

Lab - 01

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Binomial Asset Pricing Model

In the Binomial Asset Pricing Model, the following condition must be satisfied to ensure no arbitrage: -

$$0 < d < e^r < u$$

Where, r = risk-free interest rate.

u = up-factor.

d = down-factor.

Ques-1: -

M	Call price	Put price
1	43.690448	25.464531
5	41.354882	23.128964
10	41.590750	23.364832
20	41.463404	23.237486
50	41.227779	23.001861
100	41.191562	22.965644
200	41.252254	23.026336
400	41.231376	23.005458

Observation: - The initial call and put option prices are converging to around 41.23 and 23.005 respectively.

How large can M be: - The result is getting more and more accurate with increasing value of M , so, theoretically M can be set to infinity to mimic a continuous model. But in practice, M can be set according to the acceptable tolerance of the error in derivative prices. This can save computation time and resources.

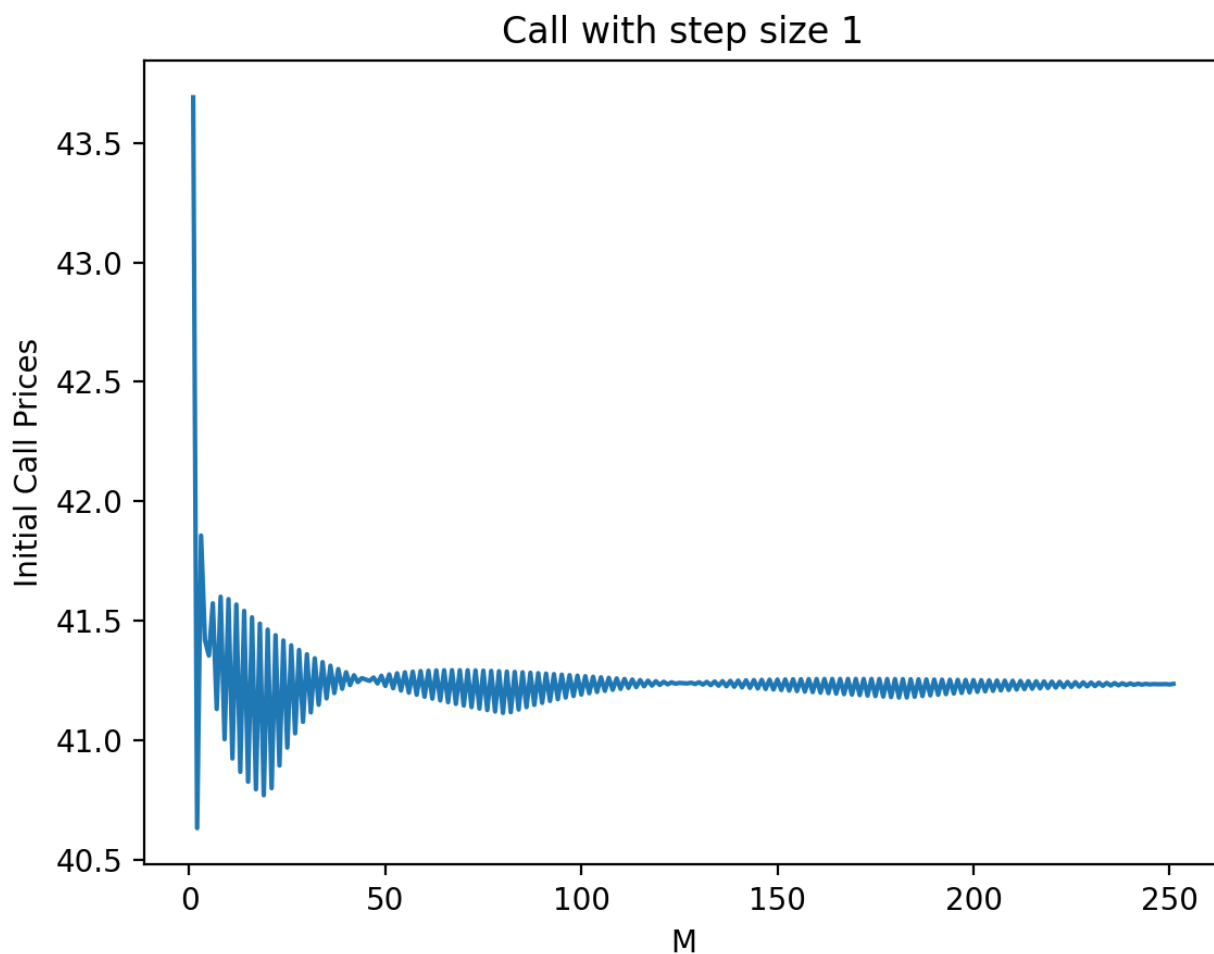
Ques-2: -

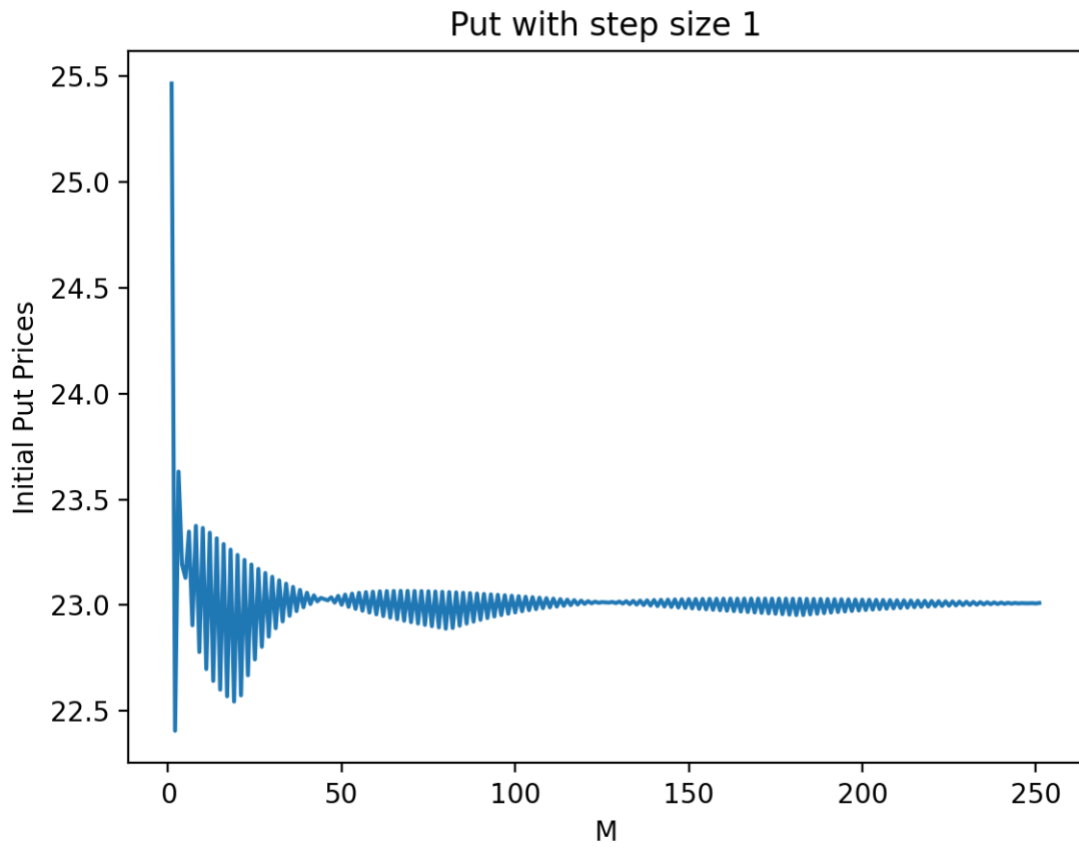
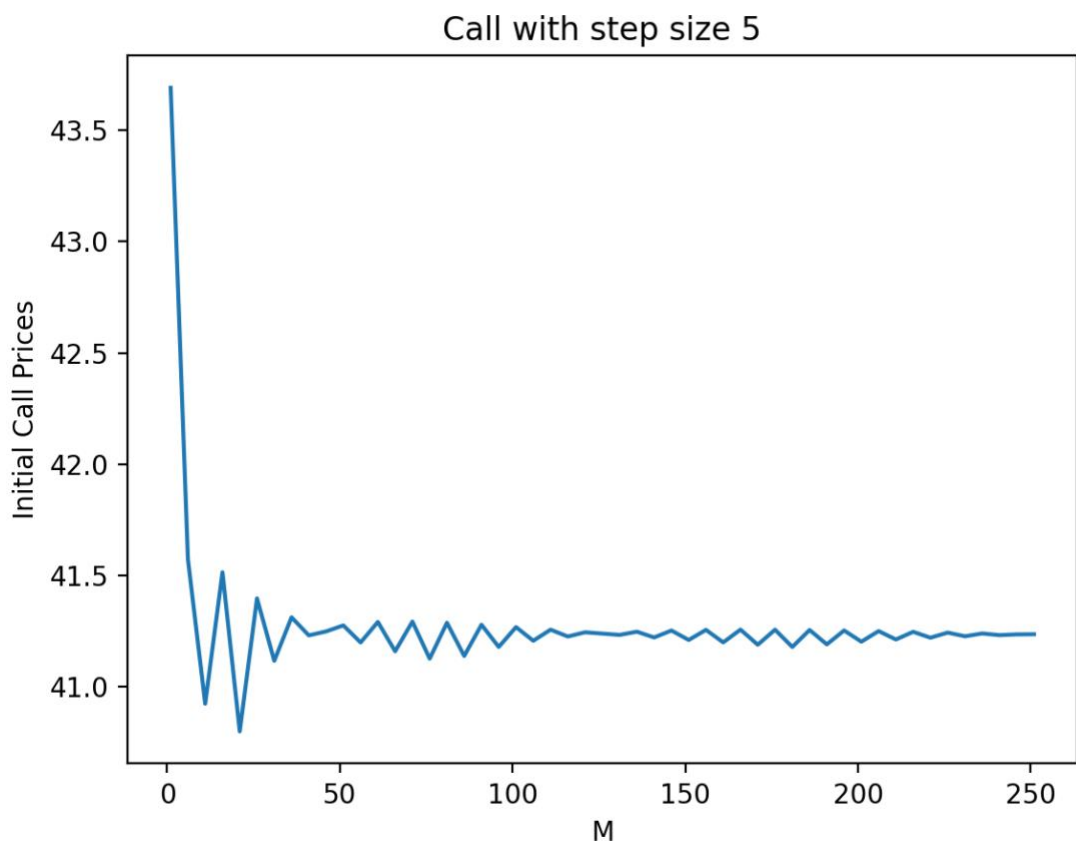
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M = 1 to 250 taking step size = 1.  
No arbitrage condition satisfied for all configurations.
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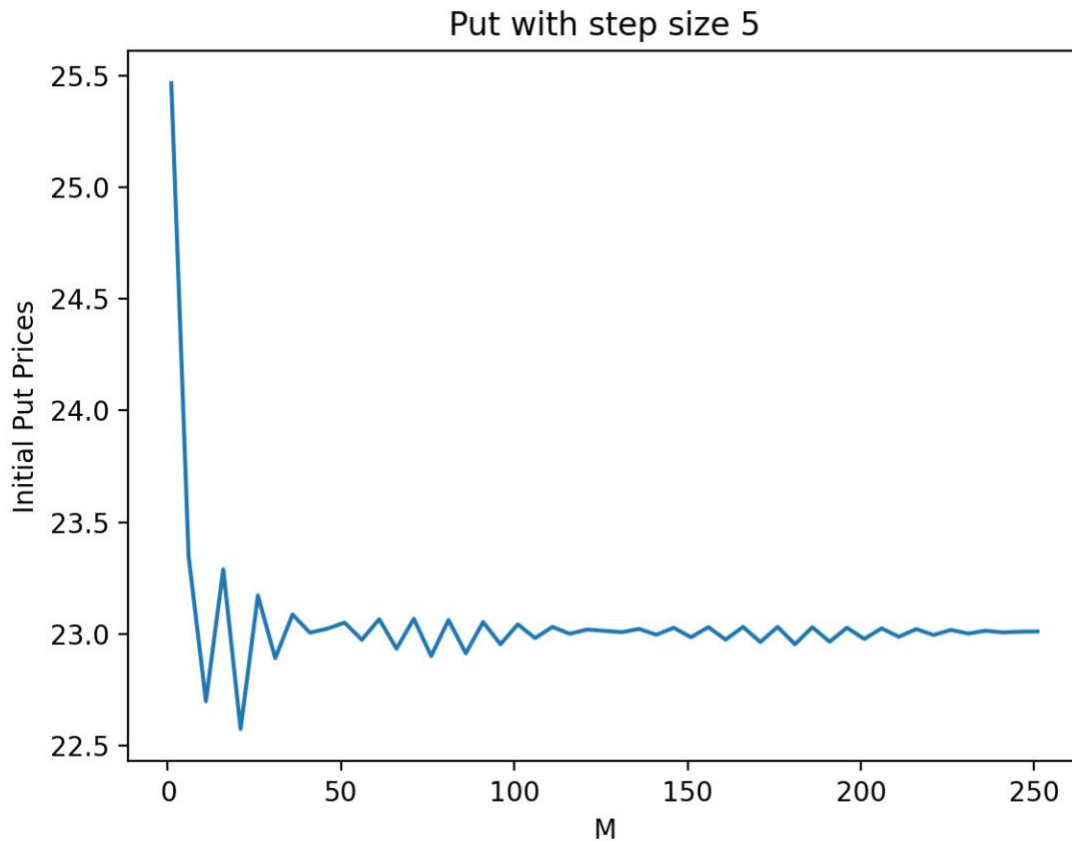
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Call option price: 41.23629993289957  
Put option price: 23.010382155397004
```

```
M = 1 to 250 taking step size = 5.  
No arbitrage condition satisfied for all configurations.
```

```
Call option price: 41.23629993289957  
Put option price: 23.010382155397004
```







Observation: - Final values after converging are same irrespective of the size of step taken, but the convergence speed with step size of 5 is greater than step size of 1. As a result, oscillations about the converging value are less in graph of step size 5.

Ques-3: -

T = 4.5		
	Call Price	Put Price
0	3095.238437	0.000000
1	2041.038658	0.000000
2	1334.387414	0.000000
3	860.704919	0.000000
4	543.186048	0.000000
5	330.346783	0.000000
6	187.676358	0.000000
7	92.041511	0.000000
8	32.544848	4.609291
9	5.713814	20.749764
10	0.000000	43.840612
11	0.000000	63.148954
12	0.000000	76.091723
13	0.000000	84.767521
14	0.000000	90.583082
15	0.000000	94.481369
16	0.000000	97.094469
17	0.000000	98.846082
18	0.000000	100.020224

T = 3.0		
	Call Price	Put Price
0	912.434537	0.000000
1	580.300951	0.000000
2	357.731699	0.066549
3	209.127321	0.699410
4	111.824978	3.433781
5	51.891331	10.556749
6	19.500857	23.115667
7	5.421859	39.167148
8	0.971959	54.914313
9	0.083160	67.564011
10	0.000000	76.555976
11	0.000000	82.639215
12	0.000000	86.716932

T = 1.5

	Call Price	Put Price
0	231.471732	2.212378
1	130.634789	6.016624
2	67.555182	13.080104
3	31.010664	23.553903
4	12.189009	36.249569
5	3.936235	49.123486
6	0.992388	60.341285

T = 1.0

	Call Price	Put Price
0	136.669118	6.659221
1	72.389701	13.582968
2	34.584379	23.506555
3	14.473872	35.389691
4	5.137162	47.498962

T = 0.5

	Call Price	Put Price
0	77.090785	13.973555
1	38.063851	23.396860
2	16.753059	34.563234

T = 0.0

	Call Price	Put Price
0	41.463404	23.237486