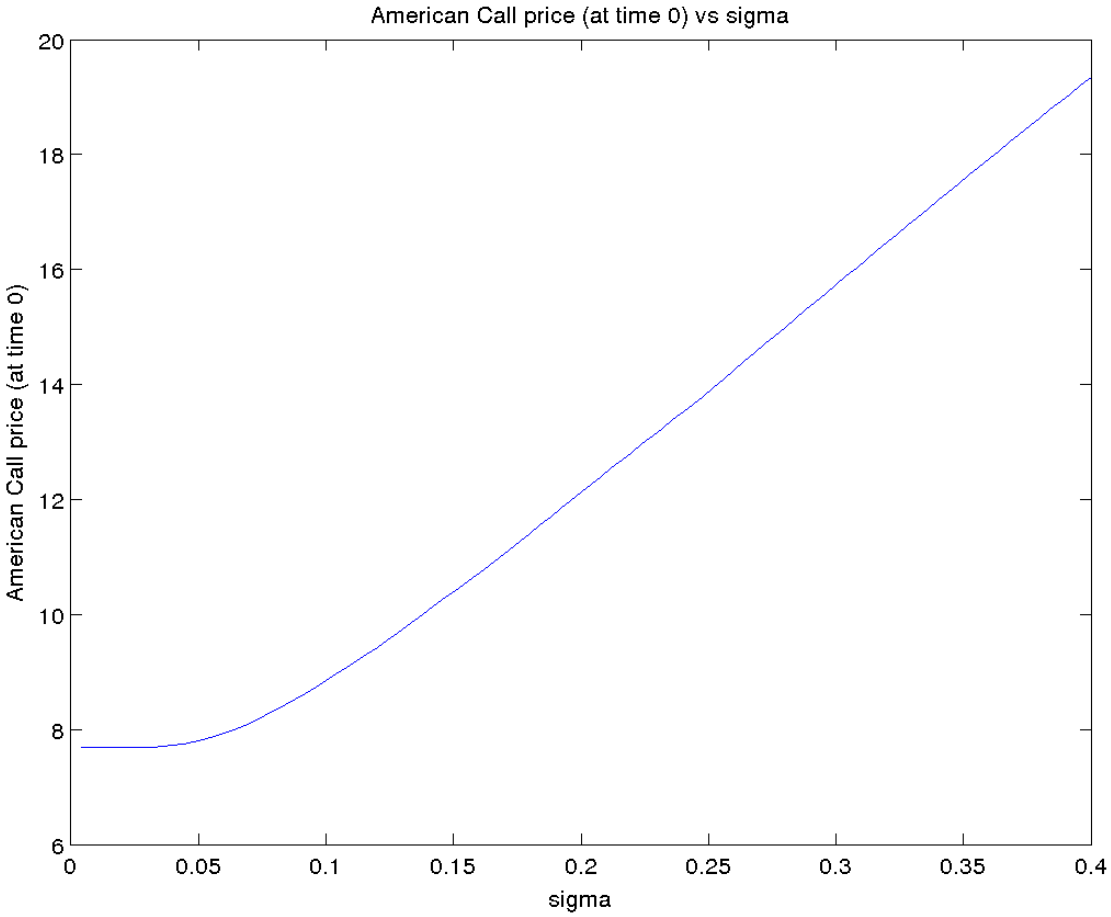

American Put price (at time 0) vs K
American Put price (at time 0)
K
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
120
140
160
180
200

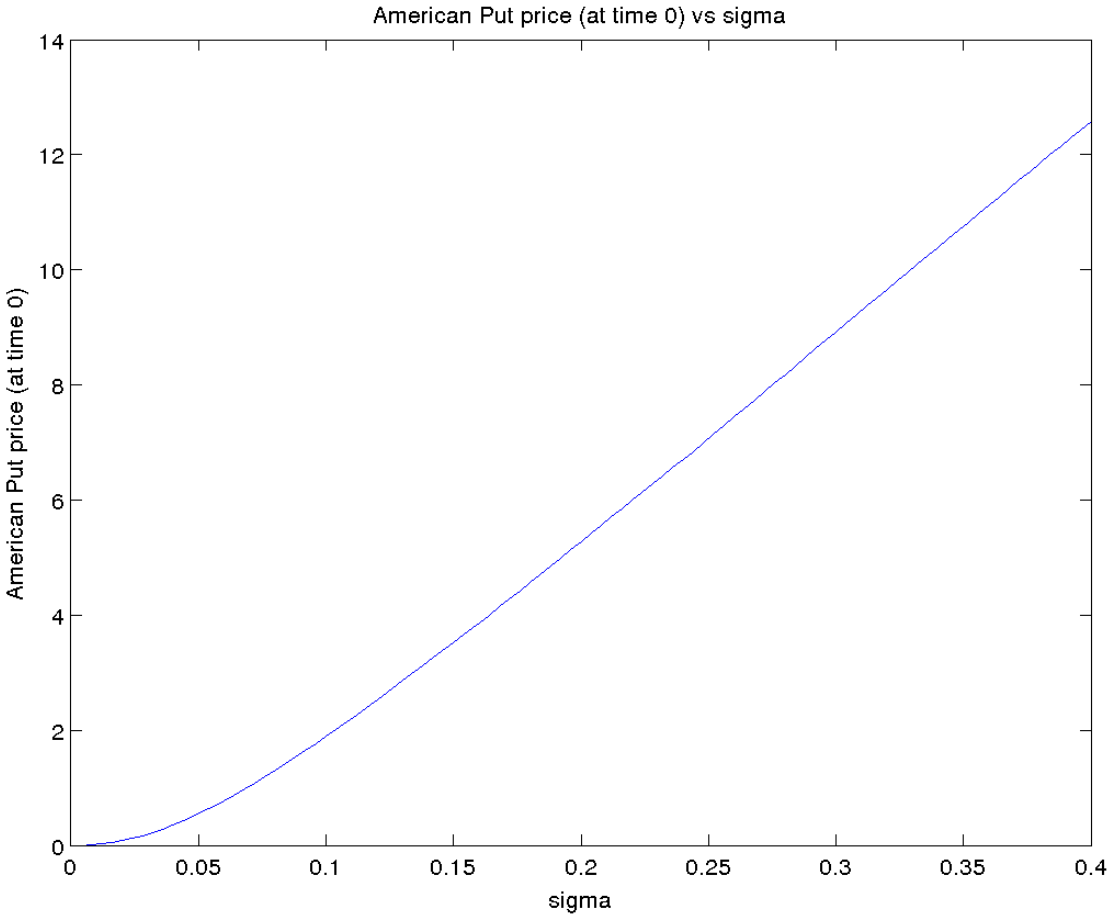
(c)


American Call price (at time 0) vs r
American Call price (at time 0)
r
0
10
20
30
40
50
60
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

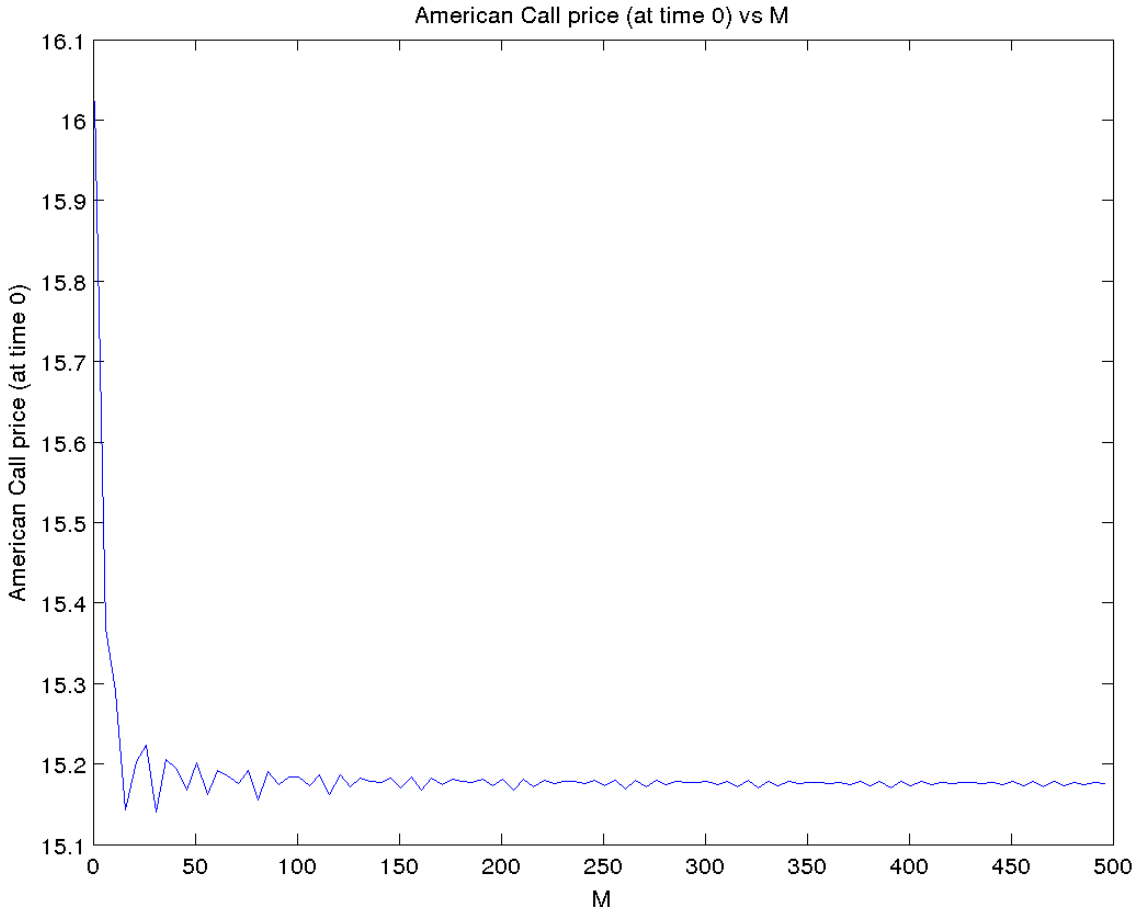

American Put price (at time 0) vs r
American Put price (at time 0)
r
0
1
2
3
4
5
6
7
8
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

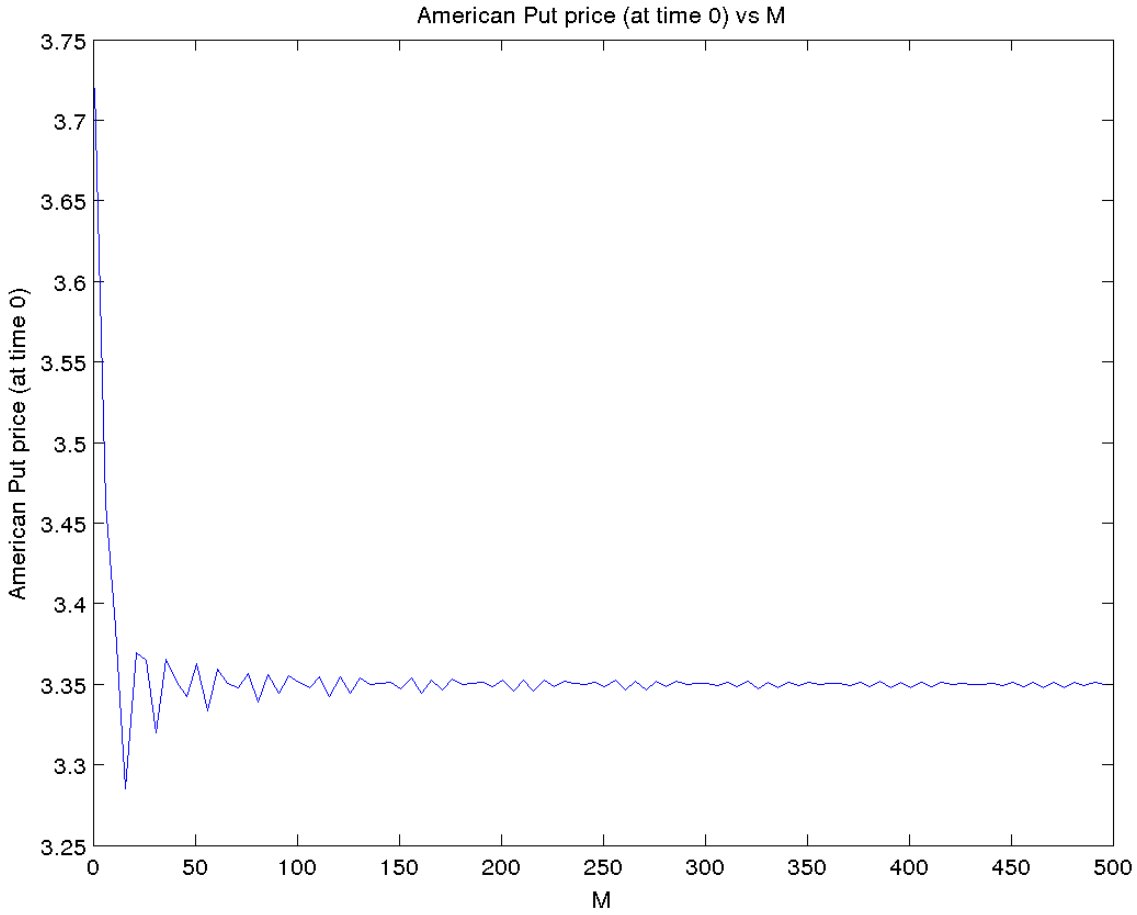
(d)


American Call price (at time 0) vs sigma
American Call price (at time 0)
sigma
20
18
16
14
12
10
8
6
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4

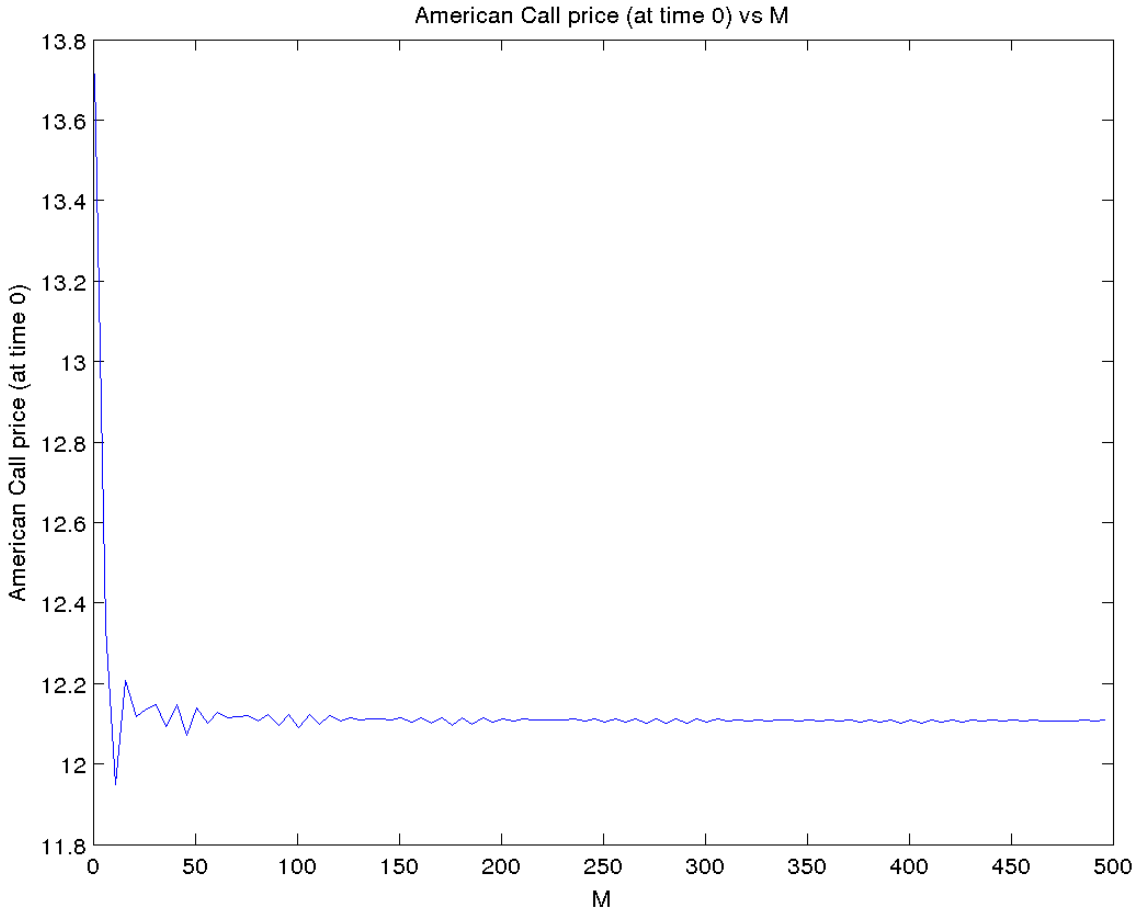

American Put price (at time 0) vs sigma
American Put price (at time 0)
sigma
14
12
10
8
6
4
2
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4

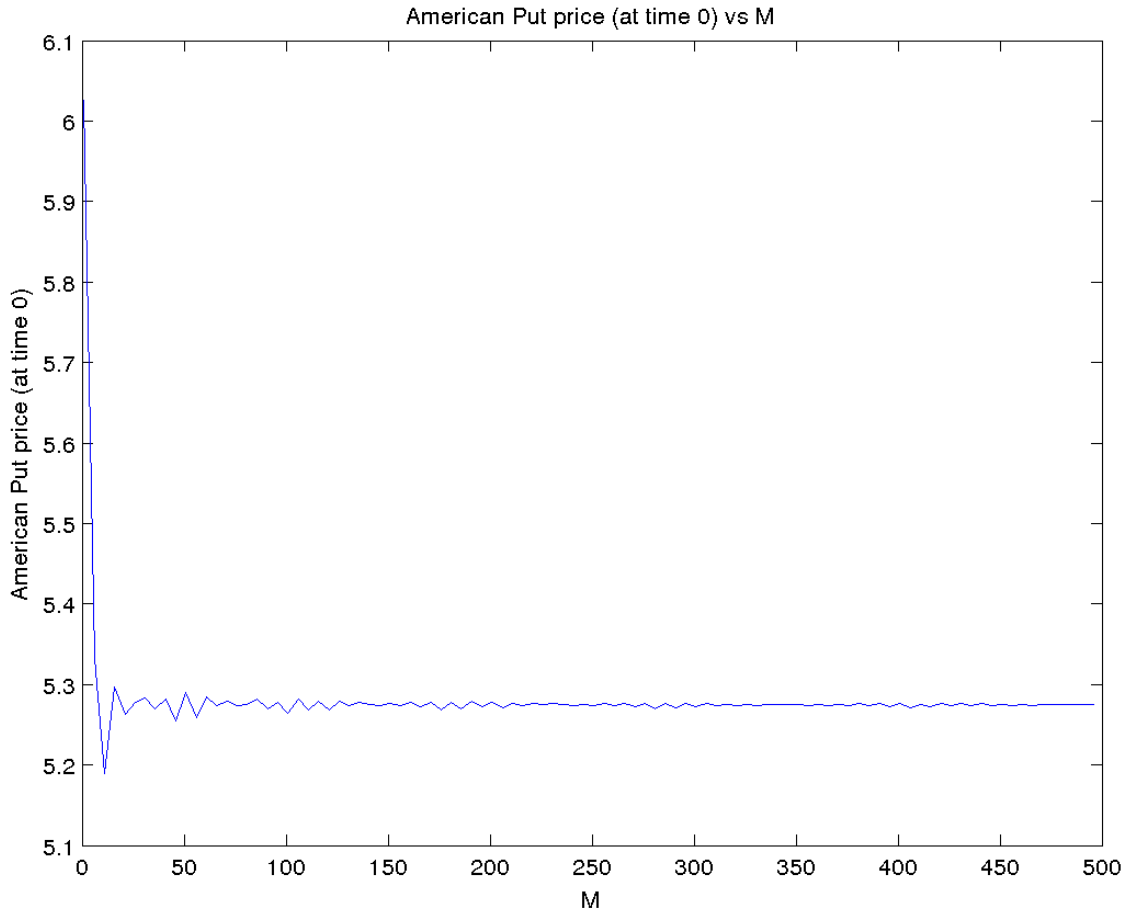
(e) K = 95


American Call price (at time 0) vs M
American Call price (at time 0)
M
16.1
16
15.9
15.8
15.7
15.6
15.5
15.4
15.3
15.2
15.1
0
50
100
150
200
250
300
350
400
450
500

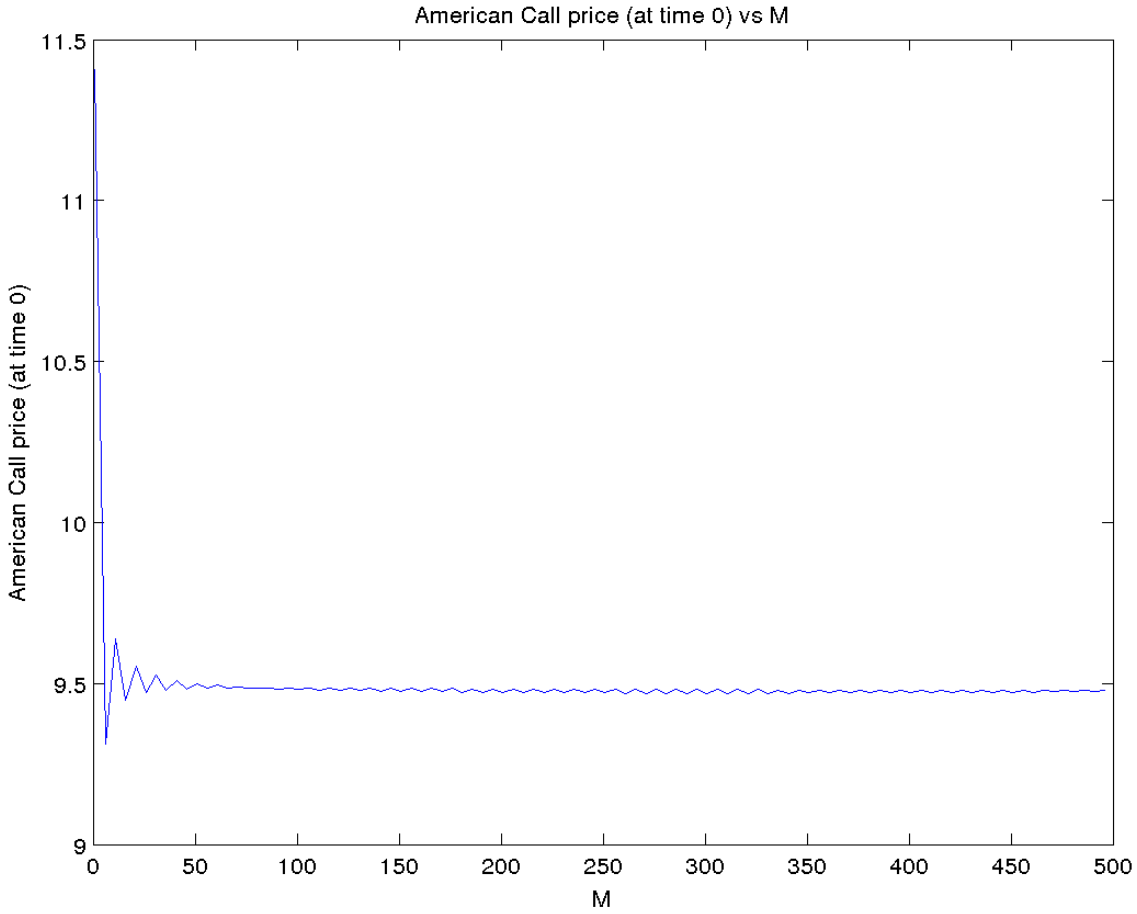

American Put price (at time 0) vs M
American Put price (at time 0)
M
3.75
3.7
3.65
3.6
3.55
3.5
3.45
3.4
3.35
3.3
3.25
0
50
100
150
200
250
300
350
400
450
500

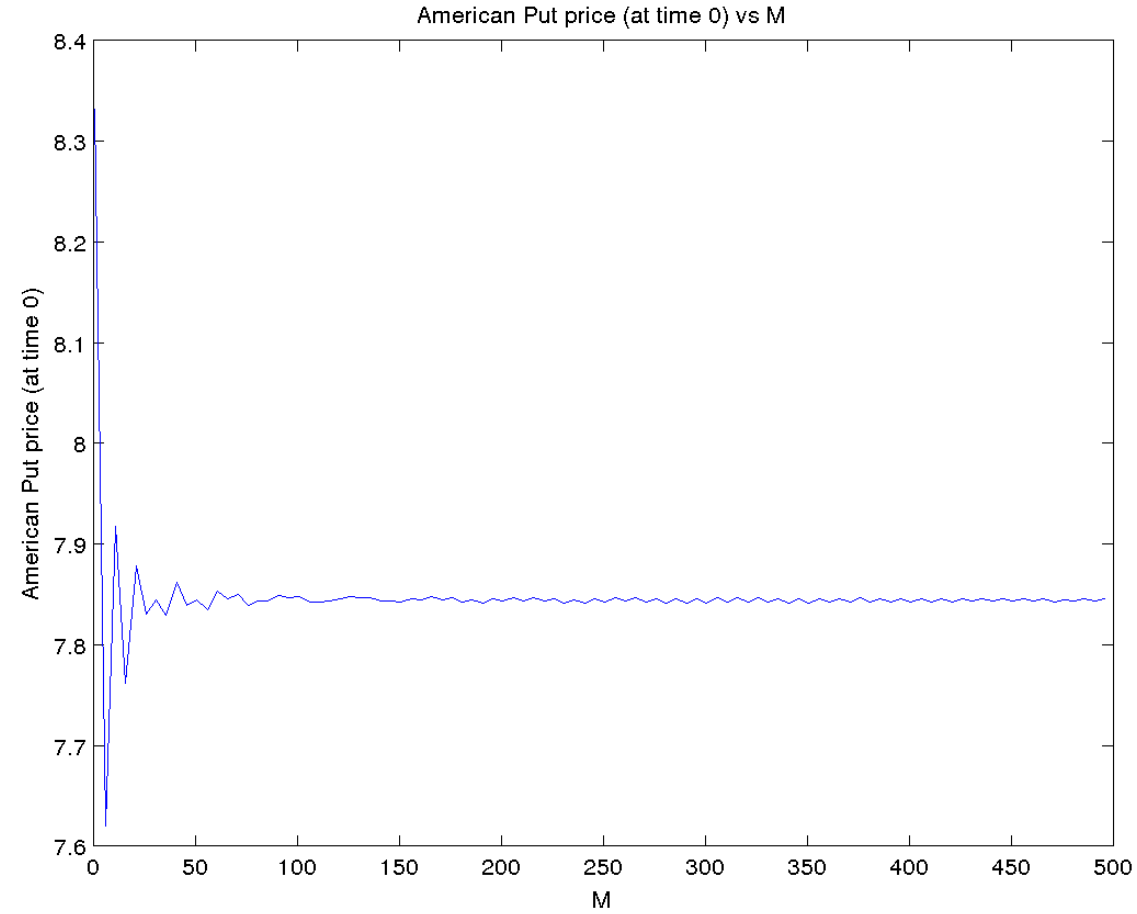
K = 100


American Call price (at time 0) vs M
American Call price (at time 0)
M
13.8
13.6
13.4
13.2
13
12.8
12.6
12.4
12.2
12
11.8
0
50
100
150
200
250
300
350
400
450
500


American Put price (at time 0) vs M
American Put price (at time 0)
M
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
0
50
100
150
200
250
300
350
400
450
500

K = 105


American Call price (at time 0) vs M
American Call price (at time 0)
M
11.5
11
10.5
10
9.5
9
0
50
100
150
200
250
300
350
400
450
500


American Put price (at time 0) vs M
American Put price (at time 0)
M
8.4
8.3
8.2
8.1
8
7.9
7.8
7.7
7.6
0
50
100
150
200
250
300
350
400
450
500

Question 2

(A)

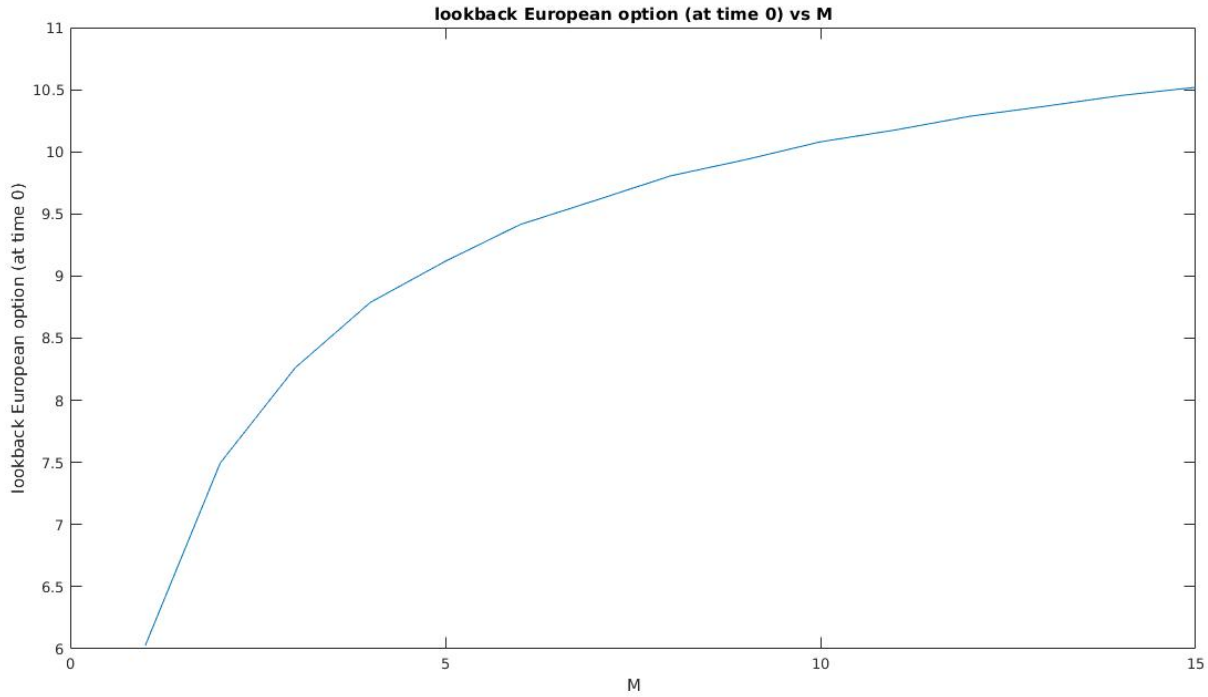
M	lookback European (initial price)
5	9.119299
7	9.609088
10	10.080583
12	10.286896
15	10.519165
17	10.647900

(B)

The value of option at time 0 is increasing with increase in M, but the slope is decreasing slowly. The option price stablizes after M has increased substantially.

M increased in steps of 1

M	lookback European option (initial price)
1	6.025847
2	7.496149
3	8.262757
4	8.788076
5	9.119299
6	9.415434
7	9.609088
8	9.806368
9	9.936758
10	10.080583
11	10.175899
12	10.286896
13	10.367182
14	10.452999
15	10.519165



(C)

M = 5

t (time) Lookback option values at time t

0.000000 9.119299

0.200000	9.027951 9.504840
0.400000	7.147916 8.548076 9.799119 12.168665
0.600000	6.201916 7.148418 7.416771 8.324615 9.955271 13.712863 17.582063
0.800000	3.846929 4.600480 5.501639 6.680843 8.003614 9.571392 10.680904 10.680904 13.071381 15.631852 21.188089 25.051229
1.000000	0.000000 2.901350 2.901350 5.330382 6.374517 7.818416 9.349917 11.181413 13.578002 13.578002 16.266374 18.805945 18.805945 19.452692 21.234977 25.394563 29.482597 32.105394

Question 3

Markov based algorithm is significantly faster. Simple method takes exponential time with respect to M, time increases by a factor of 2, while Markov method increases by factor of about 1.4. Simple method is able to handle values upto M = 20, while in the same time Markov method can go upto 40.

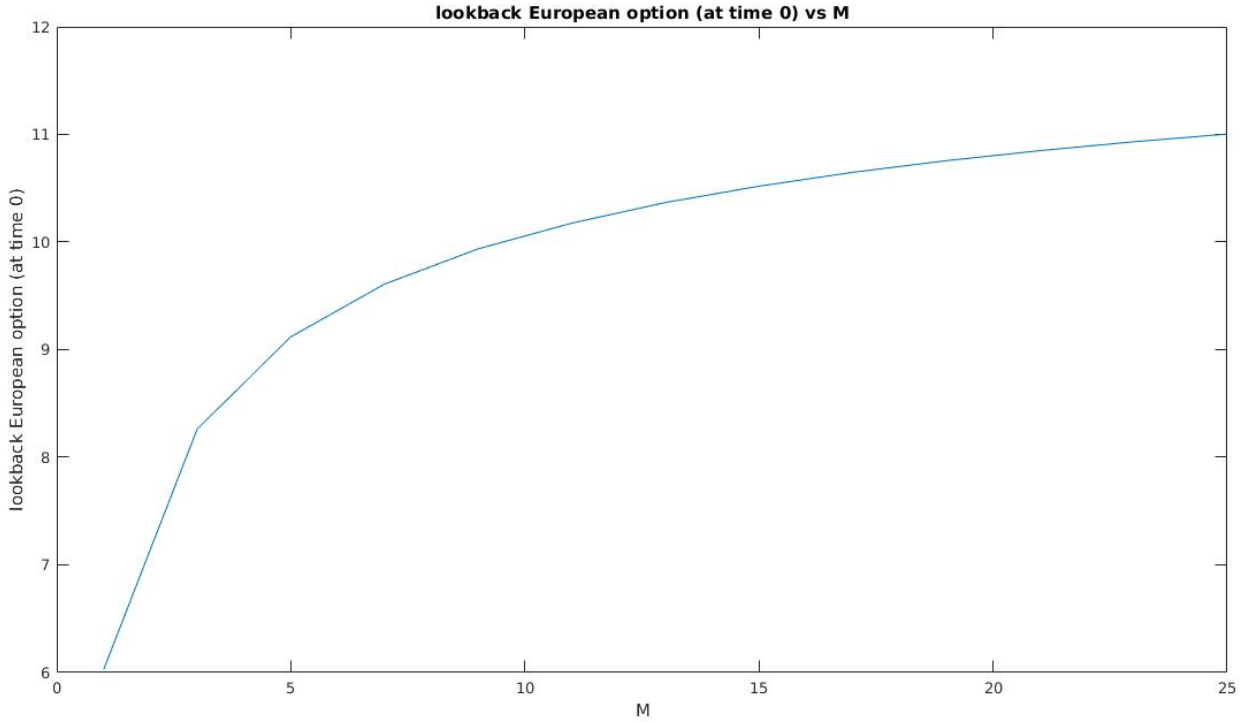
(A)

M	lookback European (initial price)
5	9.119299
10	10.080583
15	10.519165
20	10.805119
25	11.003495
30	11.152373

(B)

M increased in steps of 1

M	lookback European option (initial price)
1	6.025847
3	8.262757
5	9.119299
7	9.609088
9	9.936758
11	10.175899
13	10.367182
15	10.519165
17	10.647900
19	10.756073
21	10.849329
23	10.931549
25	11.003495



(C)

M = 20

t (time) Lookback option values at time t

0.000000 9.119299

0.200000 9.027951 9.504840

0.400000 7.147916 8.548076 9.799119 12.168665

0.600000 6.201916 7.148418 7.416771 8.324615 9.955271 13.712863 17.582063

0.800000 3.846929 4.600480 5.501639 6.680843 8.003614 9.571392 10.680904 13.071381 15.631852 21.188089 25.051229

1.000000 0.000000 2.901350 2.901350 5.330382 6.374517 7.818416 9.349917 11.181413 13.578002 13.578002 16.266374 18.805945 18.805945 19.452692 21.234977 25.394563 29.482597 32.105394 >> q3