MA374 Financial Engineering lab: 07

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Ques.1,2

- To execute my .py file
  Run **$python3 180123029_NamanGoyal_q1q2.py** on the terminal. The snapshot is shown below:

```
neo@Neo:~/Desktop/FE_Labs/lab07$ python3 180123029_NamanGoyal_q1q2.py
---------Q2----------
For T = 0, 0.2, 0.4, 0.6, 0.8, 1.0
For t =  0
For t =  0.2
For t =  0.4
For t =  0.6
For t =  0.8
For t =  1.0

(180123029_NamanGoyal_q1q2.py:39569): Gtk-WARNING **: 21:16:07.709: Theme directory 16x16@2x/plac
s-Catalina-icons-master has no size field


(180123029_NamanGoyal_q1q2.py:39569): Gtk-WARNING **: 21:16:07.711: Theme directory 24x24/apps of
alina-icons-master has no size field


For t =  0
For t =  0.2
For t =  0.4
For t =  0.6
For t =  0.8
For t =  1.0
neo@Neo:~/Desktop/FE_Labs/lab07$
```

- **Formulas** used for **C(t,x) and P(t,x)** are given below:

$$C(t,\ x)\ =\ xN(d_+)\ -\ Ke^{-r(T-t)}\,N(d_-)\ \ (0\ \le t < T)$$

$$\text{with boundary conditions } C(T,x)\ =\ (x-K)^+ \text{ and } C(t,0)\ =\ 0$$

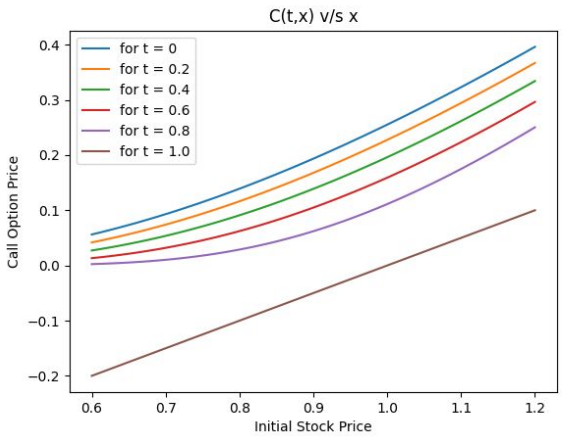
$$\text{where, } d_\pm\ =\ \frac{1}{\sigma\sqrt{T-t}}[log(x/K)\ +\ (r\ \pm\ \frac{\sigma^2}{2})(T-t)]$$

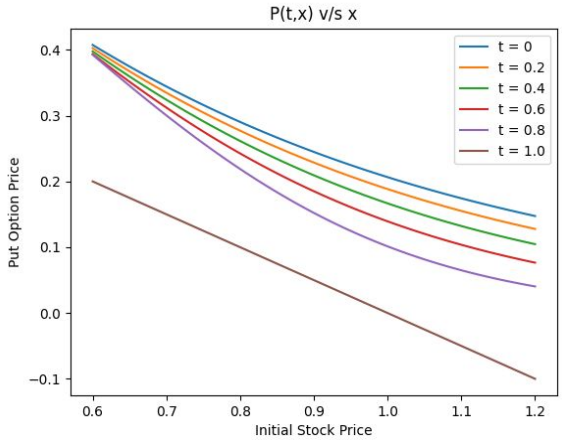
$$\text{and } N \text{ is the } CDF \text{ of } N(0,\ 1)$$

and for Put-Call Parity we may use C(t,x) that's been calculated above:

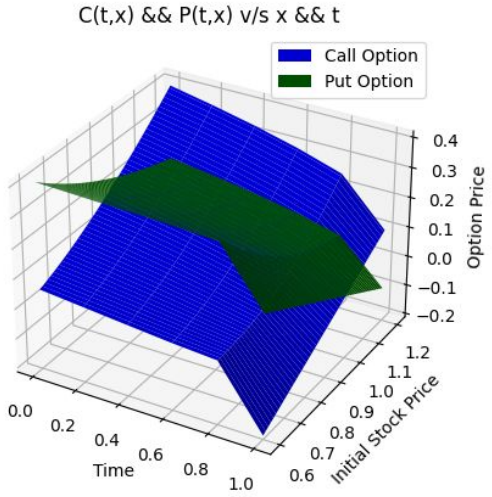
$$P(t,\ x)\ =\ C(t,x)\ +\ Ke^{-r(T-t)}\ -\ x$$

- The **2D Plots** obtained for **C(t,x)** and **P(t,x)** for varying the **Price of underlying Asset (x)** and **time = [0, 0.2, 0.4, 0.6, 0.8, 1.0].** Program written in Ques.1 are used in the further questions to calculate P(t,x) and C(t,x)





- The **3D Plot** for **C(t,x)** && **P(t,x)** obtained by **varying x && t**

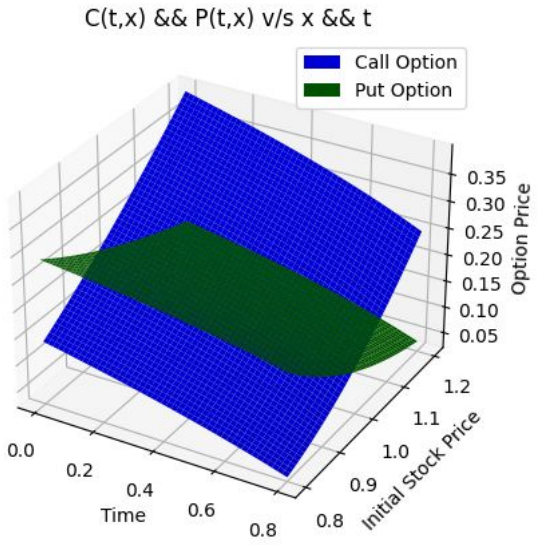


Ques.3

- To execute my .py file
  Run **$python3 180123029_NamanGoyal_q3.py** on the terminal. The snapshot is shown below:

```
neo@Neo:~/Desktop/FE_Labs/lab07$ python3 180123029_NamanGoyal_q3.py
---------Q3----------
```

- The 3D Plot obtained for **P(t,x) and C(t,x)** by **varying t && x**



Ques.4

- To execute my .py file
  Run **$python3 180123029_NamanGoyal_q4.py** on the terminal. The snapshot is shown below:

```
neo@Neo:~/Desktop/FE_Labs/lab07$ python3 180123029_NamanGoyal_q4.py
Varying Strike Price
Part I <-> 2D Plot
Part II <-> Table

     K  Call Price  Put Price
0  0.8    0.142841   0.123089
1  0.9    0.105344   0.183123
2  1.0    0.077139   0.252449
3  1.1    0.056239   0.329080
4  1.2    0.040908   0.411280

Part III <-> 3D Plot
```

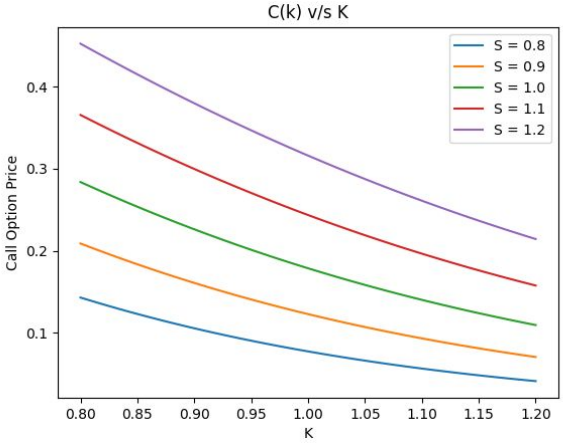
```
Varying Rate
Part I <-> 2D Plot
Part II <-> Table

     Rate  Call Price  Put Price
0  0.0100    0.072389   0.267401
1  0.0325    0.075037   0.258918
2  0.0550    0.077747   0.250621
3  0.0775    0.080518   0.242509
4  0.1000    0.083350   0.234580

Part III <-> 3D Plot
```

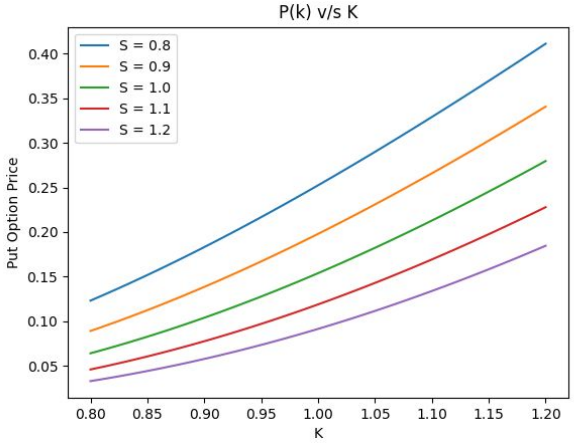
```
Varying Sigma
Part I <-> 2D Plot
Part II <-> Table

   Sigma  Call Price  Put Price
0  0.100    0.000047   0.175357
1  0.325    0.021751   0.197061
2  0.550    0.066304   0.241614
3  0.775    0.116043   0.291353
4  1.000    0.166766   0.342076

Part III <-> 3D Plot
```

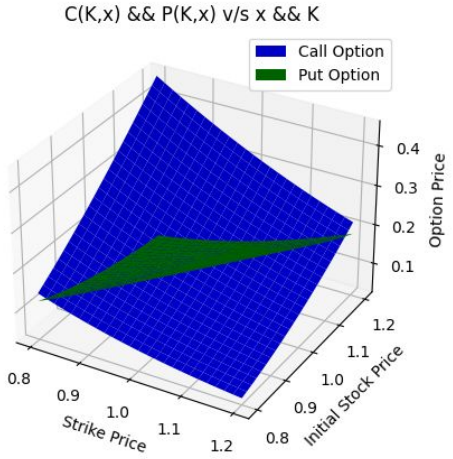
```
Part II <-> Table

   Time  Call Price  Put Price
0   0.1    0.127990   0.283988
1   0.3    0.104005   0.269610
2   0.5    0.077139   0.252449
3   0.7    0.046251   0.231363
4   0.9    0.010488   0.205500

Part III <-> 3D Plot

neo@Neo:~/Desktop/FE_Labs/lab07$
```

- The tables obtained for **varying Strike Price (K), Rate (r), Sigma, Time** are shown in the above **snapshots** itself.
- The **2D, 3D Plots** obtained for **varying the above quantities** are listed and shown below:

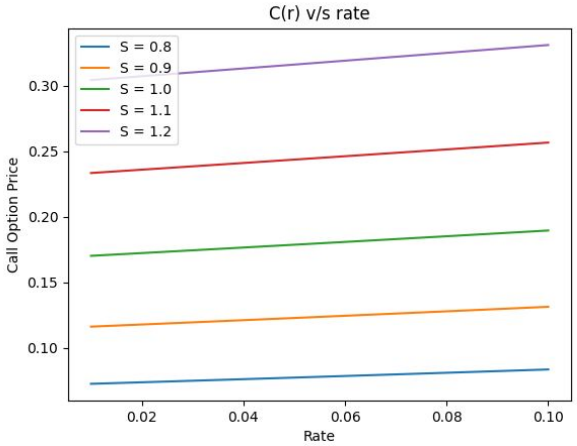
1. Varying Strike Price (K):

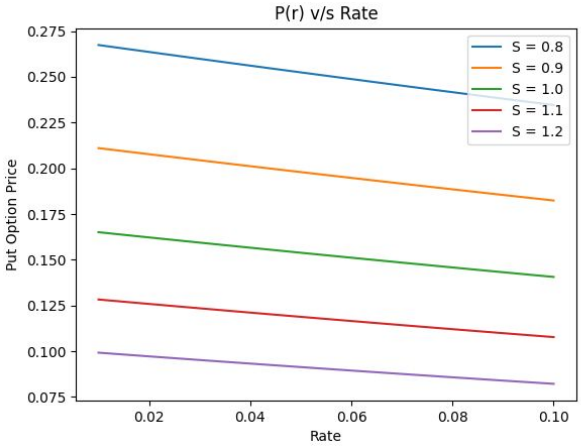


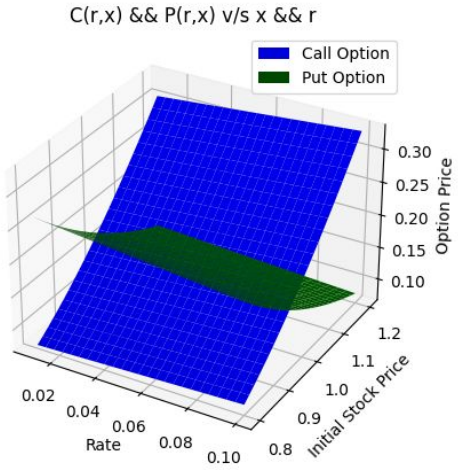




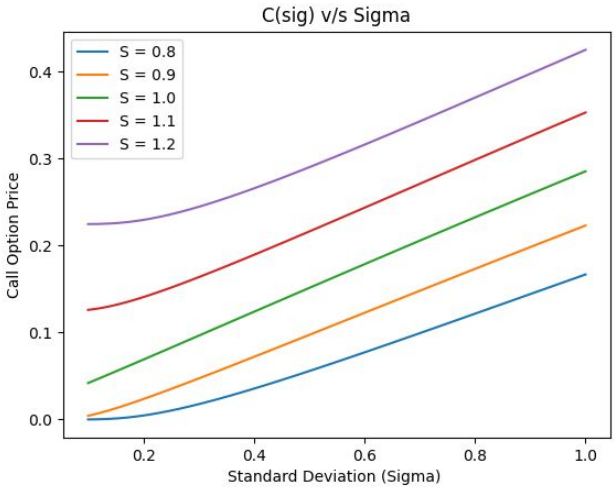
2. Varying Rate (r):

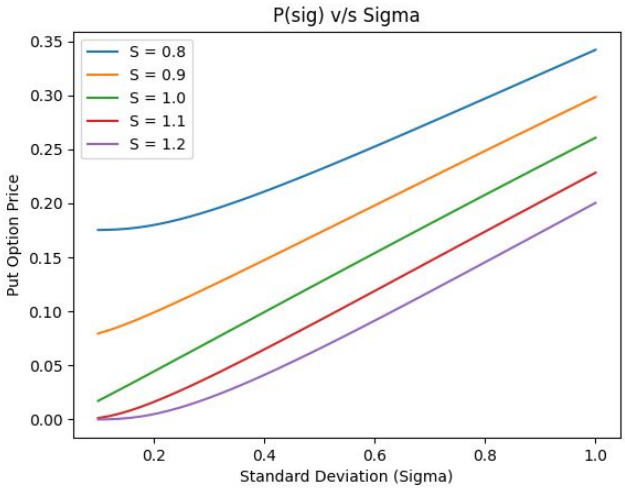


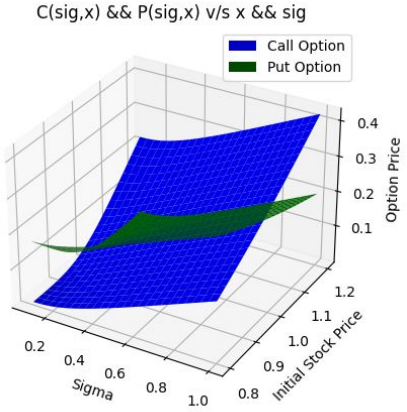
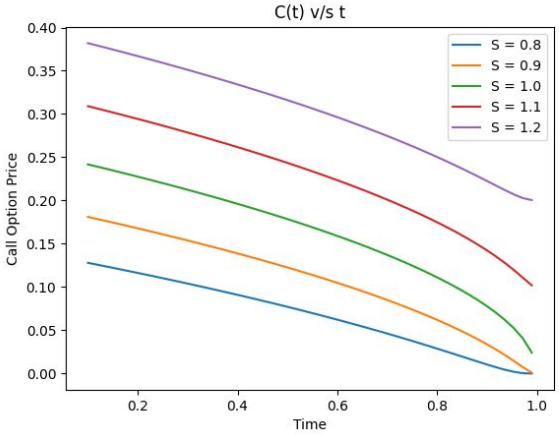
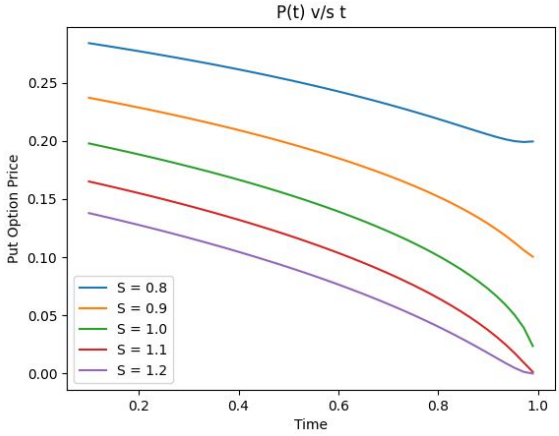
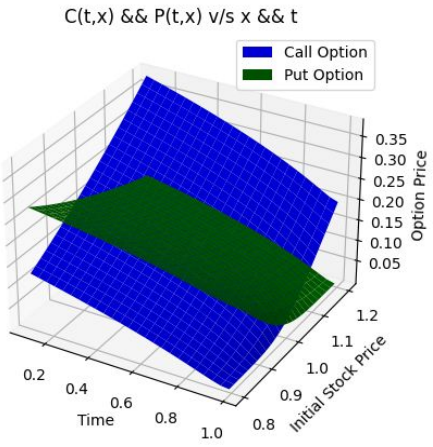




3. Varying Sigma:







4. Varying Time (t):