Lab-2

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Q1.

Set-1

Call price: 15.681760451598663

Put price: 7.99339509026264

Set-2

Call price: 15.736778626185748

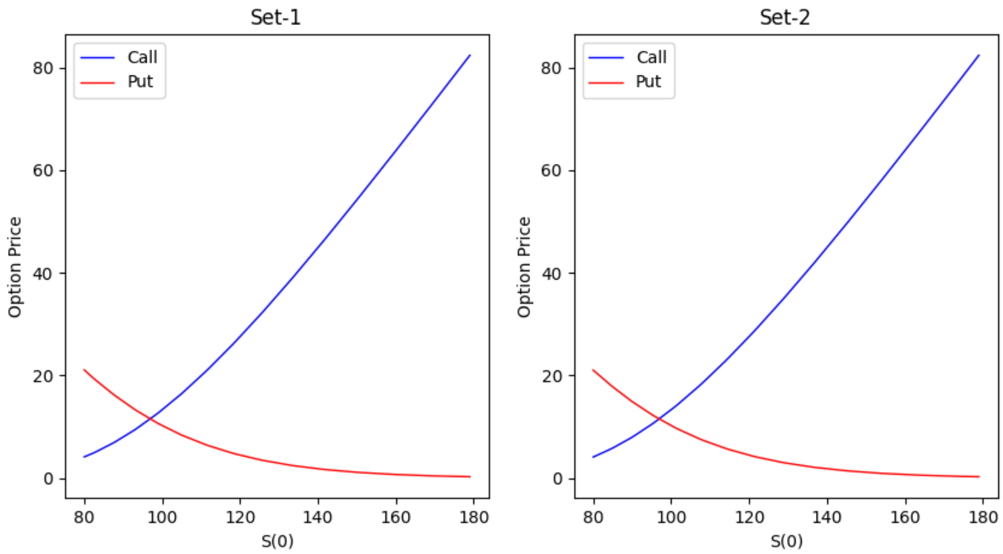
Put price: 8.048413264849748

Binomial Pricing Algorithm:

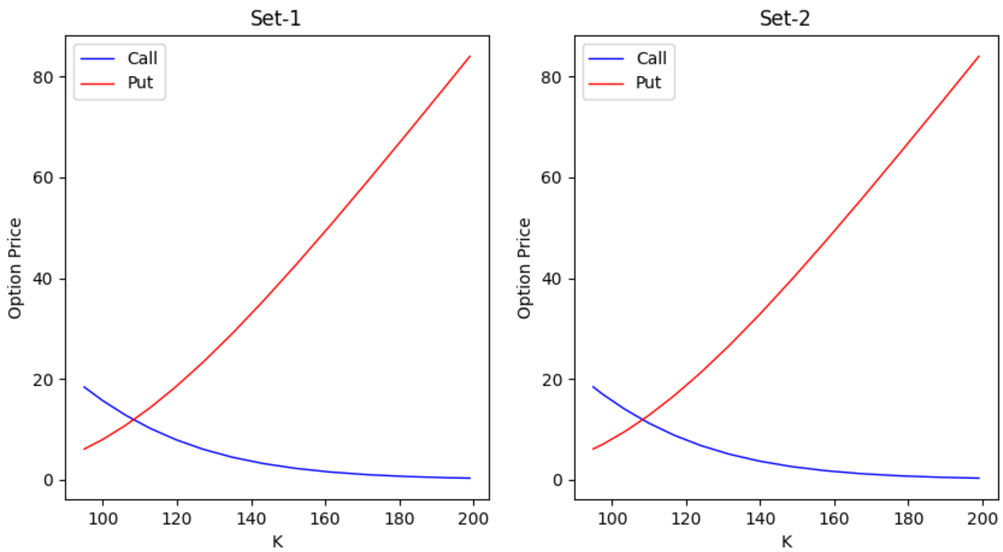
1. At time $t = t_i$ ($i \cdot \delta t$), there are $i + 1$ possible asset prices, i.e., $S_{n,i} = d_i - n \cdot u^n \cdot S_0, 0 \leq n \leq i$.
2. Since continuous compounding convention is used, gross return is $R = e^{r \cdot \delta t}$.
3. The probability (p) of an upward return in price is $R - \frac{d}{u-d}$.
4. At expiry, i.e., $t = T$, we calculate the price of the option using the respective payoff function for both the call and put option, i.e.,
   $C_{n,M} = \max(S_{n,M} - K, 0), 0 \leq n \leq M,$
   $P_{n,M} = \max(K - S_{n,M}, 0), 0 \leq n \leq M,$
   where $C_{n,M}$ is the nth possible price of the call option for the Mth interval, and $P_{n,M}$ is the nth possible price of the put option for the Mth interval.
5. Now, we continuously apply Backward Induction to find out the option price at $t = 0$ by using the following relation:
   $C_{n,i} = (1 - p) \cdot C_{n+1,i+1} + p \cdot C_{n,i+1}, 0 \leq n \leq i$ and $0 \leq i \leq M - 1,$
   $P_{n,i} = (1 - p) \cdot C_{n+1,i+1} + p \cdot P_{n,i+1}, 0 \leq n \leq i$ and $0 \leq i \leq M - 1.$
6. $C_{0,0}$ and $P_{0,0}$ are the required values, i.e., initial option prices.

Sensitivity Analysis:

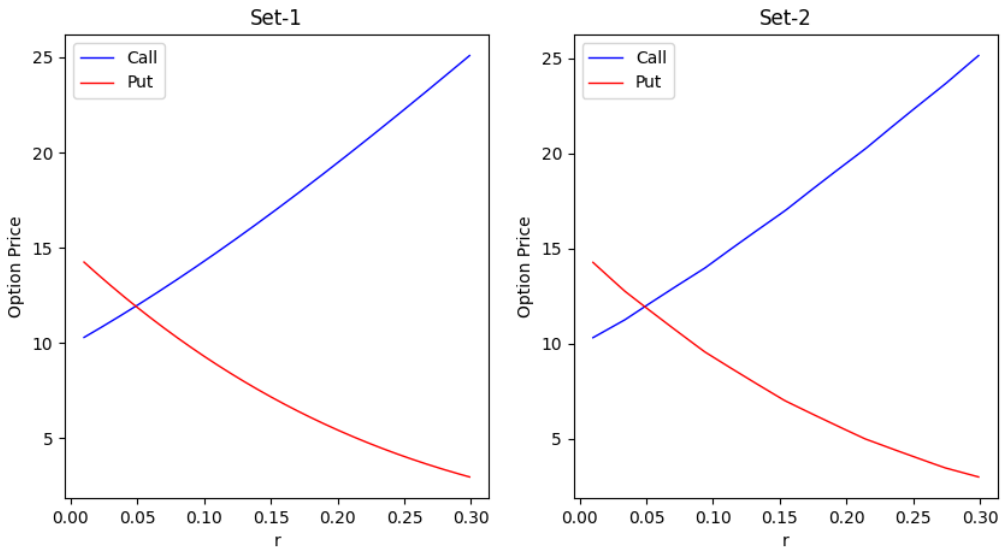
a)



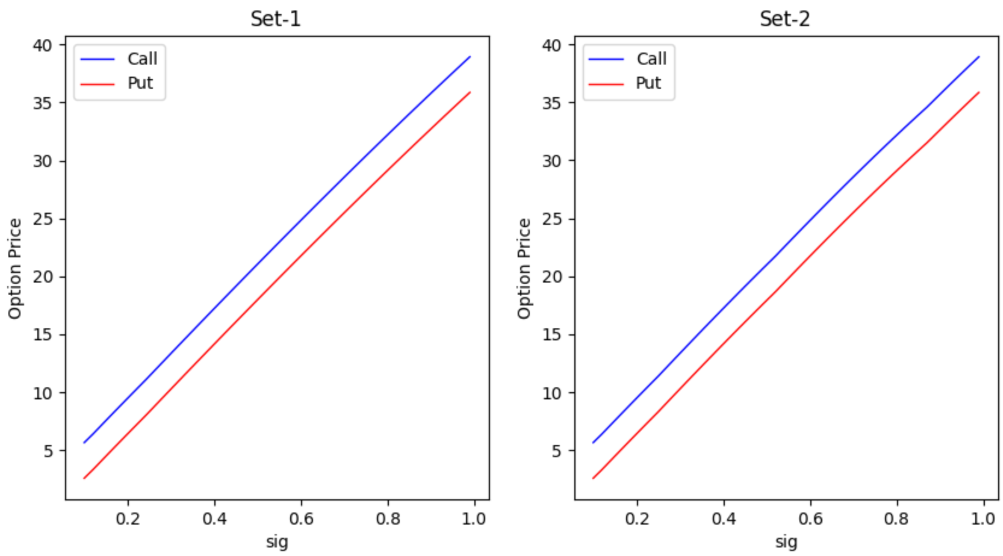
b)



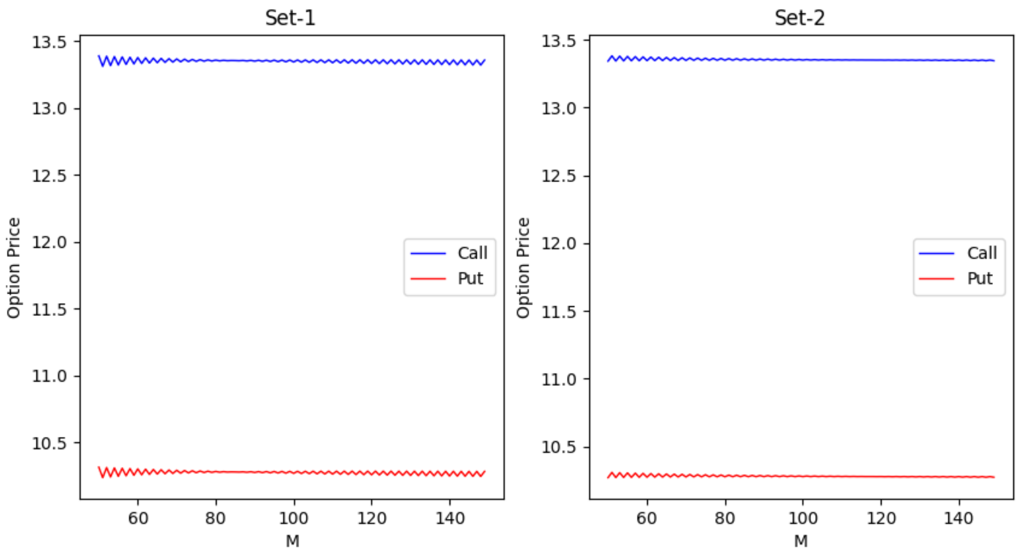
c)


Set-1
Set-2
Call
Put
Option Price
r
0.00
0.05
0.10
0.15
0.20
0.25
0.30
5
10
15
20
25

d)


Set-1
Set-2
Call
Put
Option Price
sig
0.2
0.4
0.6
0.8
1.0
5
10
15
20
25
30
35
40

e)



Q2)

S0=100

K=100

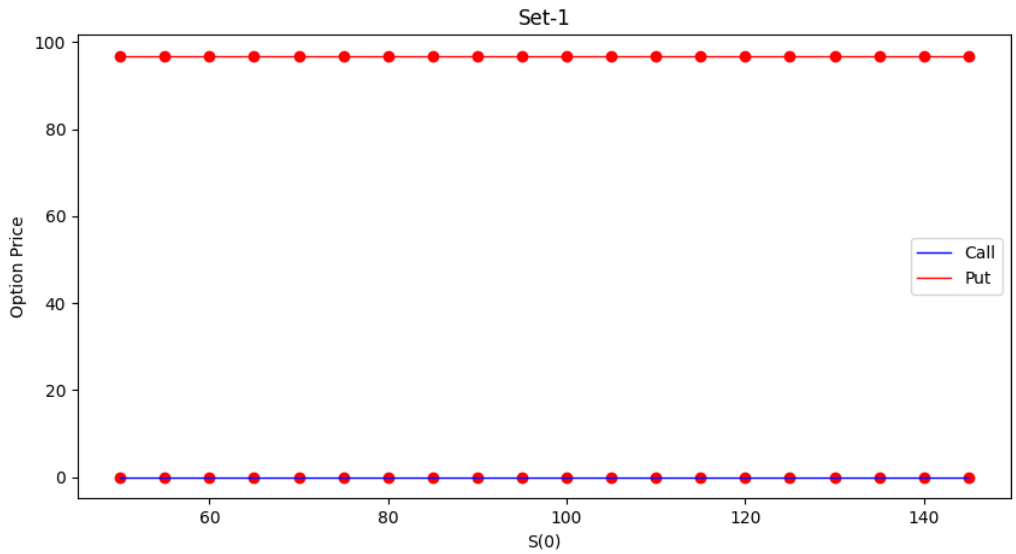
r=0.08

sigma=0.3

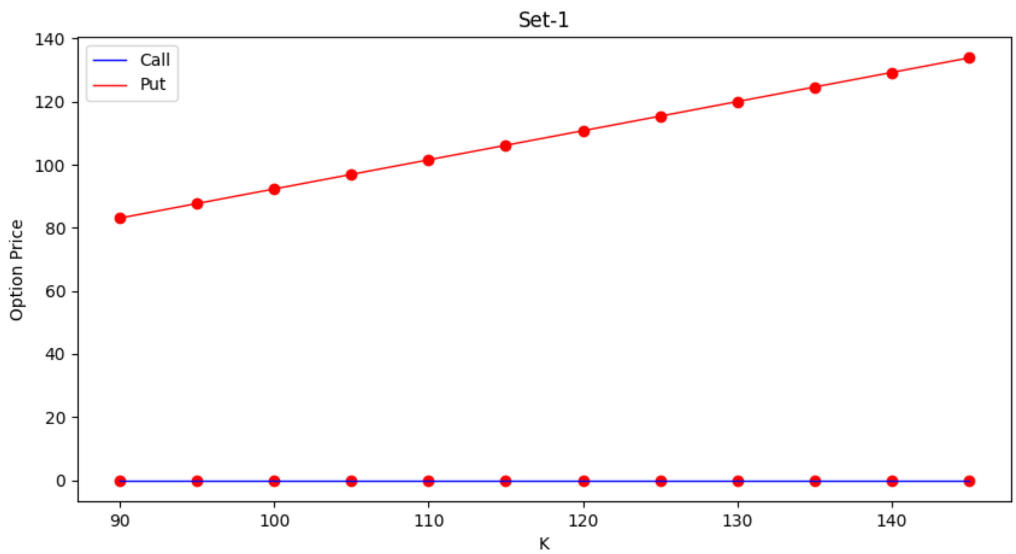
M=15

The **payoff for Asian Call Option** at expiry T is max($\frac{1}{N}\sum_{i=1}^{N} S(t_i)$ - K, 0), while the same **payoff for Asian Put Option** is max(K - $\frac{1}{N}\sum_{i=1}^{N} S(t_i)$, 0).

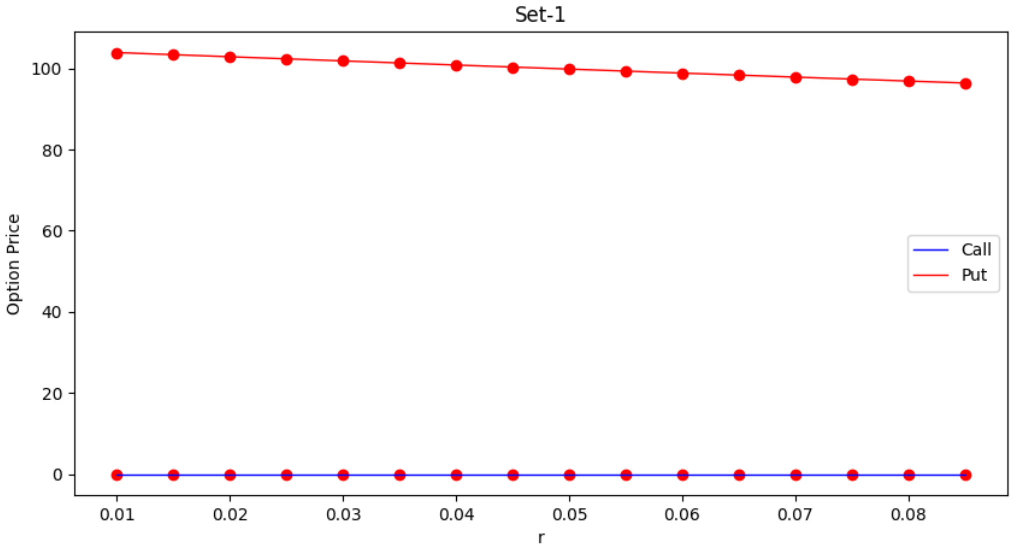
a)


Set-1
Option Price
S(0)
0
20
40
60
80
100
60
80
100
120
140
Call
Put

b)

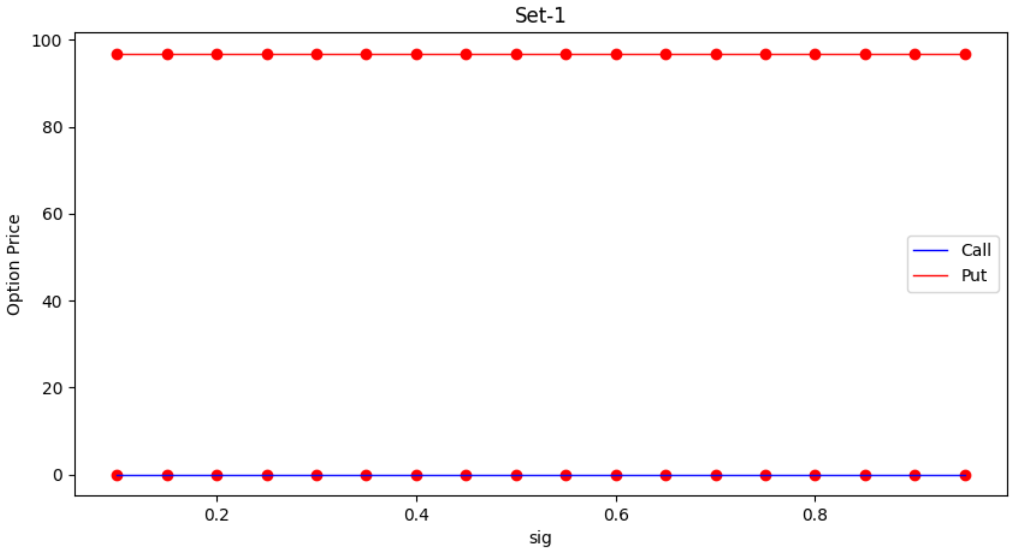

Set-1
Option Price
K
0
20
40
60
80
100
120
140
90
100
110
120
130
140
Call
Put

c)



Set-1
Option Price
r
Call
Put
100
80
60
40
20
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08

d)



Set-1
Option Price
sig
Call
Put
100
80
60
40
20
0
0.2
0.4
0.6
0.8

e)