

# MA-374 Lab Assignment 2

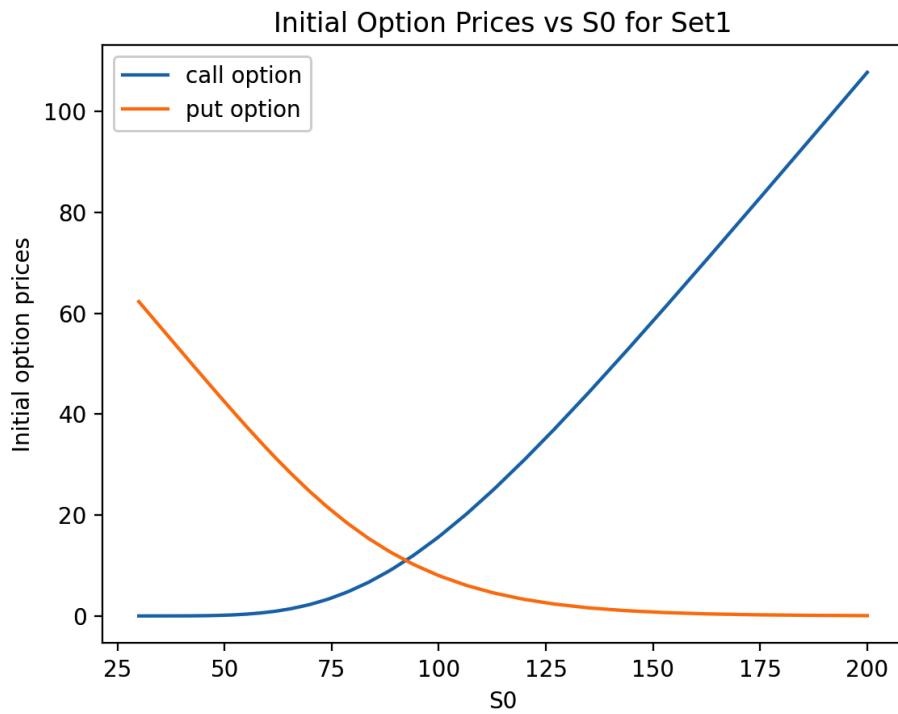
By-Arush Gupta  
210123008

## Question 1

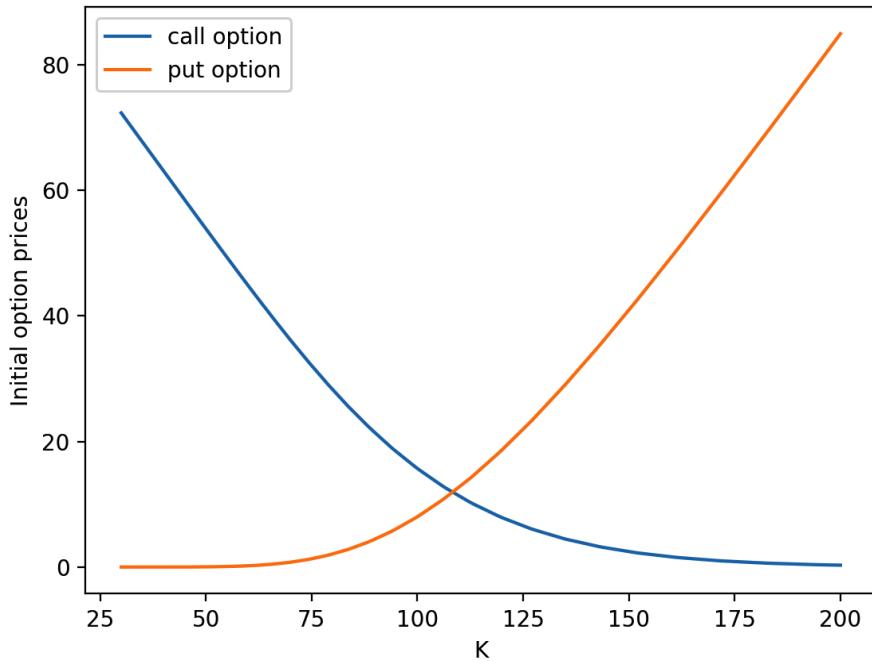
```
(base) arushgupta@depressed-guy:~/Desktop/Fe2lab% python '/Users/arushgupta/Desktop/Fe2lab/08g.arushMA374lab02/q1.py'  
*****  
Initial Call option price for SET1 is 15.68176045159868  
Initial Put option price for SET1 is 7.993395090262701  
*****  
Initial Call option price for SET2 is 15.736778626185815  
Initial Put option price for SET2 is 8.0484132648498
```

## 2D Graphs

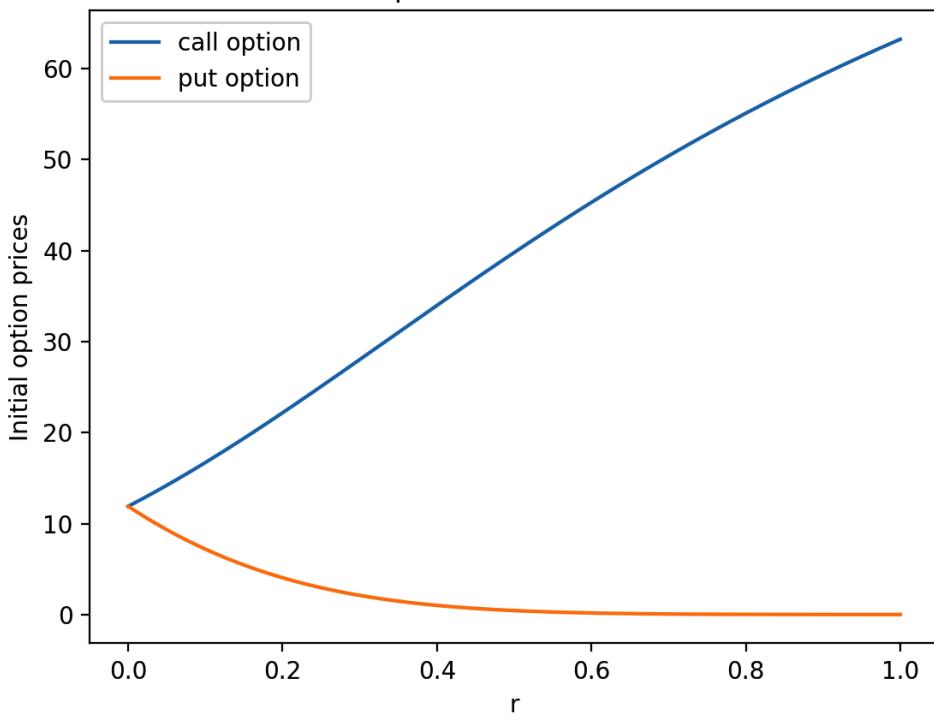
### Set 1



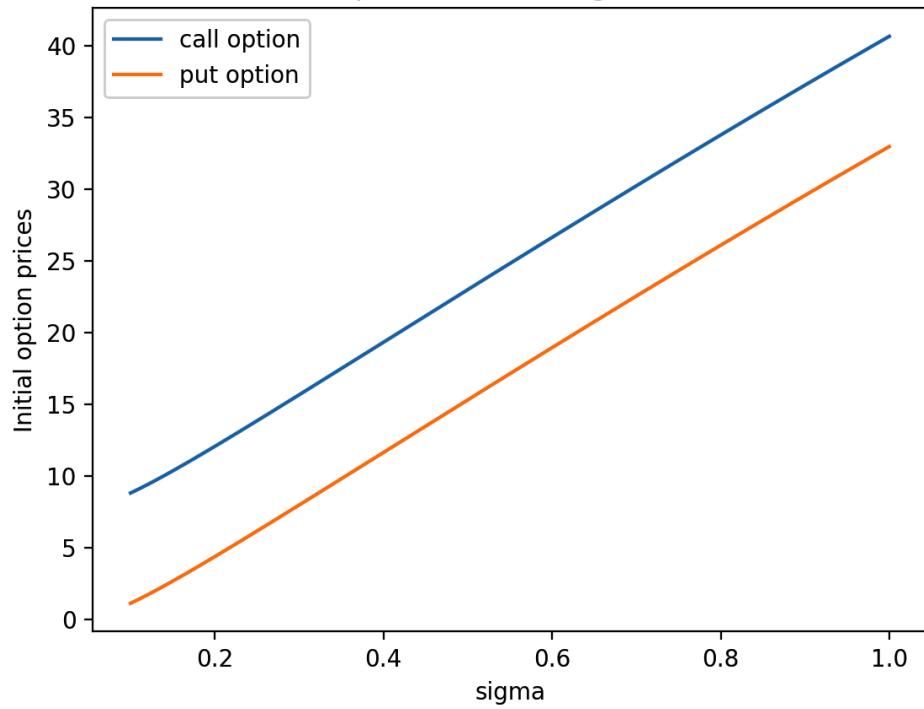
Initial Option Prices vs K for Set1



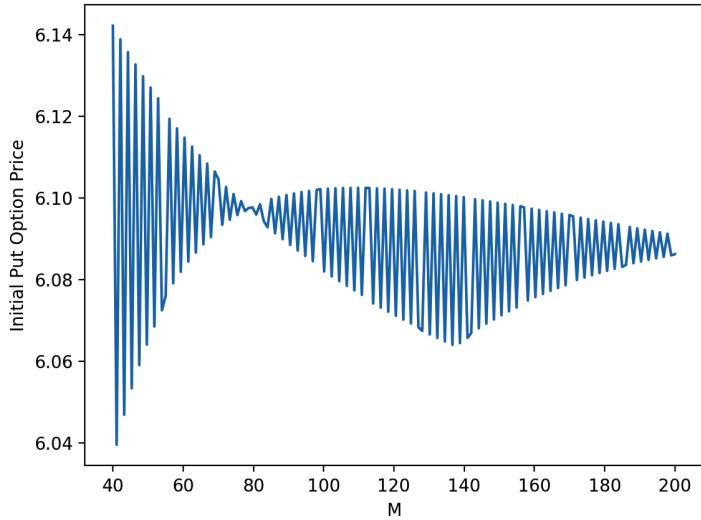
Initial Option Prices vs r for Set1



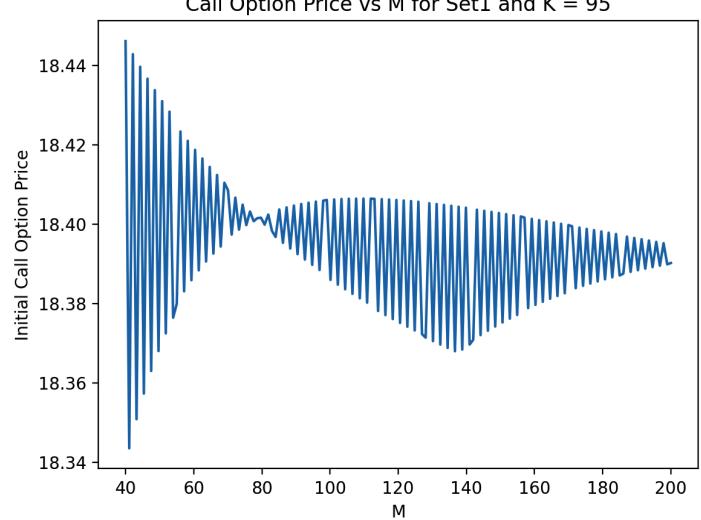
Initial Option Prices vs sigma for Set1



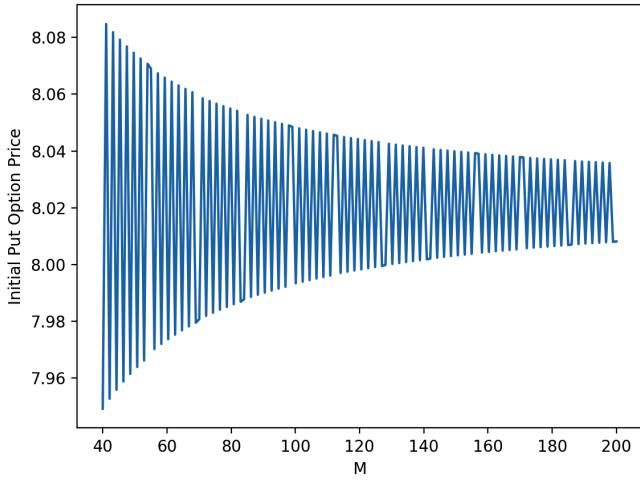
Put Option Price vs M for Set1 and K = 95



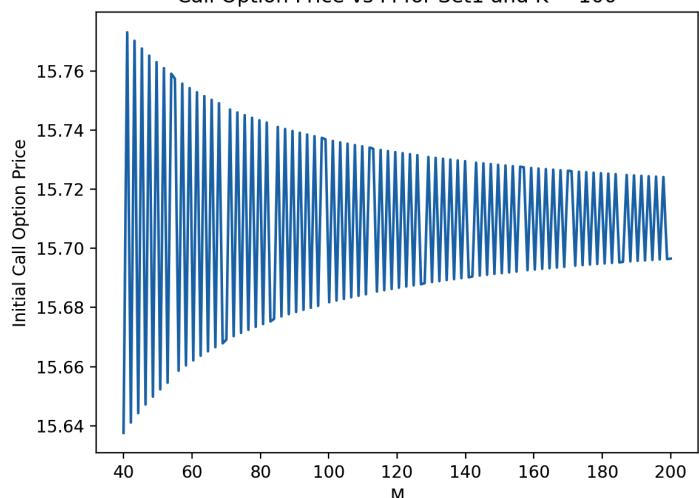
Call Option Price vs M for Set1 and K = 95



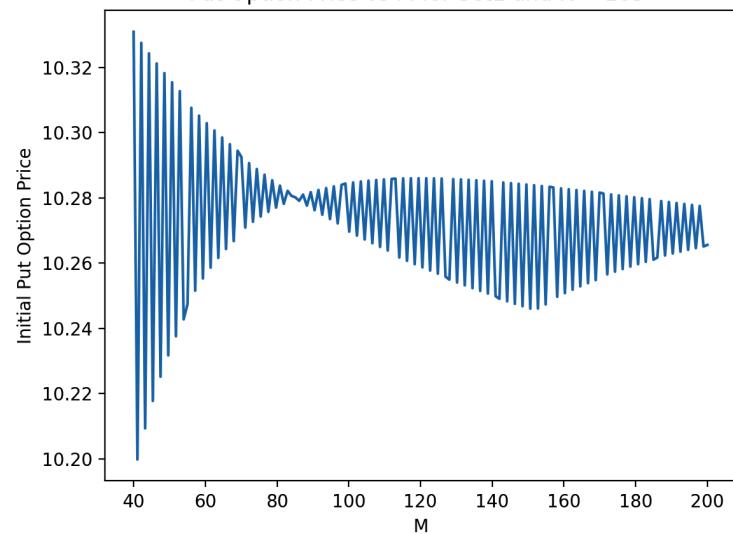
Put Option Price vs M for Set1 and K = 100



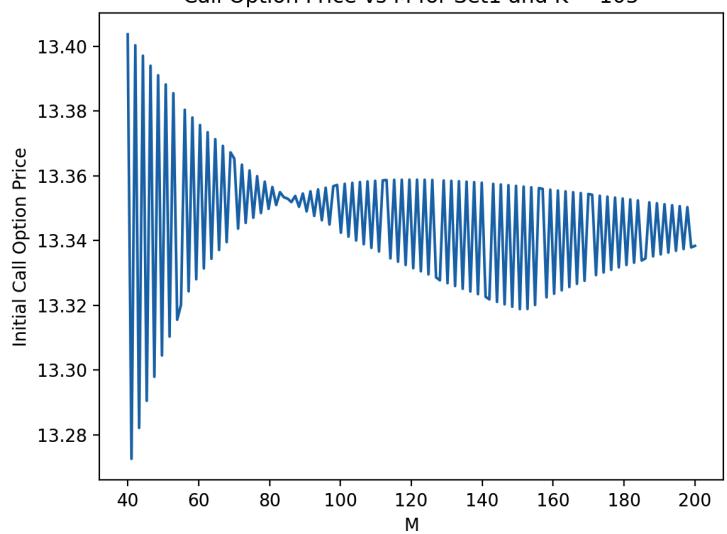
Call Option Price vs M for Set1 and K = 100



Put Option Price vs M for Set1 and K = 105

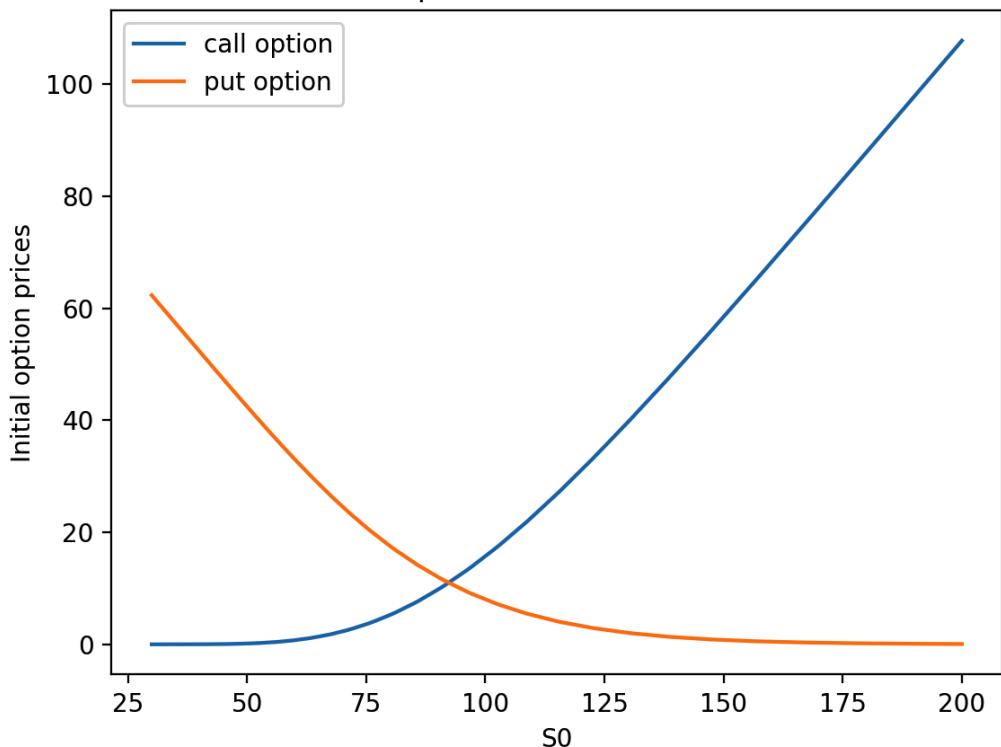


Call Option Price vs M for Set1 and K = 105

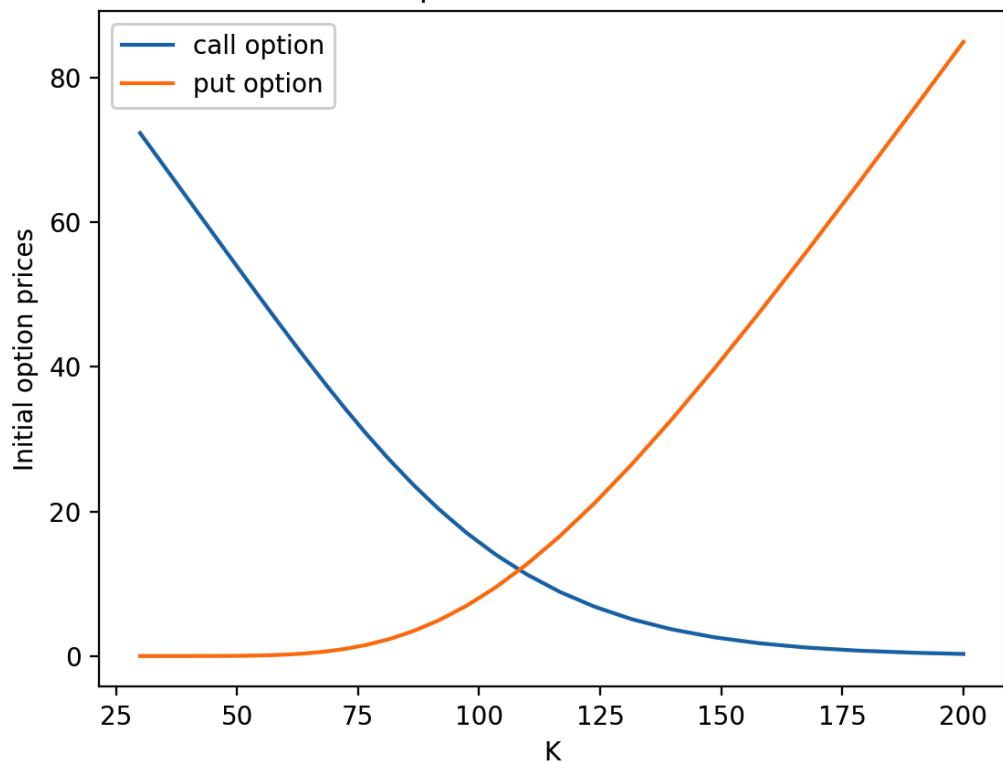


## Set 2

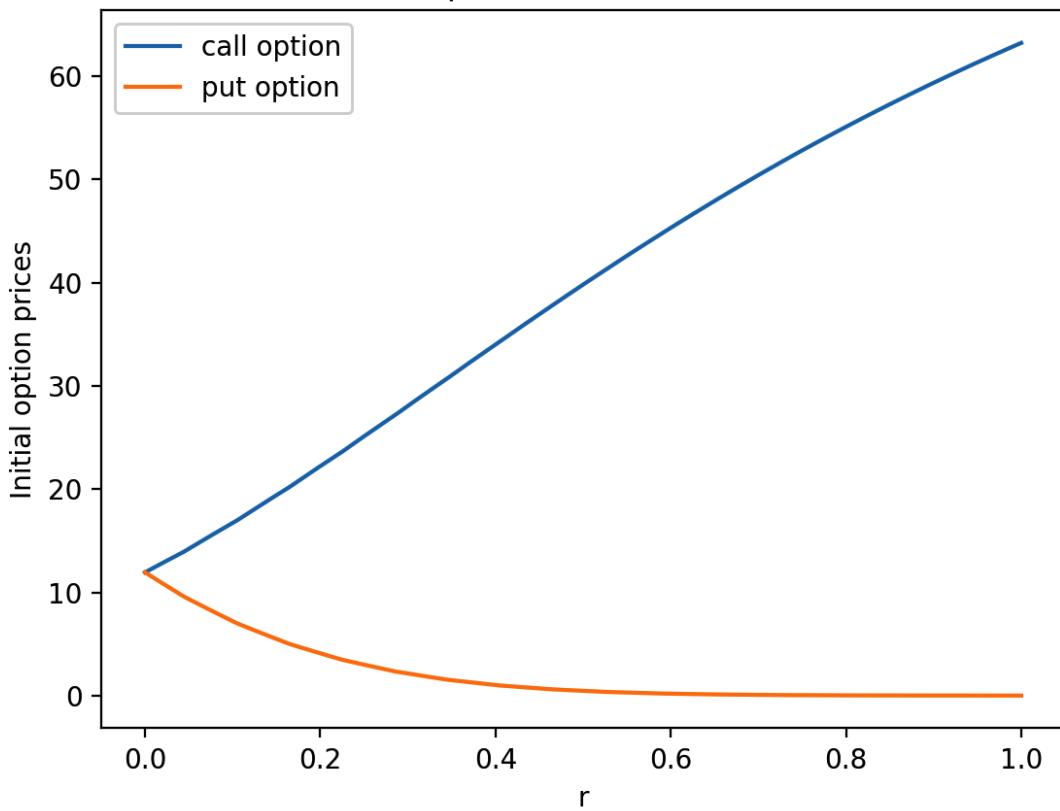
Initial Option Prices vs S0 for Set2



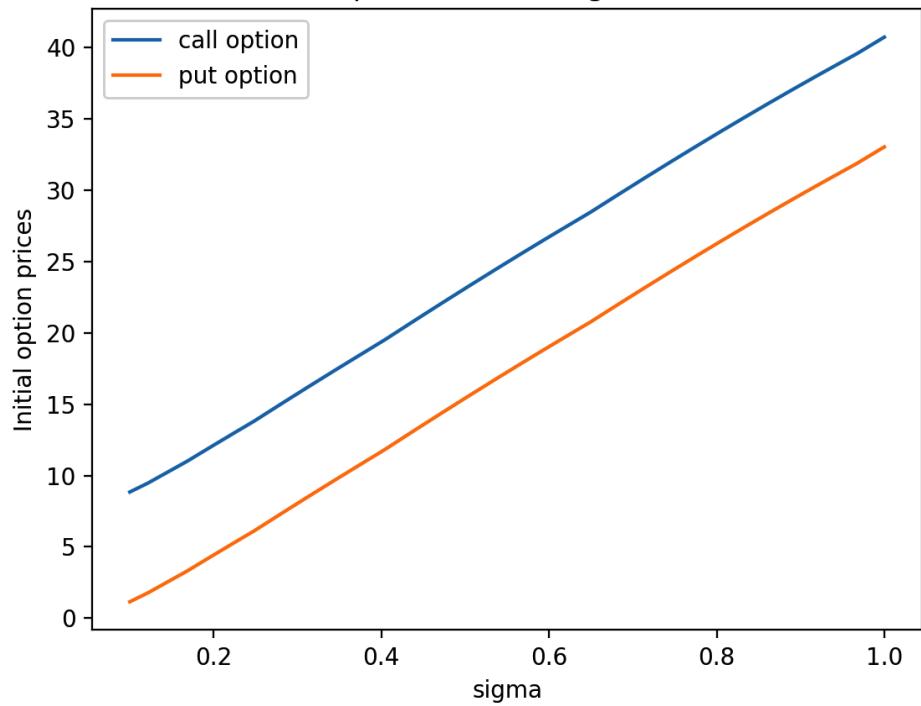
Initial Option Prices vs K for Set2



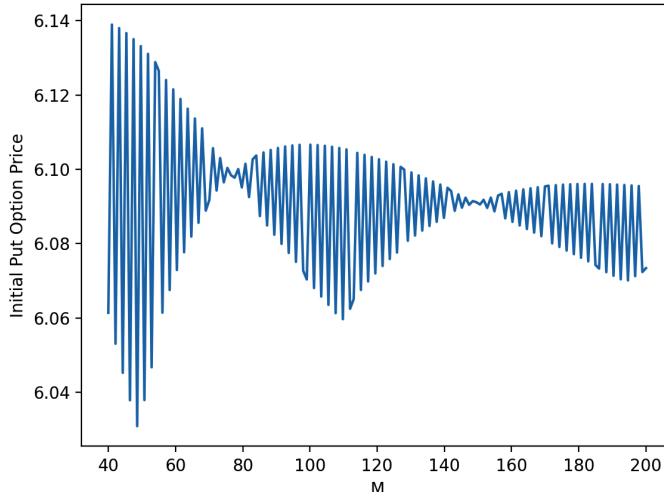
Initial Option Prices vs r for Set2



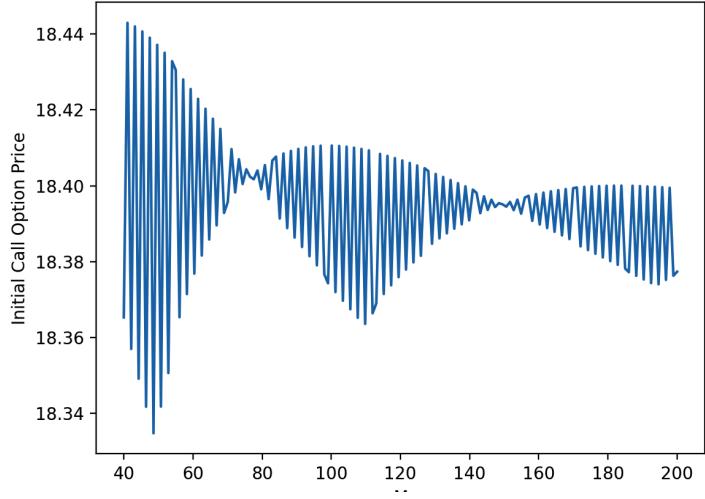
Initial Option Prices vs sigma for Set2



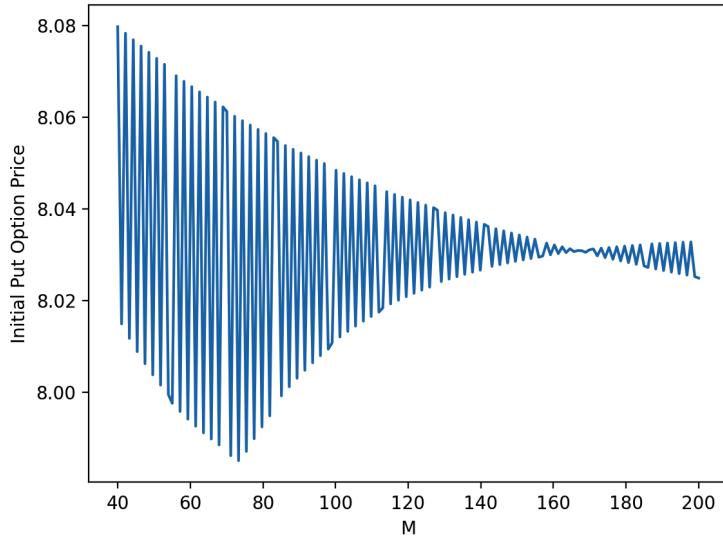
Put Option Price vs M for Set2 and K = 95



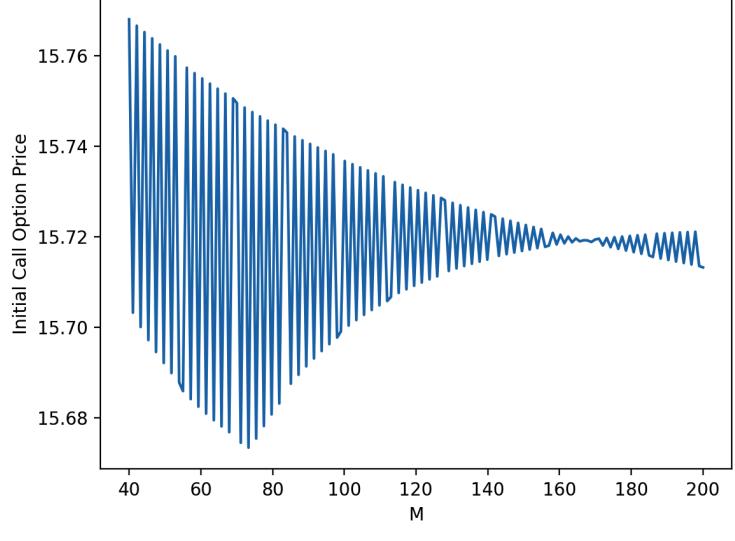
Call Option Price vs M for Set2 and K = 95

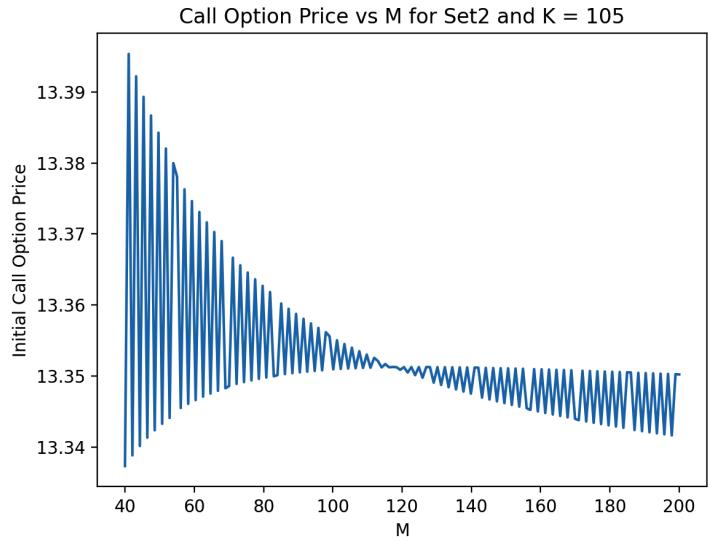
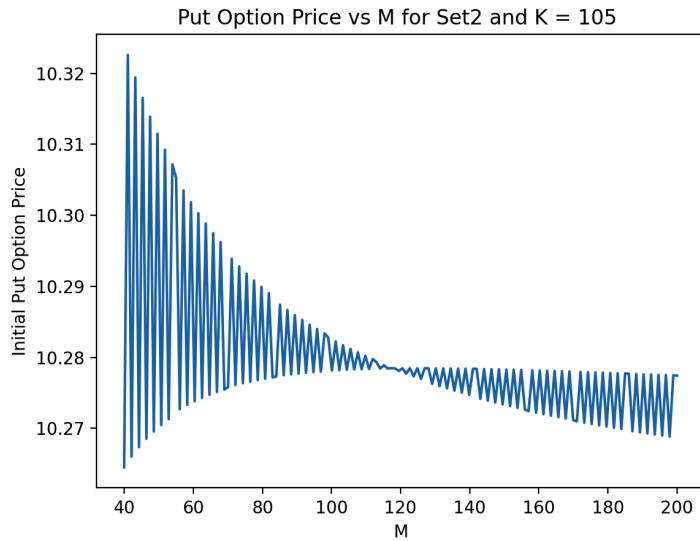


Put Option Price vs M for Set2 and K = 100



Call Option Price vs M for Set2 and K = 100





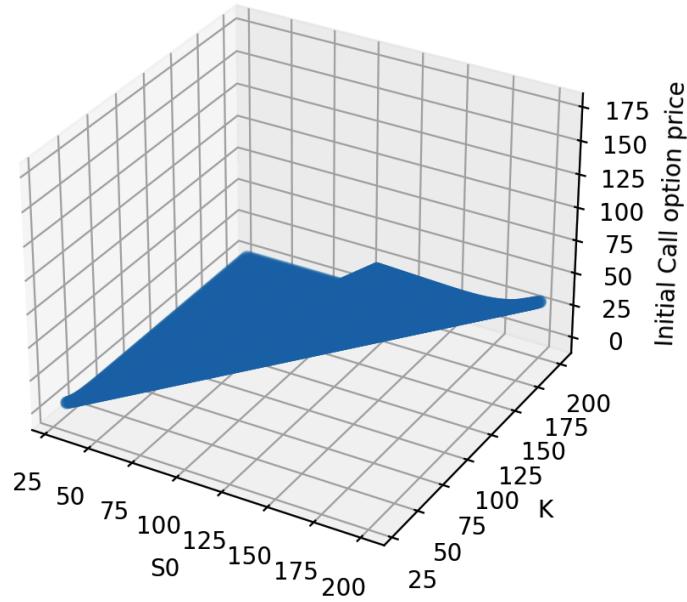
## Observation

- 1) By applying the Cos-Rubeinstein formula, it becomes clear that the Call Option value is positively influenced by  $S(0)$ , while employing the Put-Call Parity reveals that the Put Option value is negatively affected by  $S(0)$ .
- 2) Utilizing the Cos-Rubeinstein formula reveals that the Call Option price is inversely correlated with  $K$ , and employing Put-Call Parity demonstrates that the Put Option price exhibits a positive correlation with  $K$ .
- 3) Applying the Cos-Rubeinstein formula makes it clear that the Call Option price is positively influenced by the interest rate ( $r$ ), and employing Put-Call Parity demonstrates that the Put Option price is negatively affected by the interest rate ( $r$ )

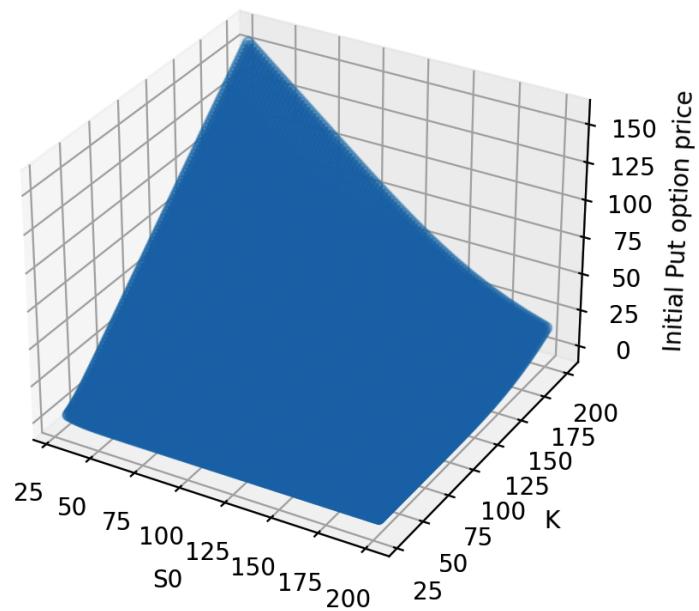
## 3D Graphs

**Set1 ( Set 2 graphs were very similar to Set 1 graph given below so Only showing Set 1 3D graphs)**

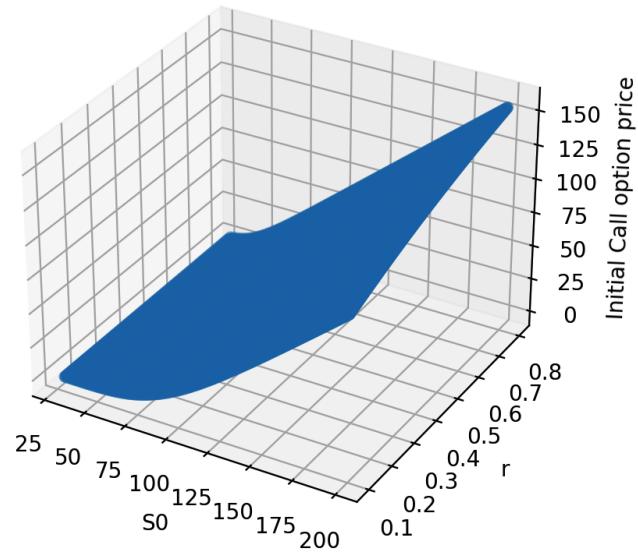
Initial Call Option Price vs  $S_0$  vs  $K$  for Set1



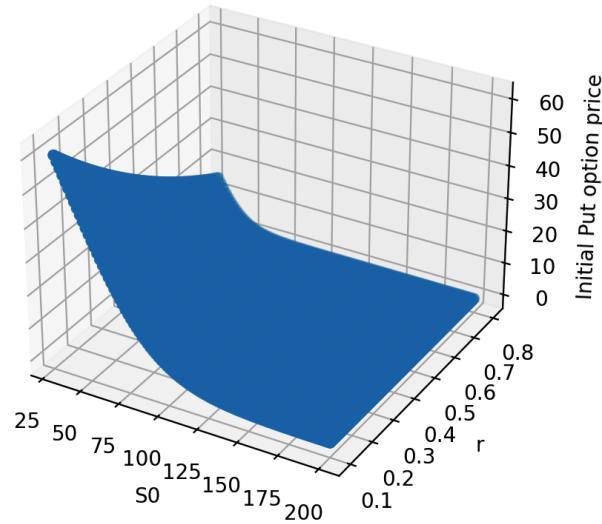
Initial Put Option Price vs  $S_0$  vs  $K$  for Set1



Initial Call Option Price vs  $S_0$  vs  $r$  for Set1



Initial Put Option Price vs  $S_0$  vs  $r$  for Set1



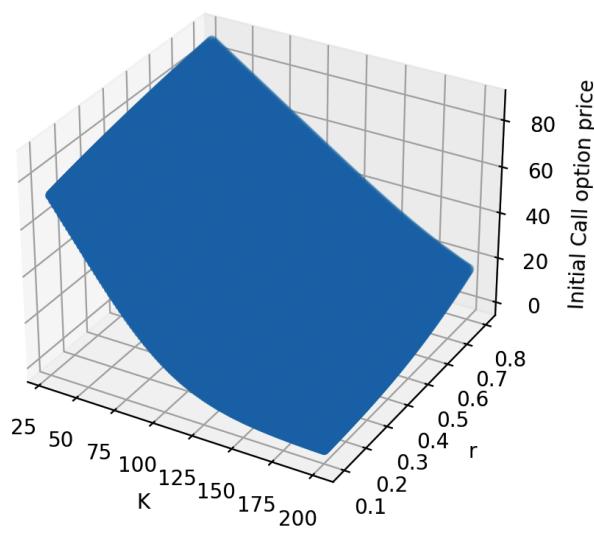
Initial Call Option Price vs  $S_0$  vs  $\sigma$  for Set1



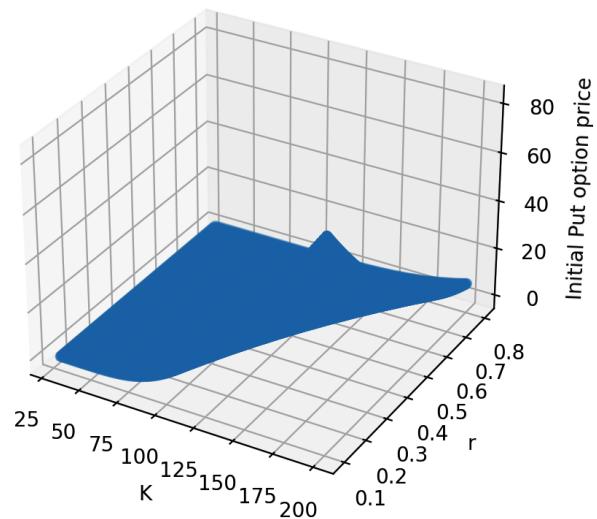
Initial Put Option Price vs  $S_0$  vs  $\sigma$  for Set1



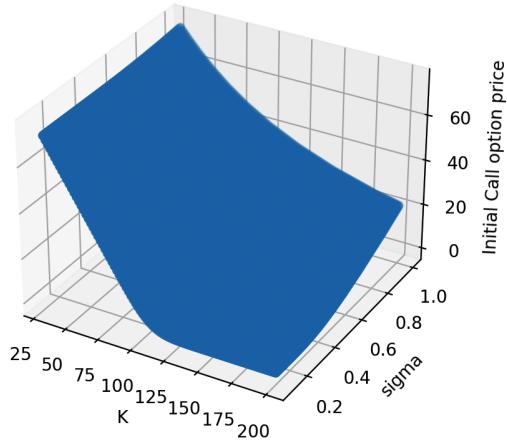
Initial Call Option Price vs K vs r for Set1



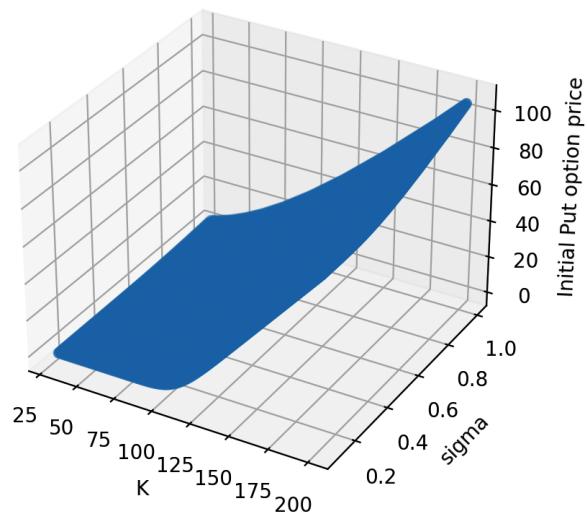
Initial Put Option Price vs K vs r for Set1



Initial Call Option Price vs K vs sigma for Set1

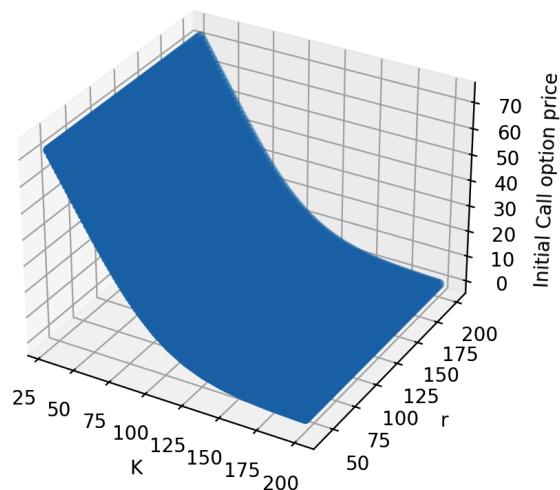


Initial Put Option Price vs K vs sigma for Set1

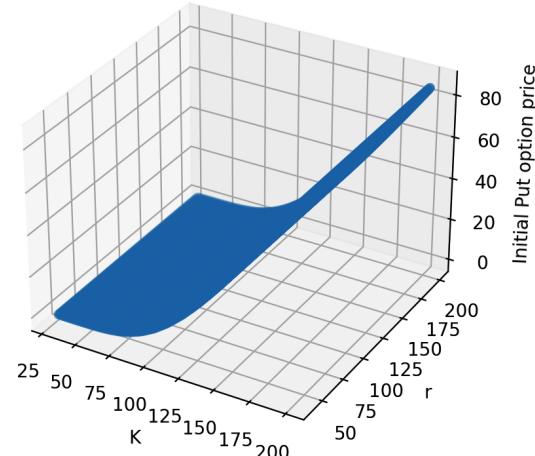


**Below One is For K vs M(not r)**

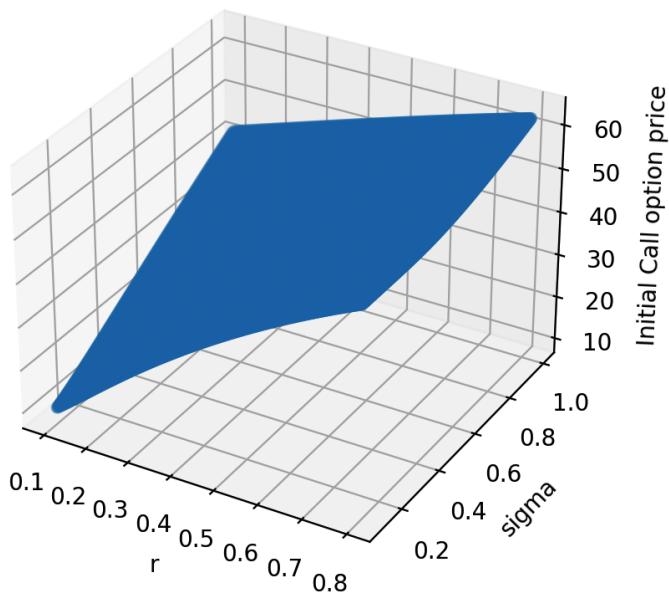
Initial Call Option Price vs K vs r for Set1



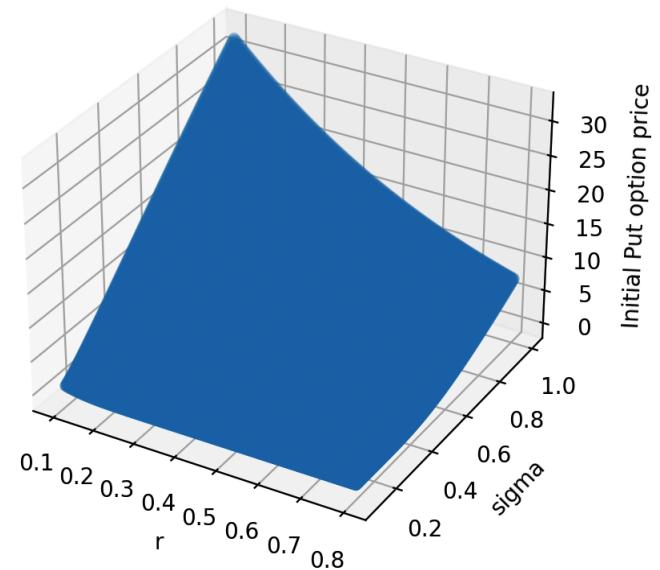
Initial Put Option Price vs K vs r for Set1



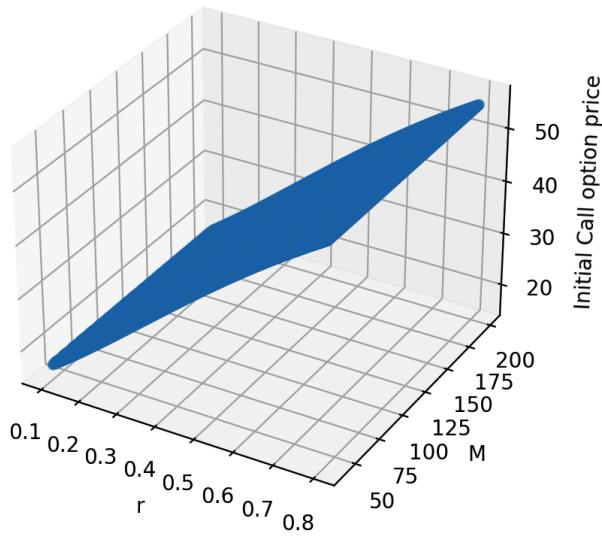
Initial Call Option Price vs r vs sigma for Set1



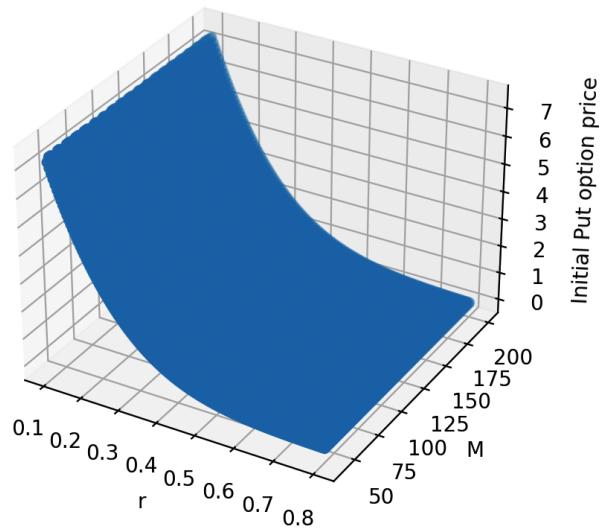
Initial Put Option Price vs r vs sigma for Set1



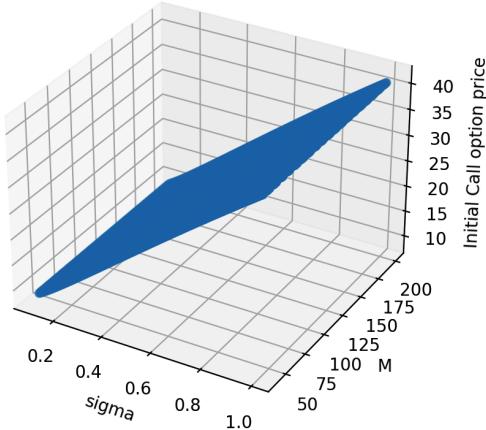
Initial Call Option Price vs r vs M for Set1



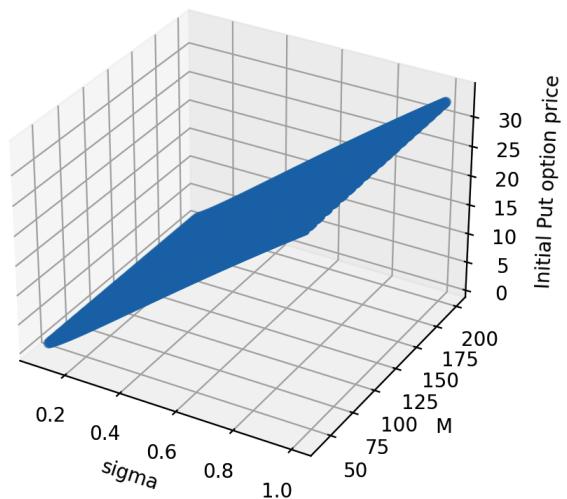
Initial Put Option Price vs r vs M for Set1



Initial Call Option Price vs sigma vs M for Set1



Initial Put Option Price vs sigma vs M for Set1



## Question 2

The path dependent derivative chosen is **Fixed Lookback Option.**(Here **Fixed Lookback option is different from Floating Lookback Option**)

A lookback option allows the holder to exercise an option at the most beneficial price of the underlying asset, over the life of the option.

When using a fixed strike lookback option, the strike price is set or fixed at purchase, similar to most other types of option trades. Unlike other options, however, at the time of exercise, the most beneficial price of the underlying asset over the life of the contract is used instead of the current market price. In the case of a call, the option holder can review the price history and choose to exercise at the **point of highest return potential**.

For a put option, the holder may execute at the **asset's lowest price point** to realize the greatest gain

Initial Call and Put option prices for  $S_0=100, M=10, K=100, T=1, r=0.08, \sigma=0.3$  is given below for both the Set ie Set1 and Set2

```
o (base) arushgupta@depressed-guy Fe2lab % python '/Users/arushgupta/Desktop/Fe2lab/08g.arushMA374lab02/q2.py'
*****
Initial Call option price for SET1 is 24.3500260950029
Initial Put option price for SET1 is 14.169167660723982
*****
Initial Call option price for SET2 is 24.638705853114136
Initial Put option price for SET2 is 14.394557152706502
[]
```

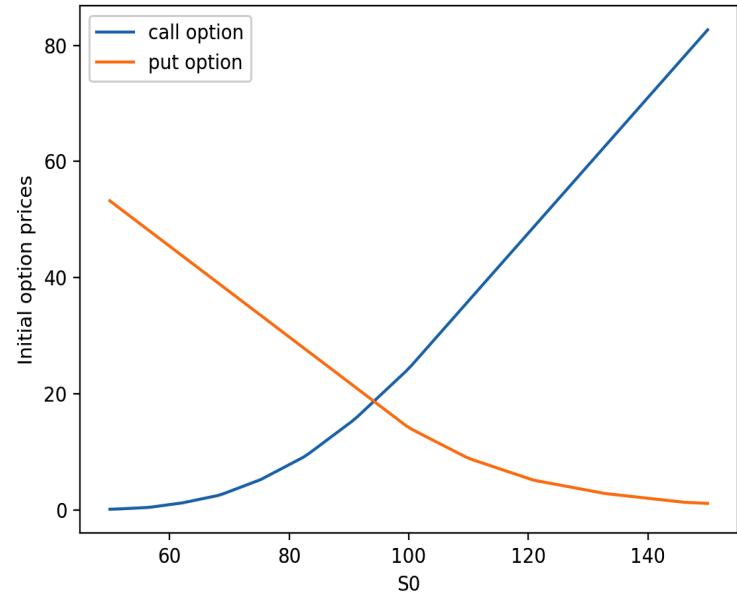
The payoff for **Fixed Lookback Call Option** is  $\text{Max}(0, \text{Max}(S) - K)$  Here  $\text{Max}(S)$  is the maximum price encountered in the path of the Graph.

The payoff for **Fixed Lookback Put Option** is  $\text{Max}(0, K - \text{Min}(S))$  Here  $\text{Min}(S)$  is the minimum price encountered in the path of the Graph.

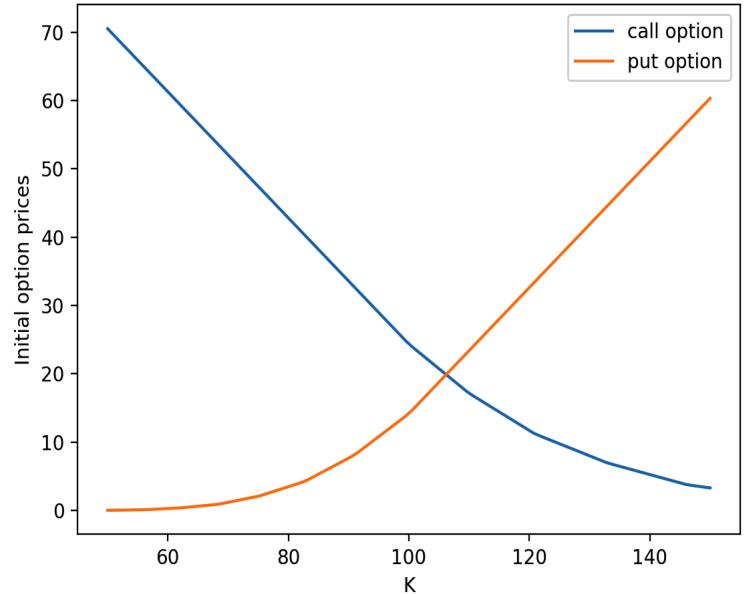
## 2D Graphs

### Set 1

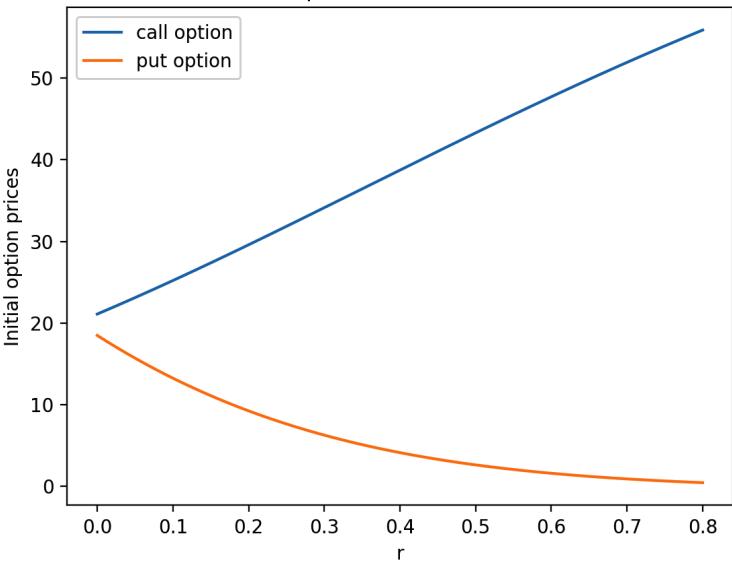
Initial Option Prices vs  $S_0$  for Set1



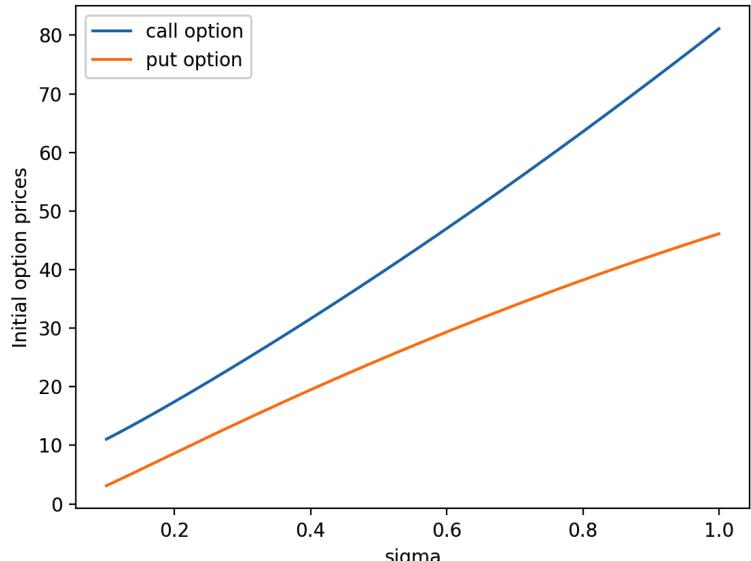
Initial Option Prices vs  $K$  for Set1



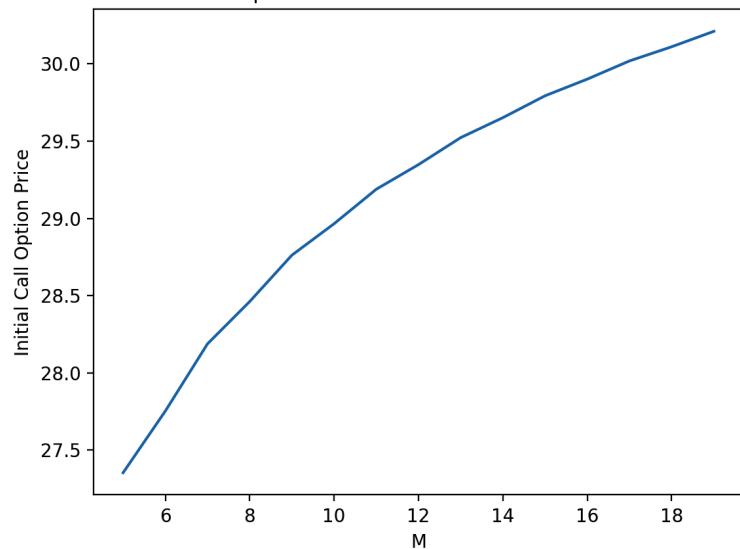
Initial Option Prices vs  $r$  for Set1



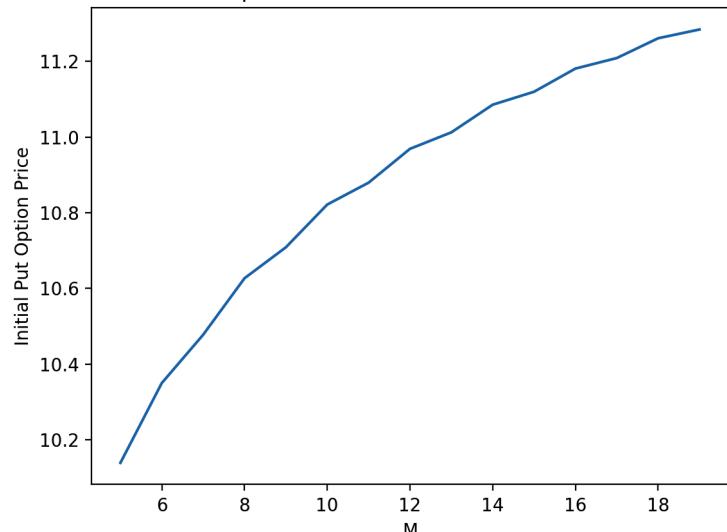
Initial Option Prices vs sigma for Set1



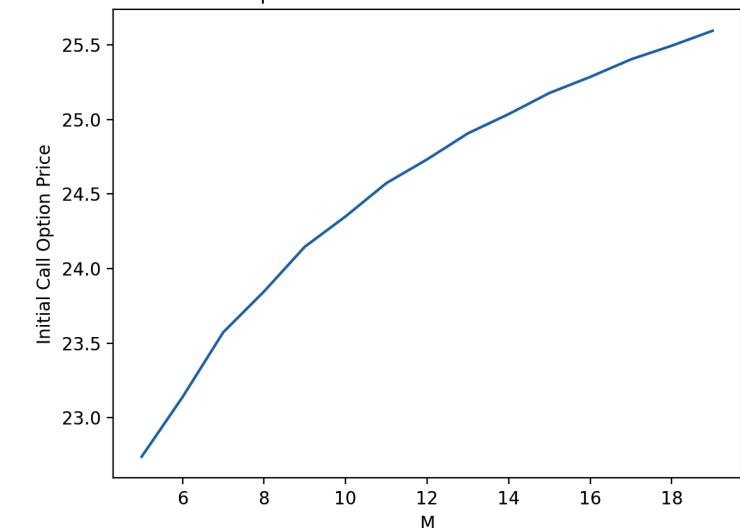
Call Option Price vs  $M$  for Set1 and  $K = 95$



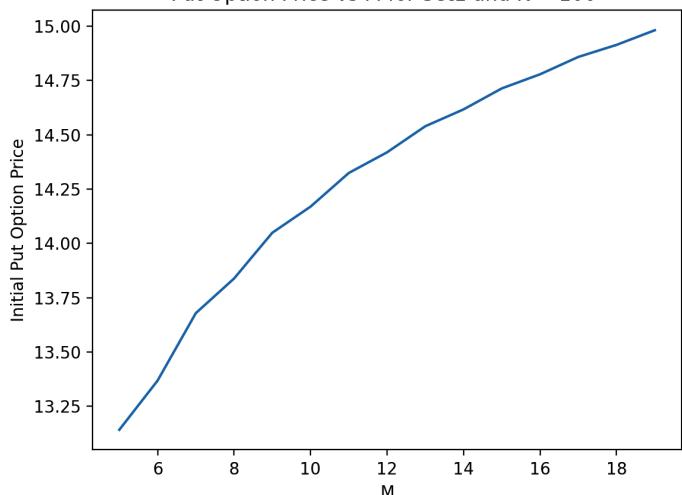
Put Option Price vs  $M$  for Set1 and  $K = 95$

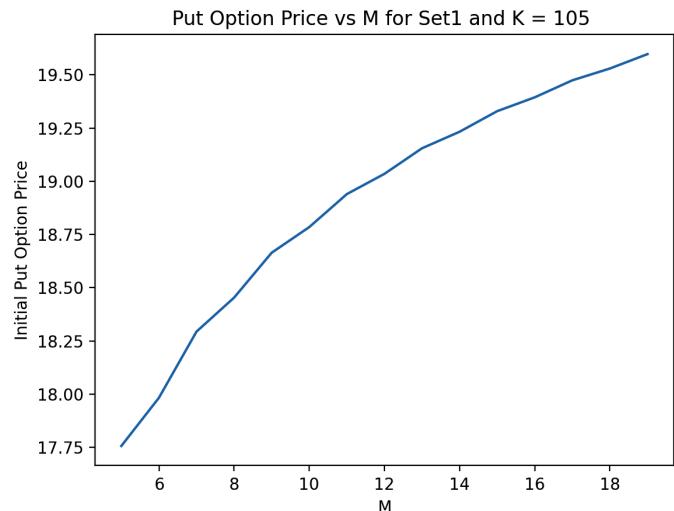
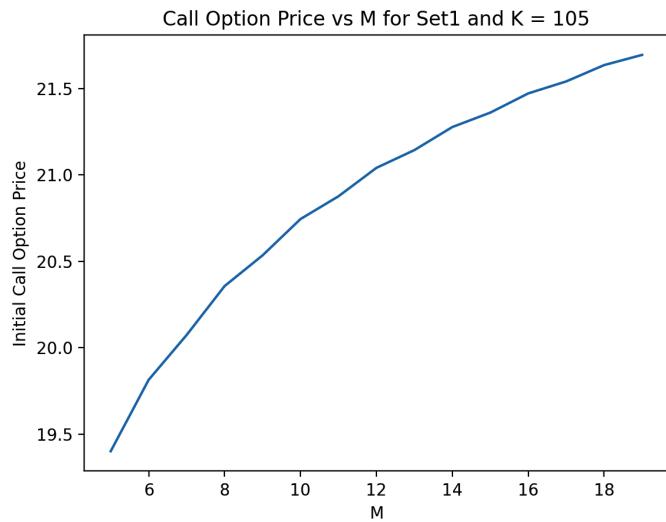


Call Option Price vs  $M$  for Set1 and  $K = 100$

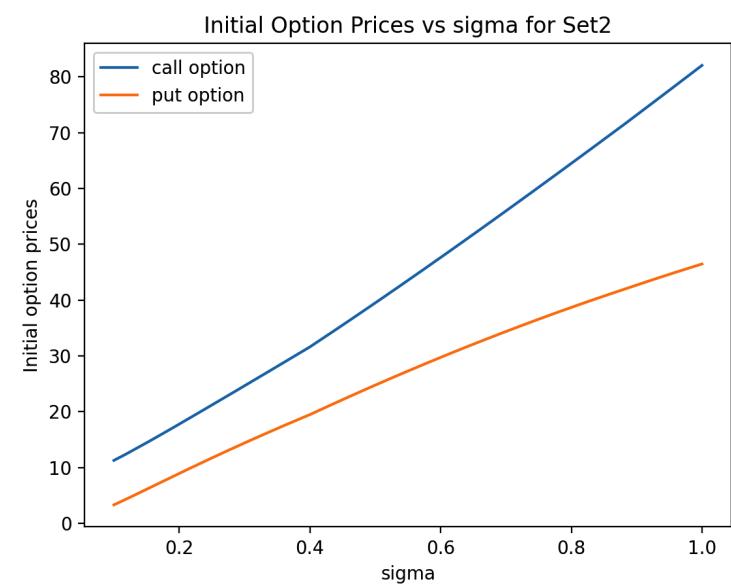
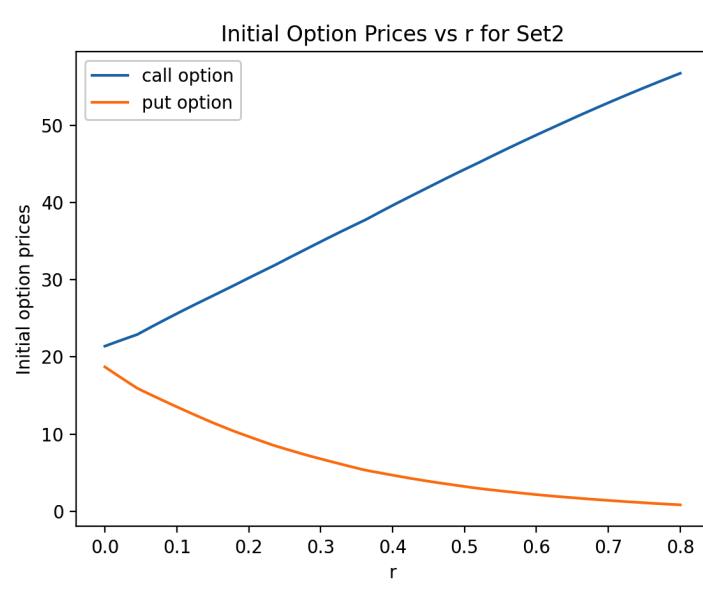
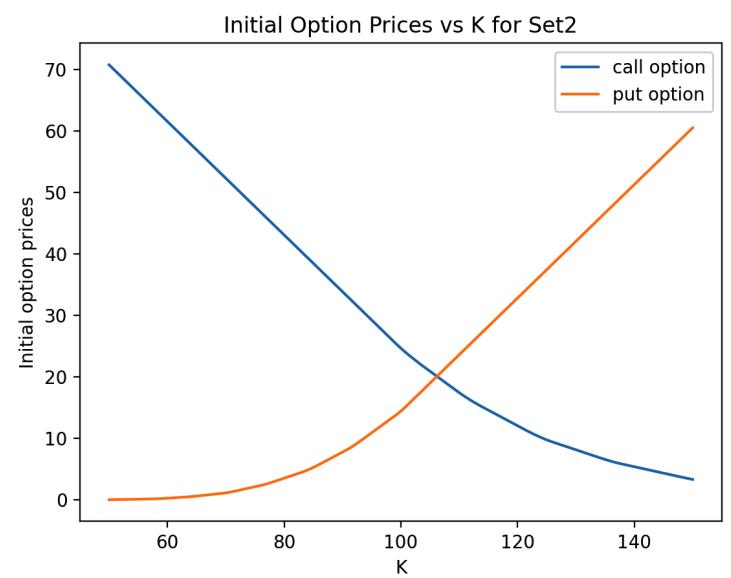
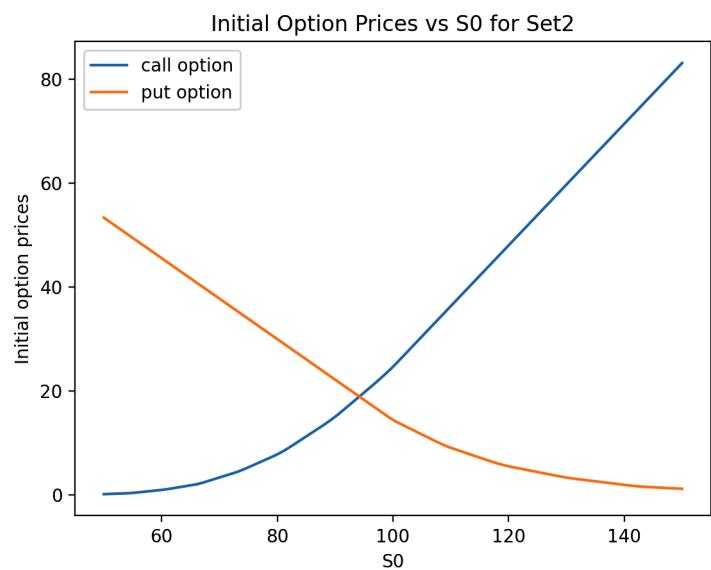


Put Option Price vs  $M$  for Set1 and  $K = 100$

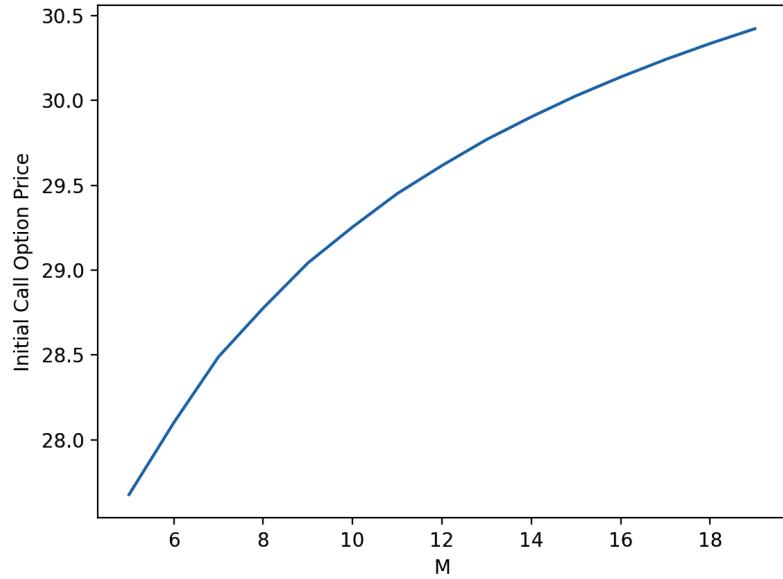




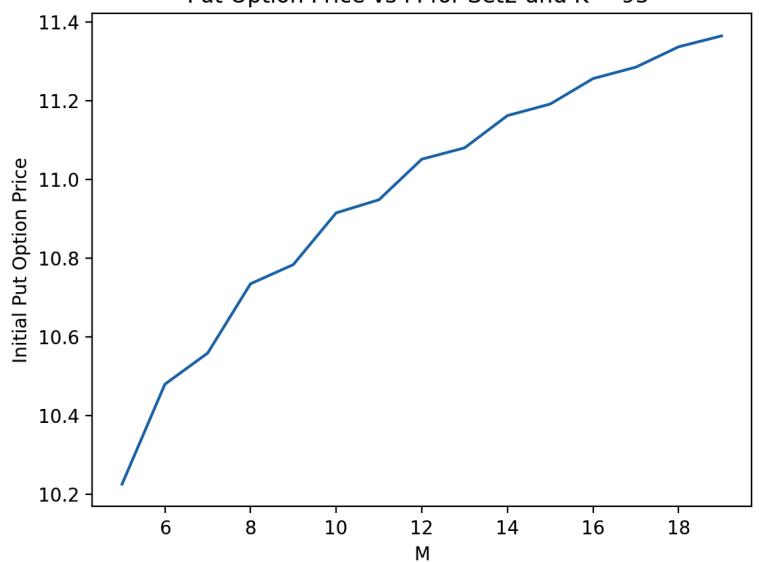
## Set 2



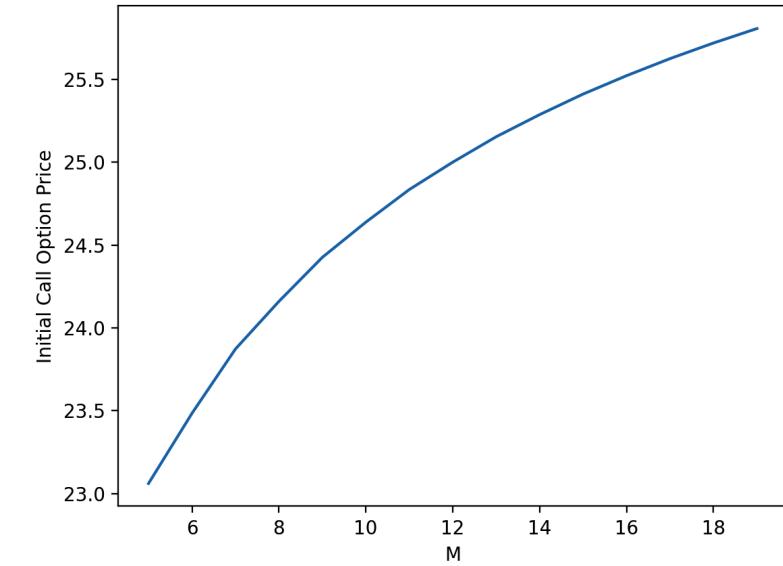
Call Option Price vs M for Set2 and K = 95



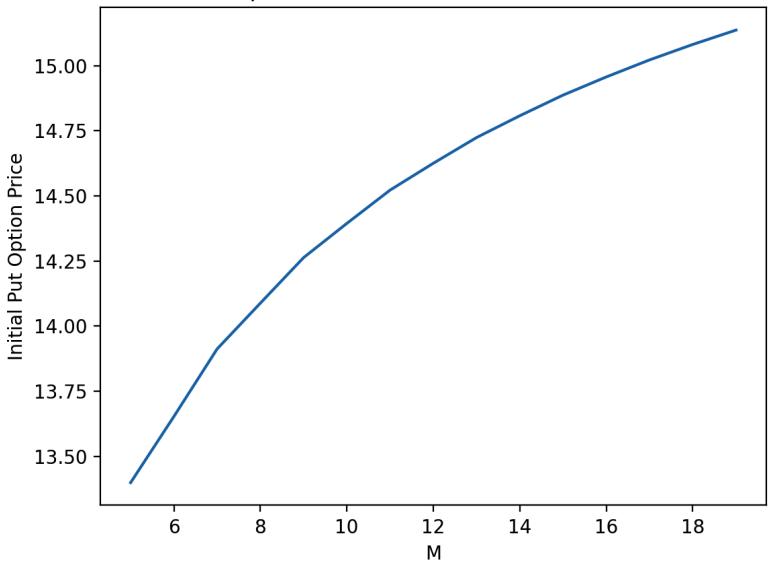
Put Option Price vs M for Set2 and K = 95



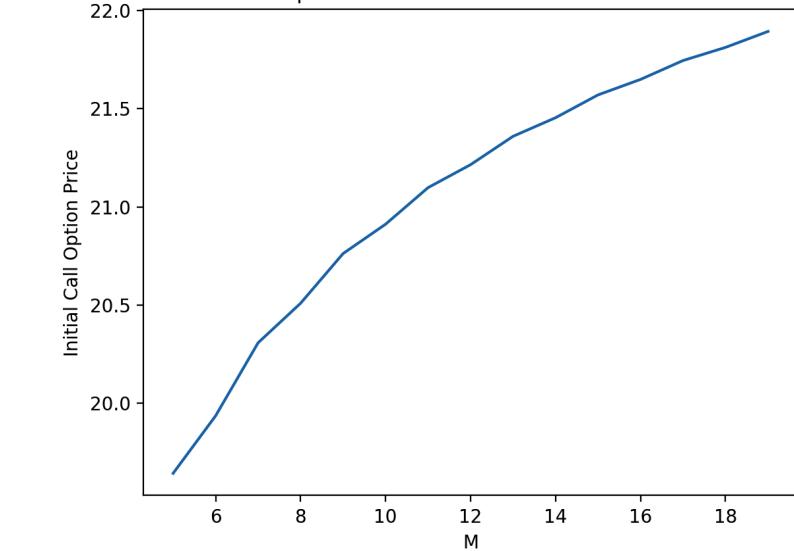
Call Option Price vs M for Set2 and K = 100



Put Option Price vs M for Set2 and K = 100



Call Option Price vs M for Set2 and K = 105



Put Option Price vs M for Set2 and K = 105

