# Financial Engineering Lab 2

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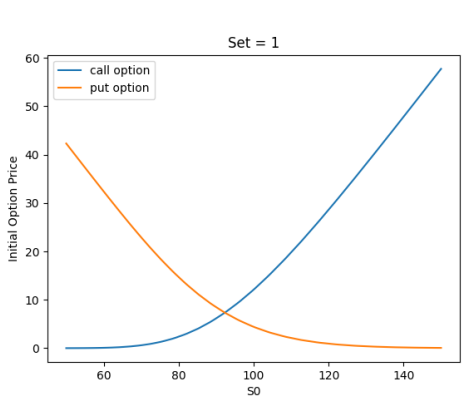
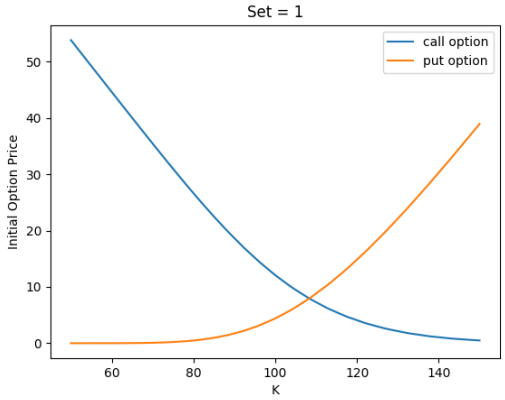
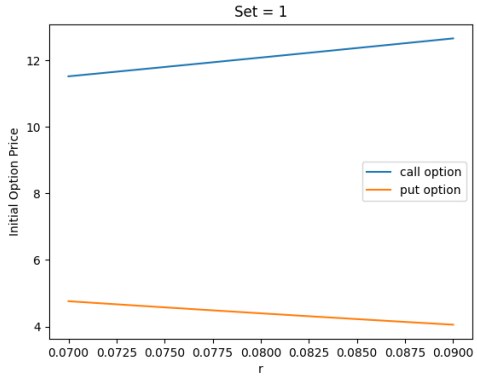
## Q1

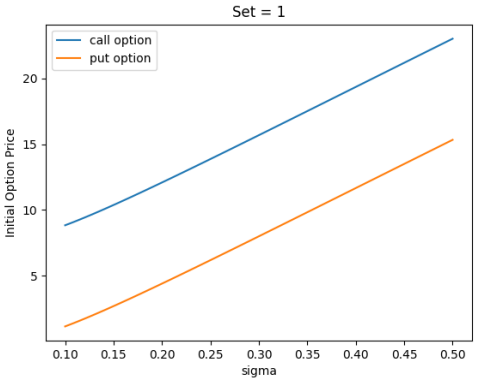
```
Set = 0
initial call option value: 12.085380013710187
initial put option value: 4.397014652374166
Set = 1
initial call option value: 12.12304707401251
initial put option value: 4.434681712676494
```

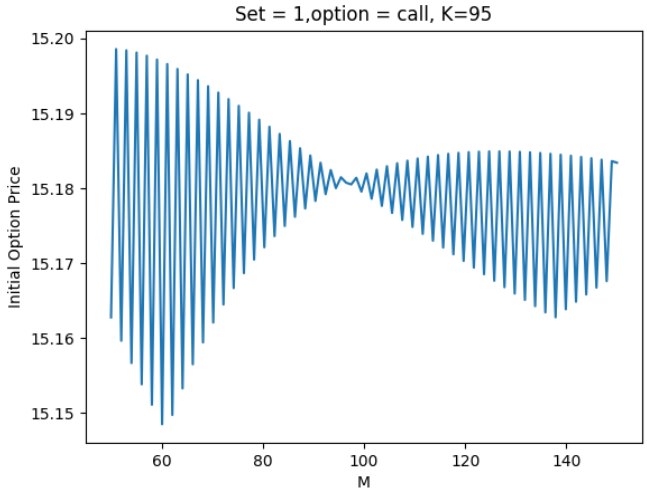
### Set 1

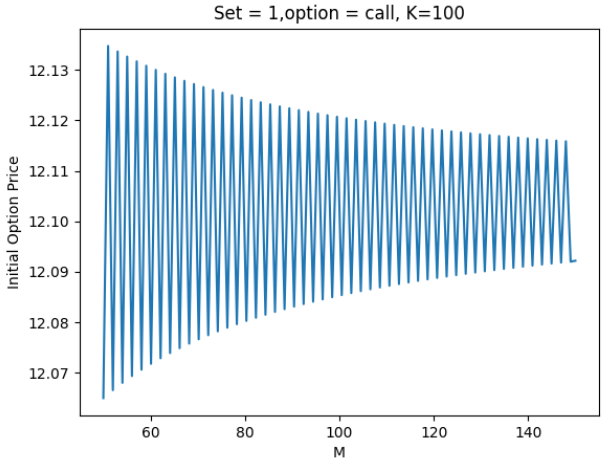


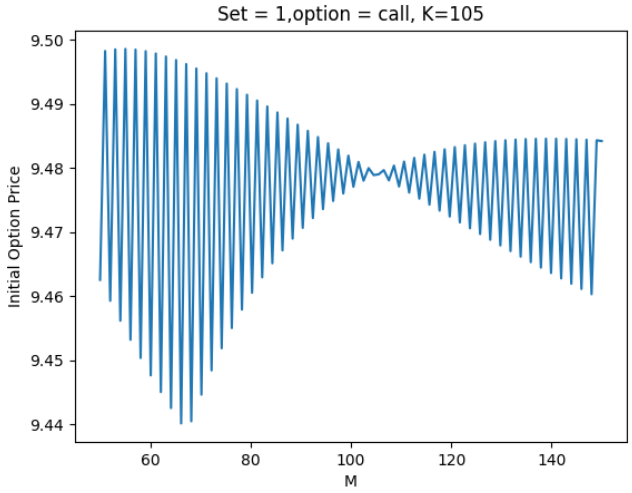



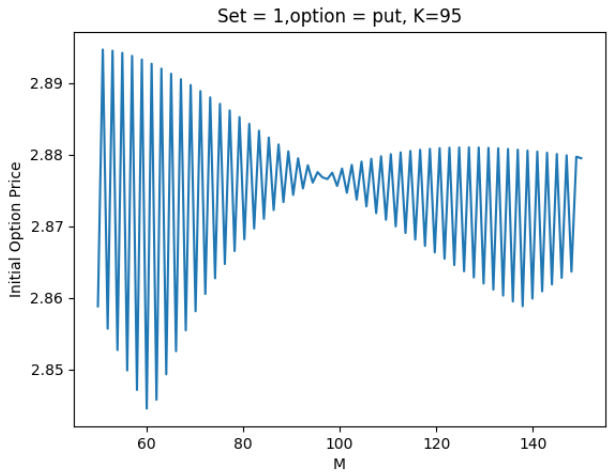



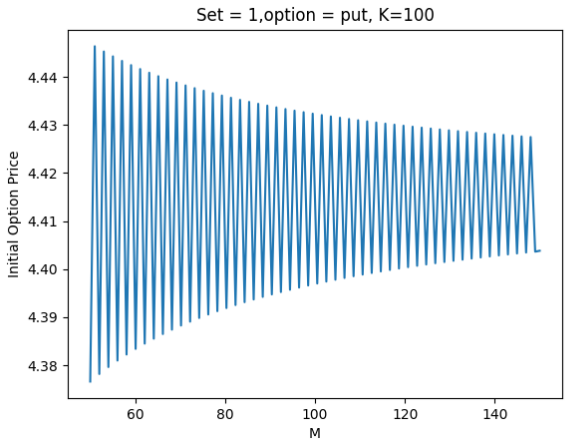



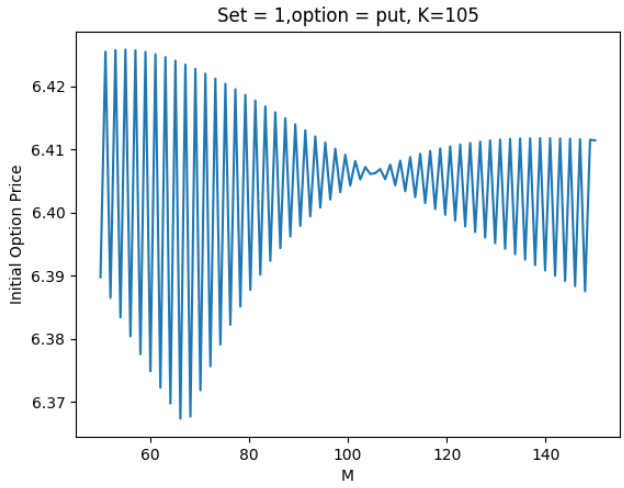

Set = 1,option = call, K=95
Initial Option Price
M
15.20
15.19
15.18
15.17
15.16
15.15
60
80
100
120
140


Set = 1,option = call, K=100
Initial Option Price
M
12.13
12.12
12.11
12.10
12.09
12.08
12.07
60
80
100
120
140

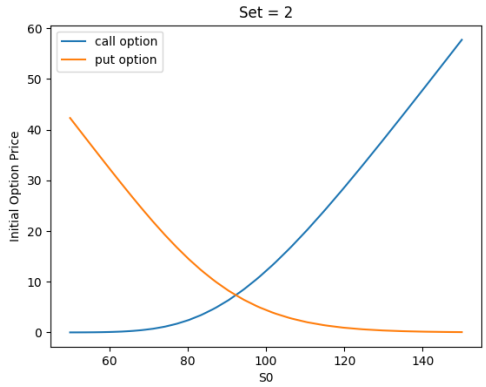

Set = 1,option = call, K=105
Initial Option Price
M
9.50
9.49
9.48
9.47
9.46
9.45
9.44
60
80
100
120
140

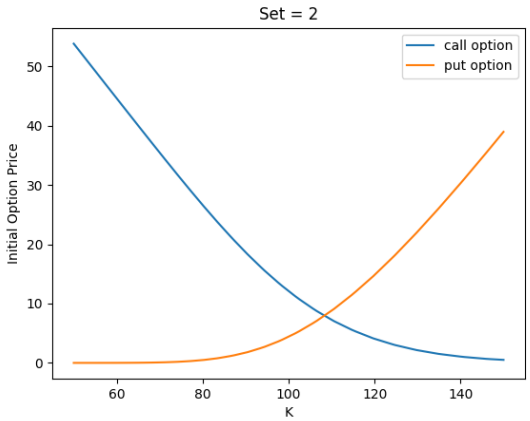

Set = 1,option = put, K=95
Initial Option Price
2.89
2.88
2.87
2.86
2.85
60
80
100
120
140
M

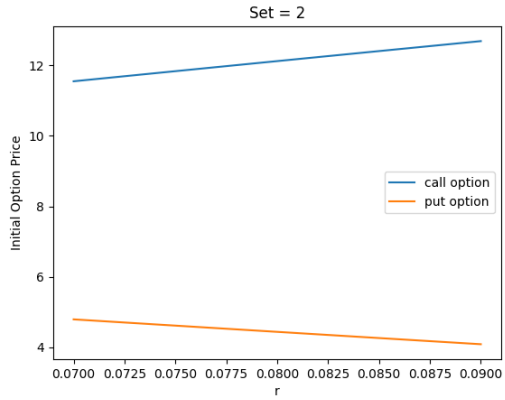

Set = 1,option = put, K=100
Initial Option Price
4.44
4.43
4.42
4.41
4.40
4.39
4.38
60
80
100
120
140
M

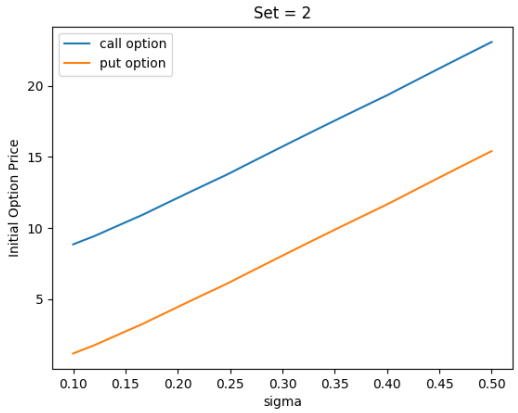

Set = 1,option = put, K=105
Initial Option Price
6.42
6.41
6.40
6.39
6.38
6.37
60
80
100
120
140
M

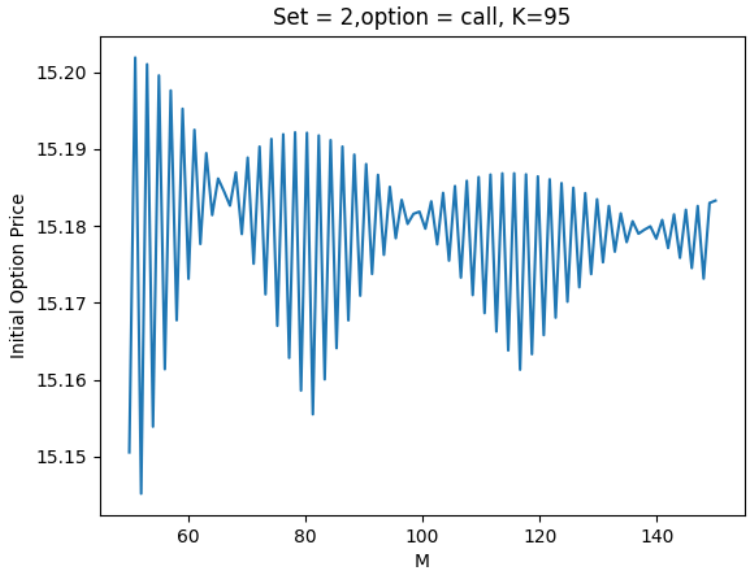
## Set 2

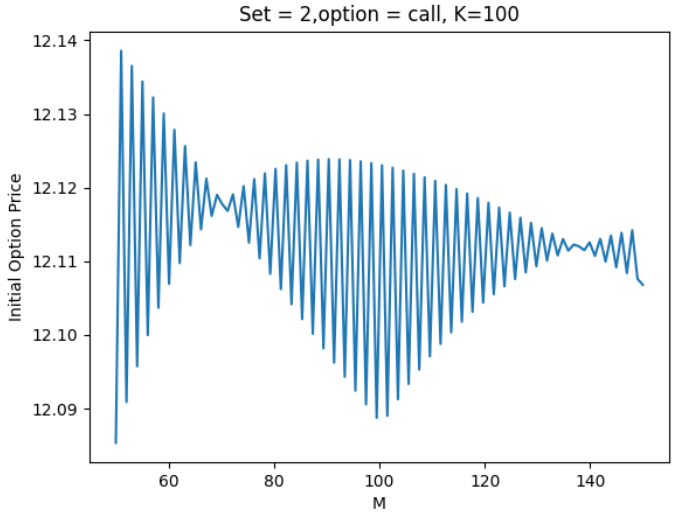

Set = 2
call option
put option
Initial Option Price
S0

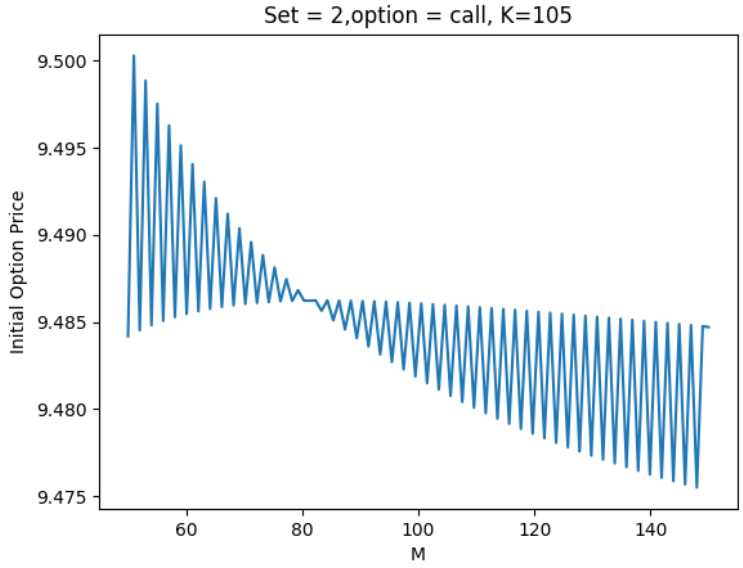

Set = 2
call option
put option
Initial Option Price
K

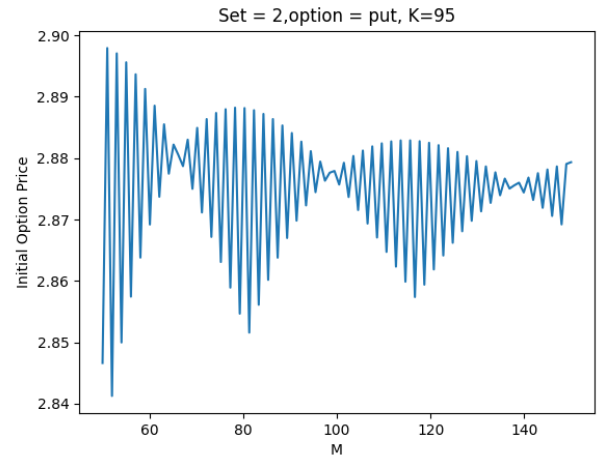

Set = 2
call option
put option
Initial Option Price
r

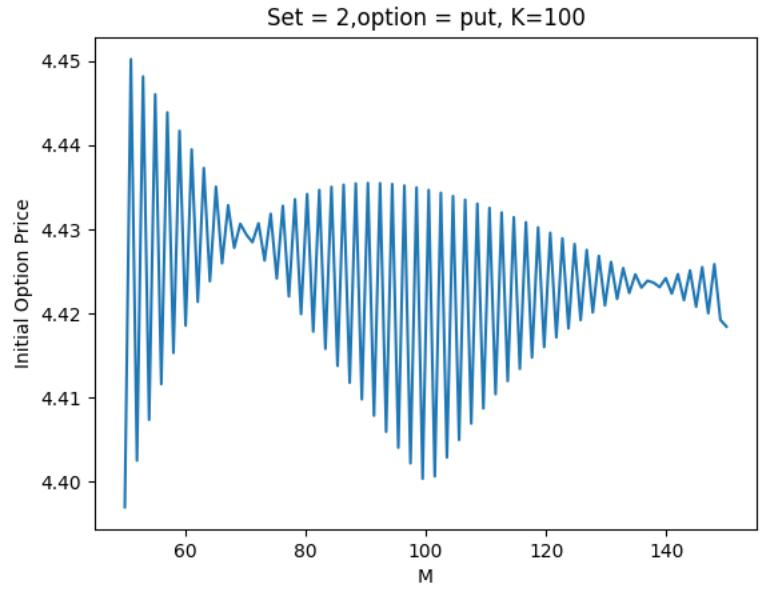

Set = 2
call option
put option
Initial Option Price
sigma

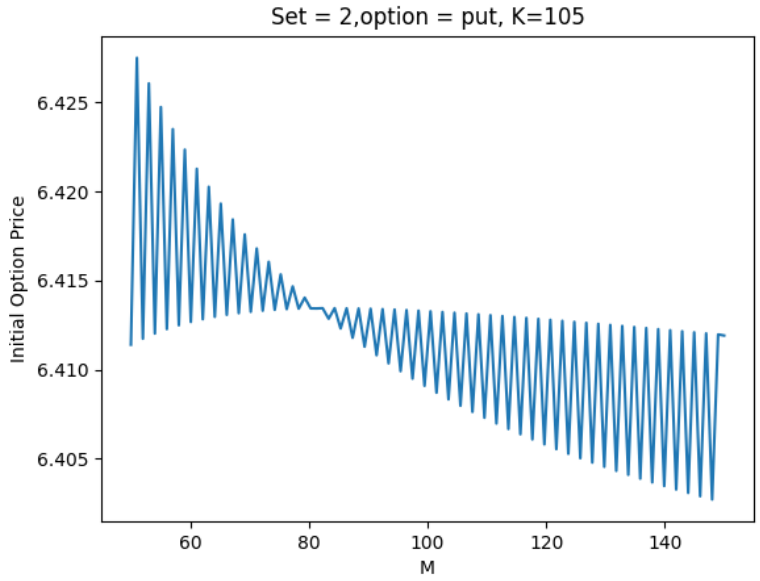

Set = 2,option = call, K=95
Initial Option Price
M


Set = 2,option = call, K=100
Initial Option Price
M
12.14
12.13
12.12
12.11
12.10
12.09
60
80
100
120
140


Set = 2,option = call, K=105
Initial Option Price
M
9.500
9.495
9.490
9.485
9.480
9.475
60
80
100
120
140


Set = 2,option = put, K=95
Initial Option Price
M
2.90
2.89
2.88
2.87
2.86
2.85
2.84
60
80
100
120
140



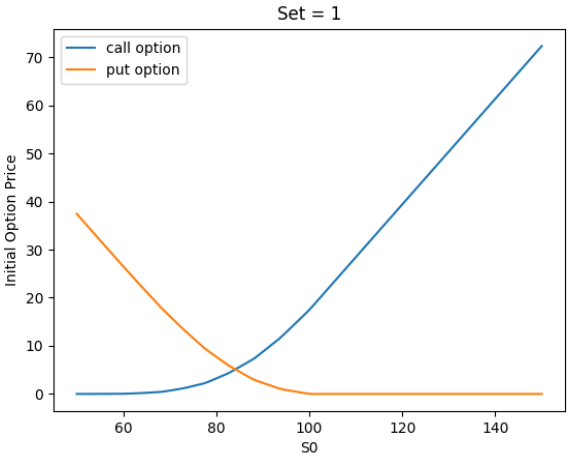



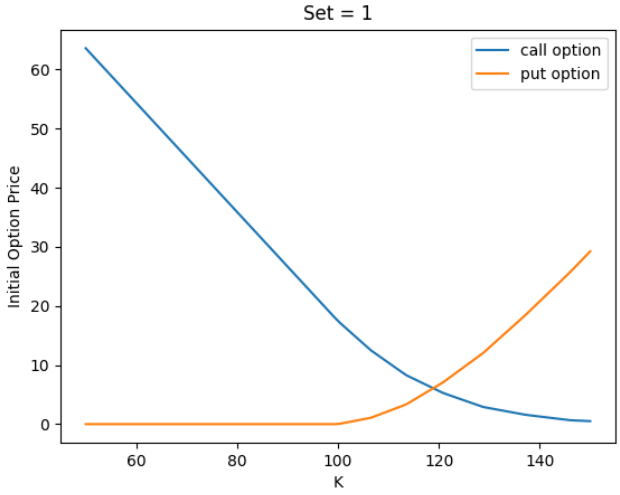

Q2

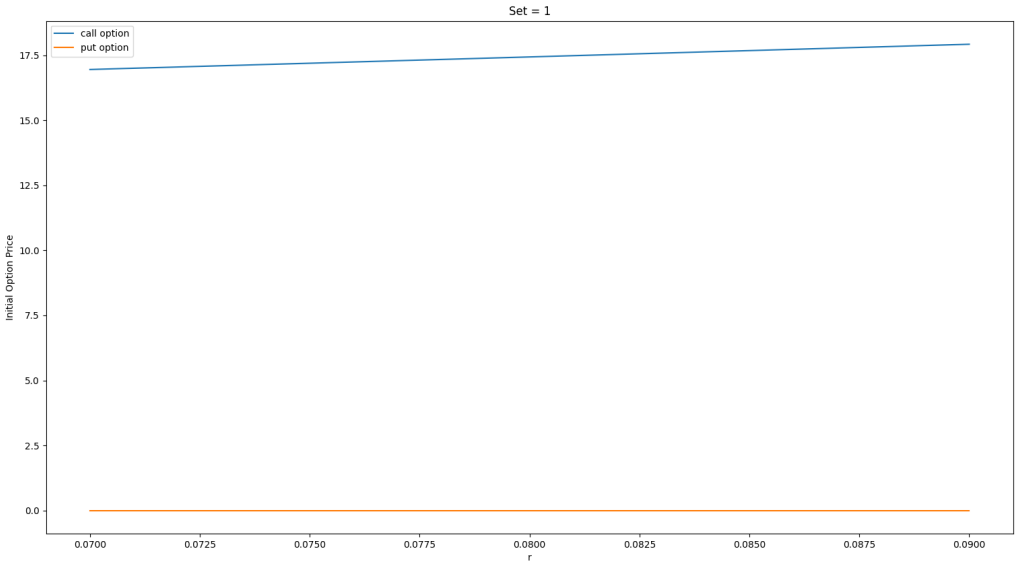
I am taking the loopback option as the path dependent option, i.e, the payoff will depend on the maximum price of the stock since the contract has been issued.

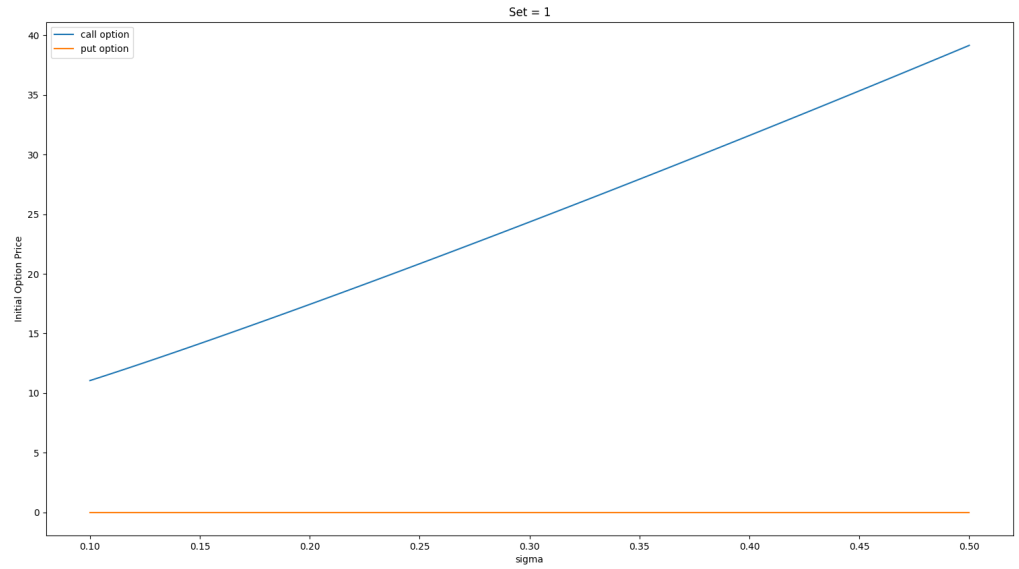
```
Set = 0
initial call option value: 17.438530963574404
initial put option value: 0.0
Set = 1
initial call option value: 17.76894826816747
initial put option value: 0.0
```

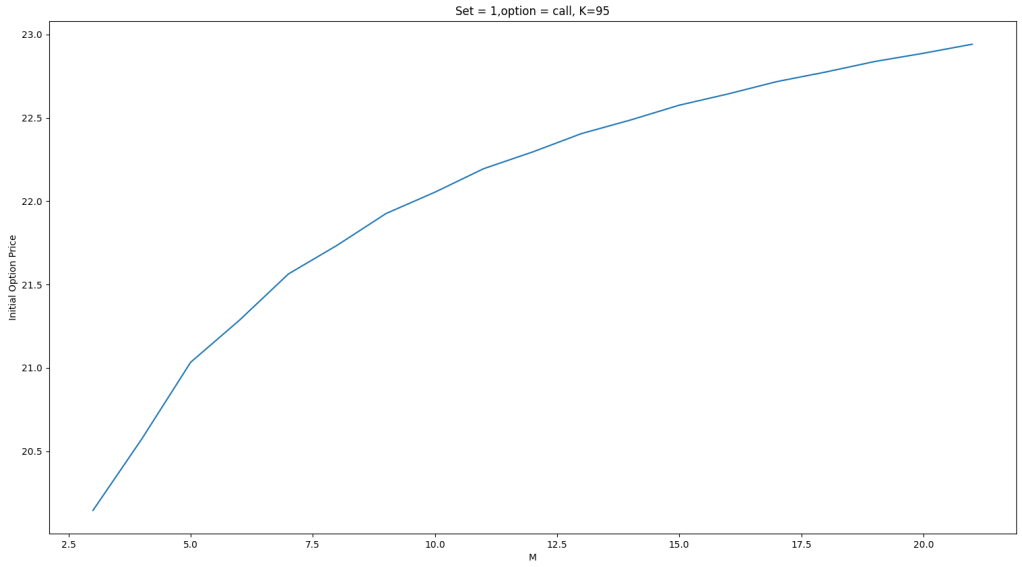
## Set 1

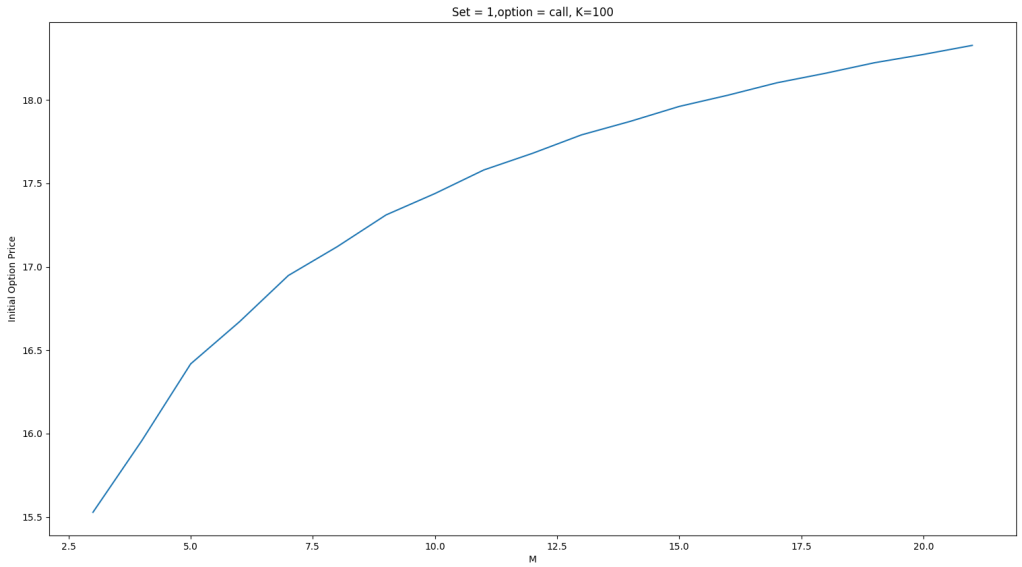

Set = 1
call option
put option
Initial Option Price
S0
0
10
20
30
40
50
60
70
60
80
100
120
140

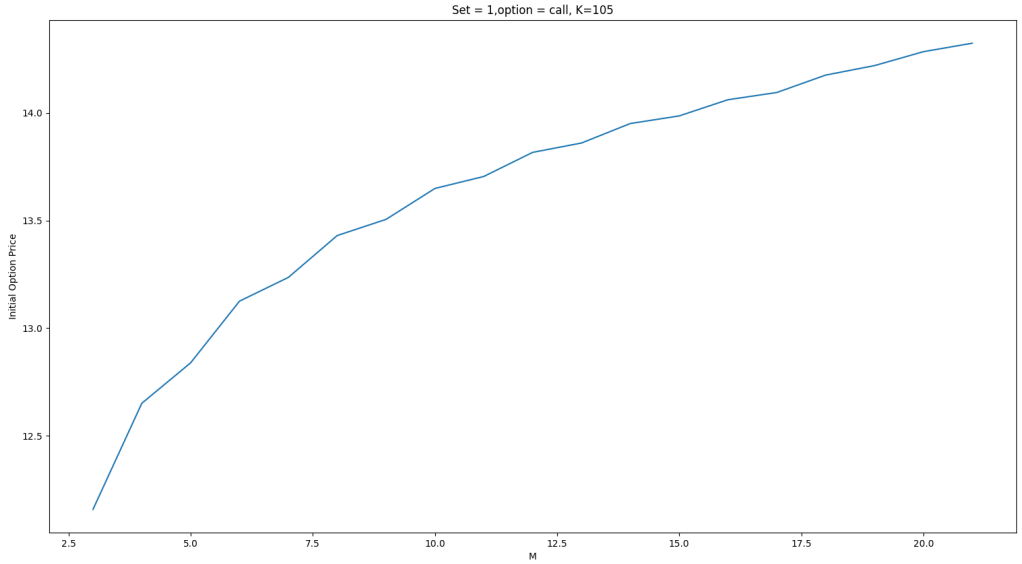

Set = 1
call option
put option
Initial Option Price
K
0
10
20
30
40
50
60
60
80
100
120
140

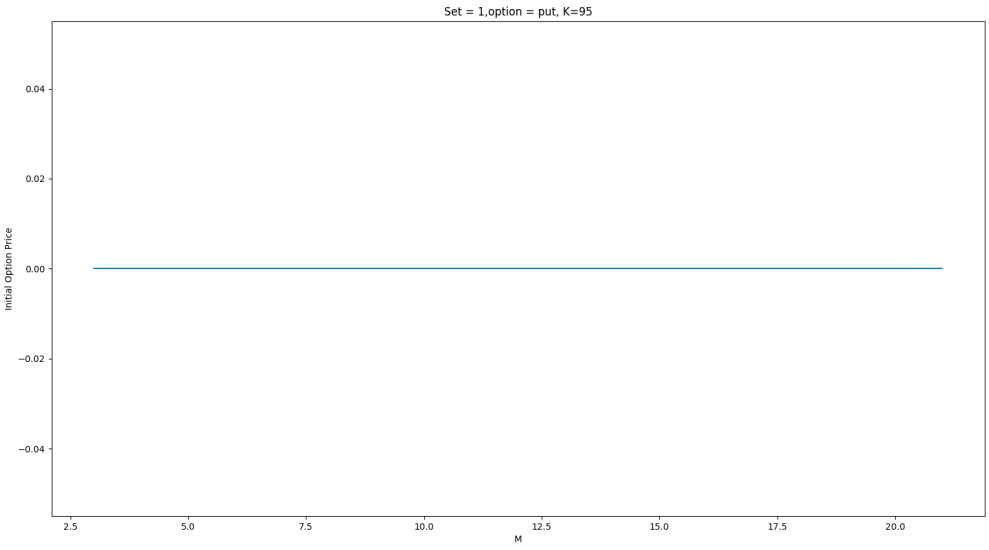

Set = 1
call option
put option
Initial Option Price
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0.0700
0.0725
0.0750
0.0775
0.0800
0.0825
0.0850
0.0875
0.0900
r

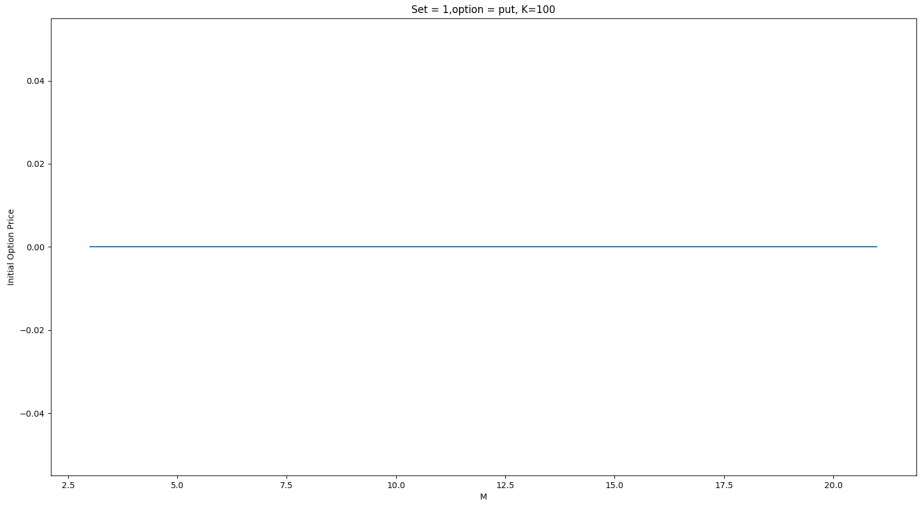

Set = 1
call option
put option
Initial Option Price
40
35
30
25
20
15
10
5
0
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
sigma

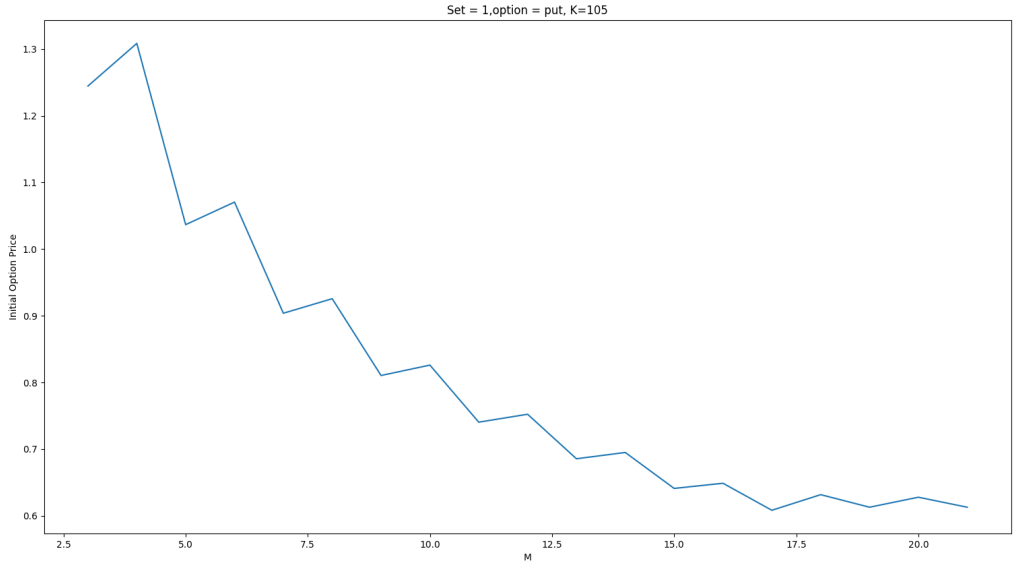

Set = 1,option = call, K=95
Initial Option Price
M
23.0
22.5
22.0
21.5
21.0
20.5
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Set = 1,option = call, K=100
Initial Option Price
M
18.0
17.5
17.0
16.5
16.0
15.5
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

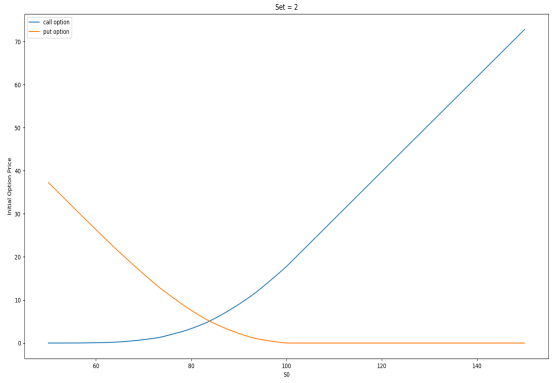

Set = 1,option = call, K=105
Initial Option Price
14.0
13.5
13.0
12.5
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
M

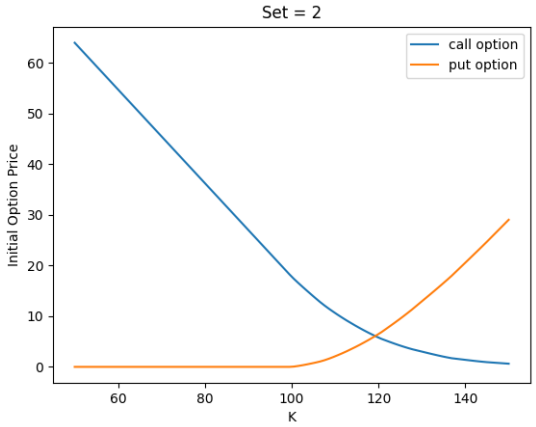

Set = 1,option = put, K=95
Initial Option Price
0.04
0.02
0.00
−0.02
−0.04
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
M

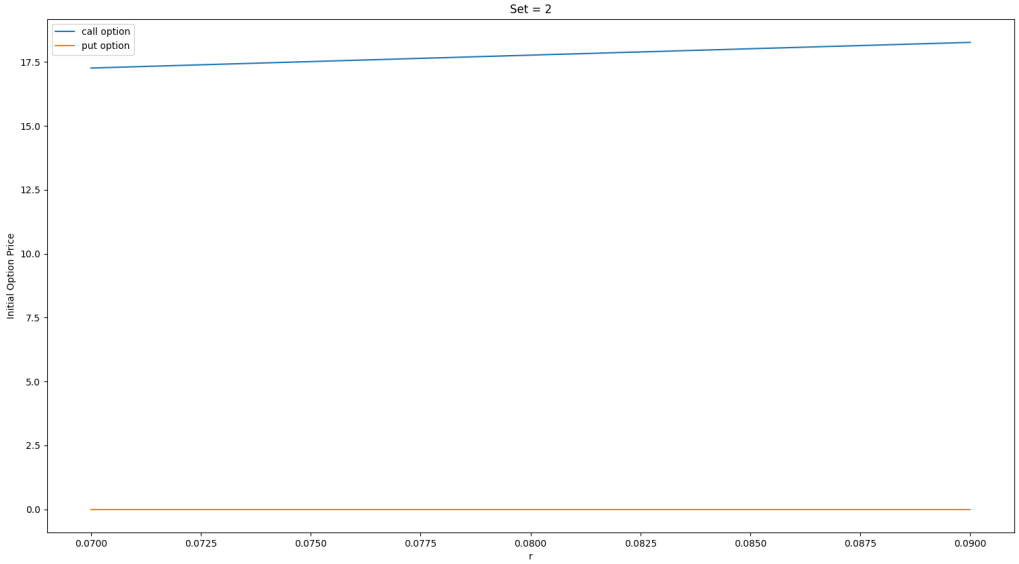

Set = 1,option = put, K=100
Initial Option Price
M
0.04
0.02
0.00
−0.02
−0.04
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

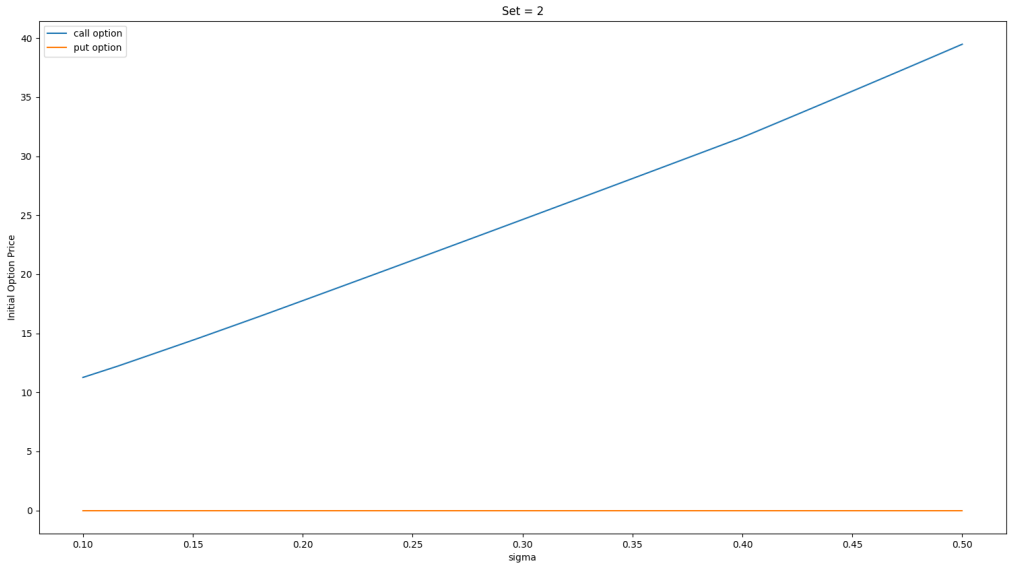

Set = 1,option = put, K=105
Initial Option Price
M
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

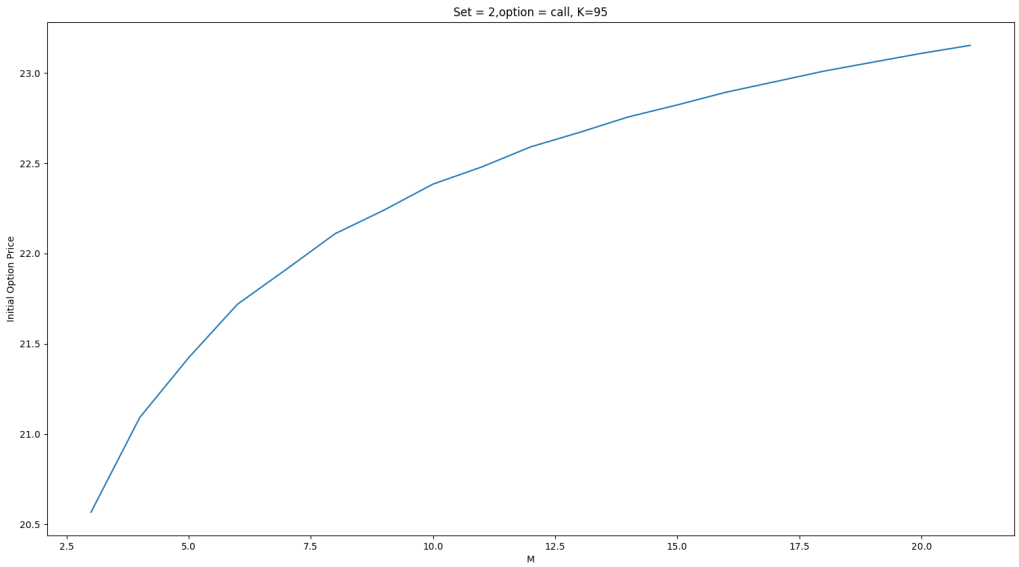
## Set 2

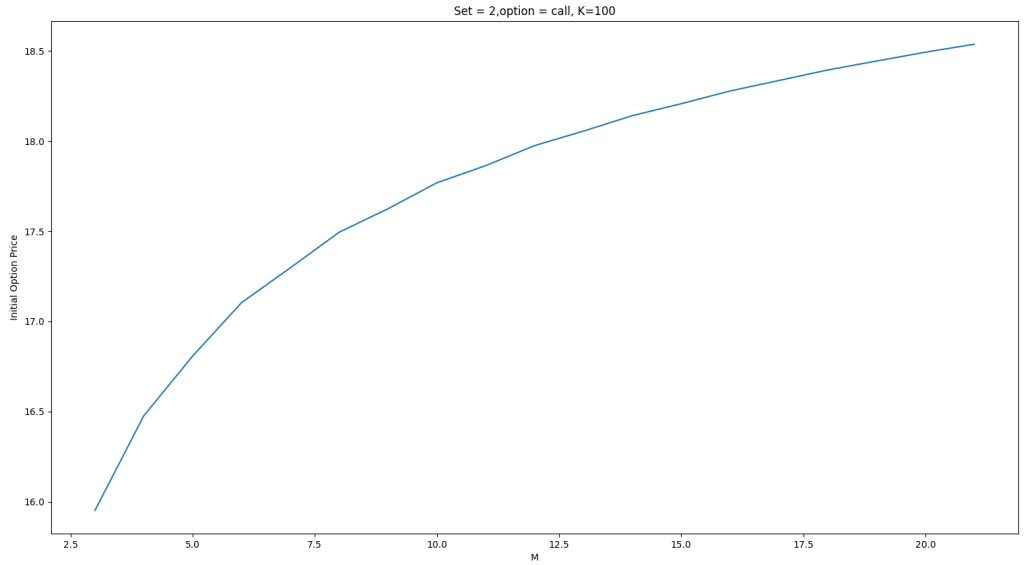

Set = 2
call option
put option
Initial Option Price
60
80
100
120
140
50

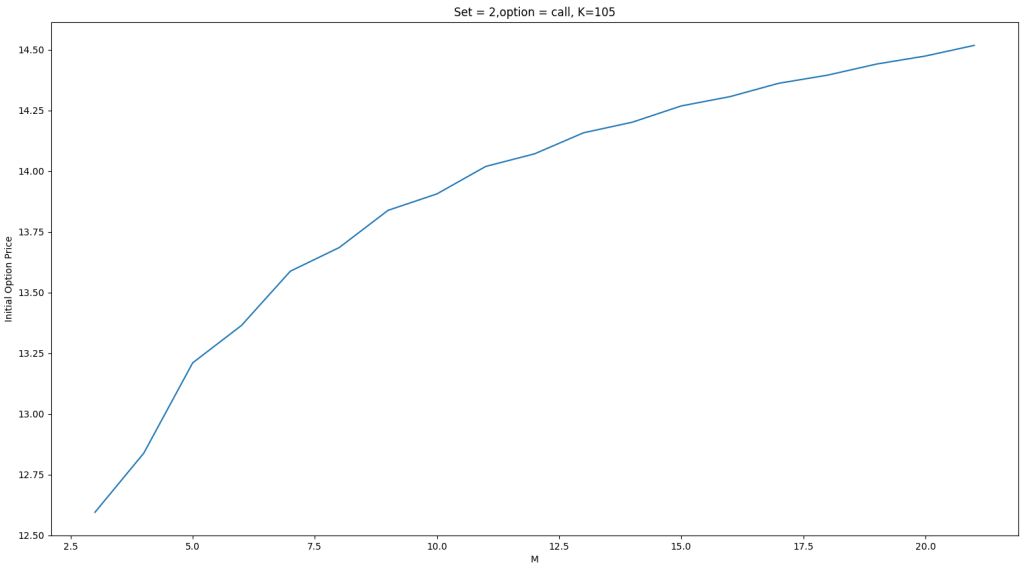

Set = 2
call option
put option
Initial Option Price
0
10
20
30
40
50
60
60
80
100
120
140
K

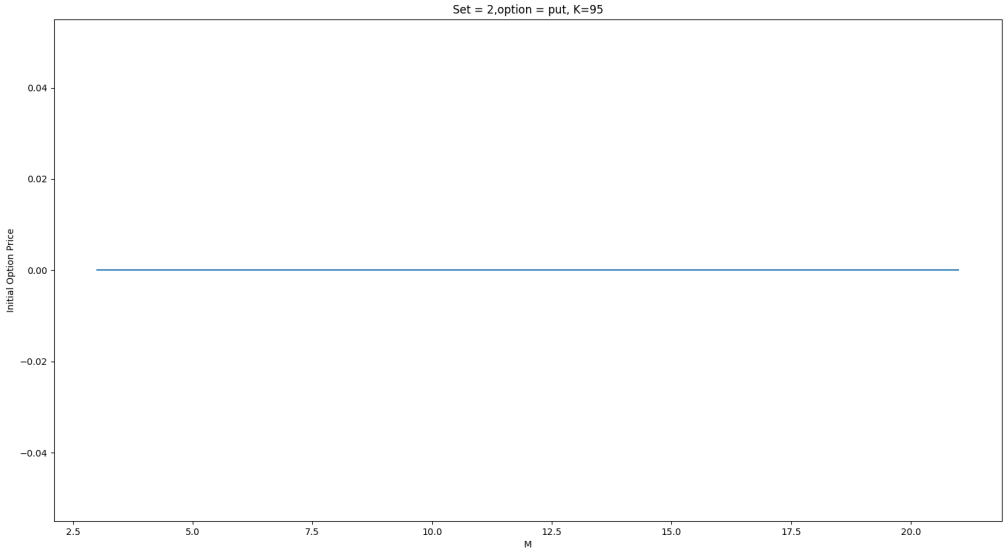

Set = 2
call option
put option
Initial Option Price
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
0.0700
0.0725
0.0750
0.0775
0.0800
0.0825
0.0850
0.0875
0.0900
r

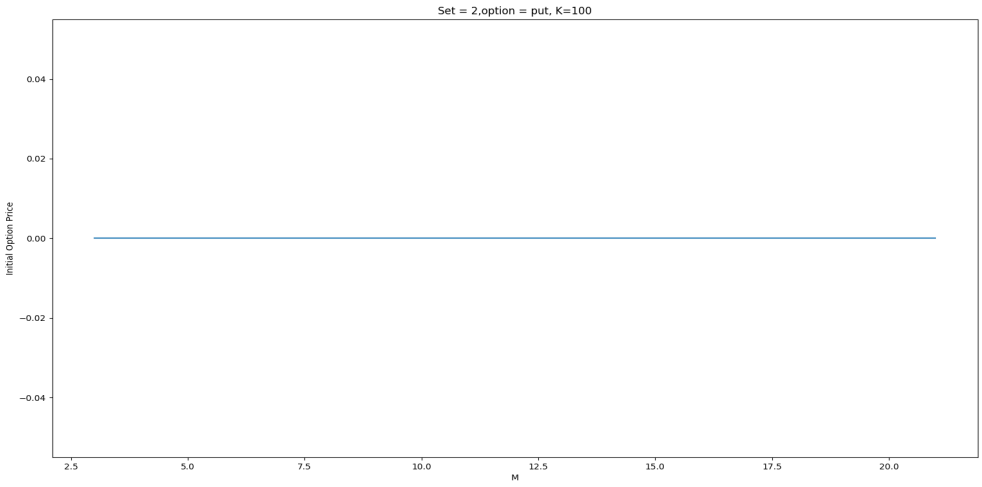

Set = 2
call option
put option
Initial Option Price
sigma
0
5
10
15
20
25
30
35
40
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50

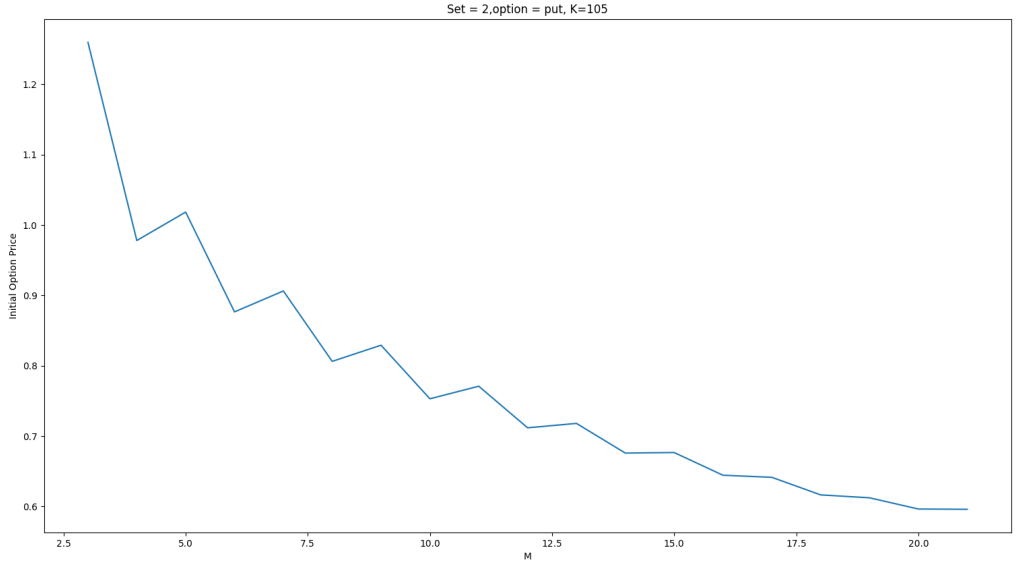

Set = 2,option = call, K=95
Initial Option Price
M
20.5
21.0
21.5
22.0
22.5
23.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Set = 2,option = call, K=100
Initial Option Price
M
18.5
18.0
17.5
17.0
16.5
16.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Set = 2,option = call, K=105
Initial Option Price
M
14.50
14.25
14.00
13.75
13.50
13.25
13.00
12.75
12.50
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Set = 2,option = put, K=95
Initial Option Price
0.04
0.02
0.00
−0.02
−0.04
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
M




## Observations

In the case of the put option, the payoff is $(-\max(S)+K)^+$. Since S(0)= 100, max(S)>=100. Hence if K<=100, -max(S)+K<=0, which means that $(-\max(S)+K)^+ = 0$

Thus, if K is 95 or 100, the value of the put option is 0, as we can see from the graphs.