Financial Engineering Lab (MA374)

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Roll Number - 180123021
Lab - 07

To run the code type **python3 180123021_Kartikeya_Singh_q123.py** into the terminal for q1,2,3 and **python3 180123021_Kartikeya_Singh_q4.py** for q4.

Question 1

On solving the Black-Scholes PDE, the price of a European Call Option is given by the equation-

$$C(t,\ x)\ =\ xN(d_+)\ -\ Ke^{-r(T-t)}N(d_-)\ \ (0\ \leq t < T)$$
$$\textit{with boundary conditions } C(T,x)\ =\ (x-K)^+ \textit{ and }\ C(t,0)\ =\ 0$$

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

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

The price of a European Put Option is calculated using the Put-Call Parity and is given by -

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

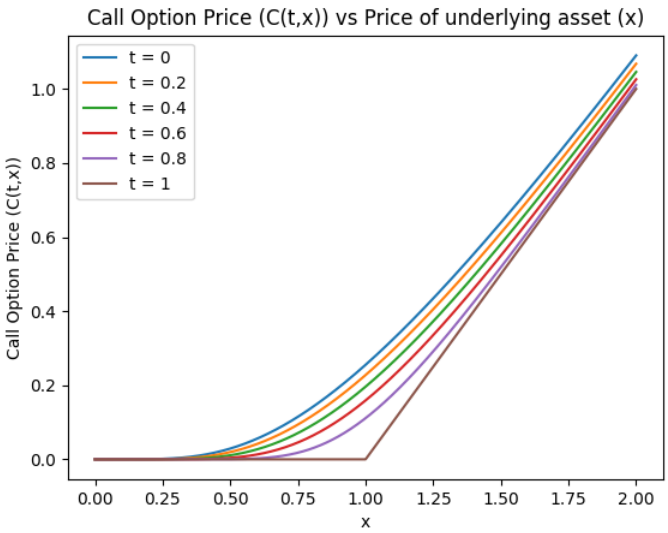
The function N (CDF of N(0,1)) can be calculated using the equation -

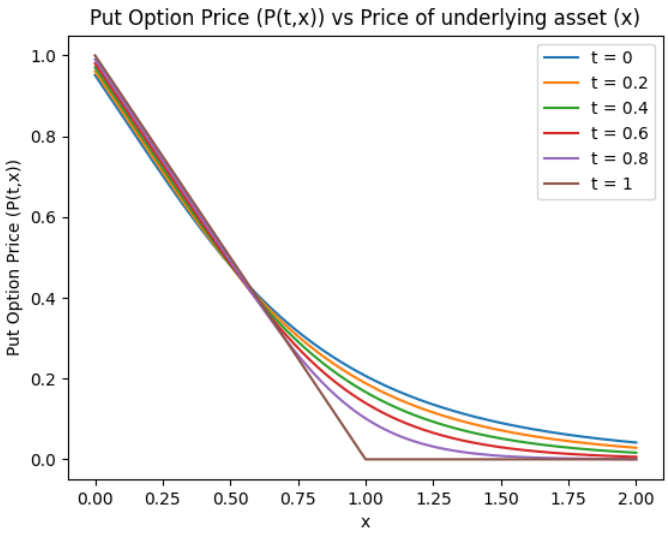
$$N(x) = \frac{1}{2}(1 + erf(x))$$

$$Where,\ erf(x) = \frac{2}{\sqrt{\pi}}\int_0^x e^{-\frac{t^2}{2}}dt\ \ is\ the\ error\ function.$$

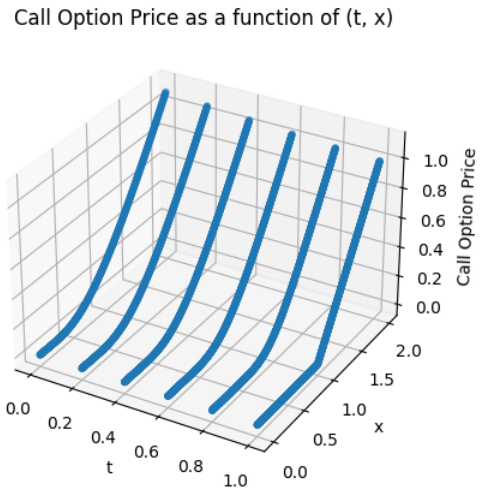
Question 2

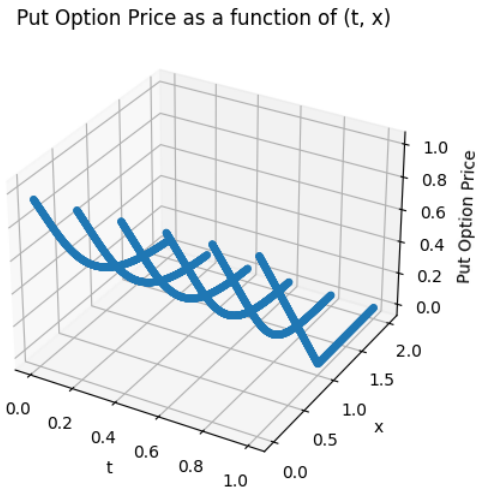
The 2-D graphs are -





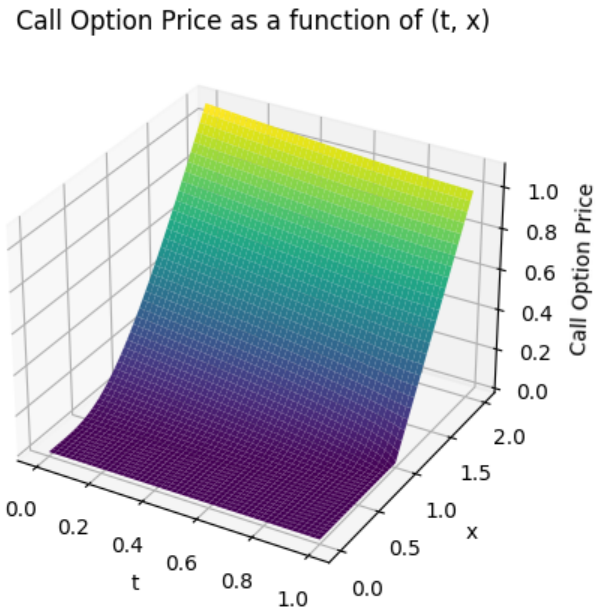
The 3-D graphs are -

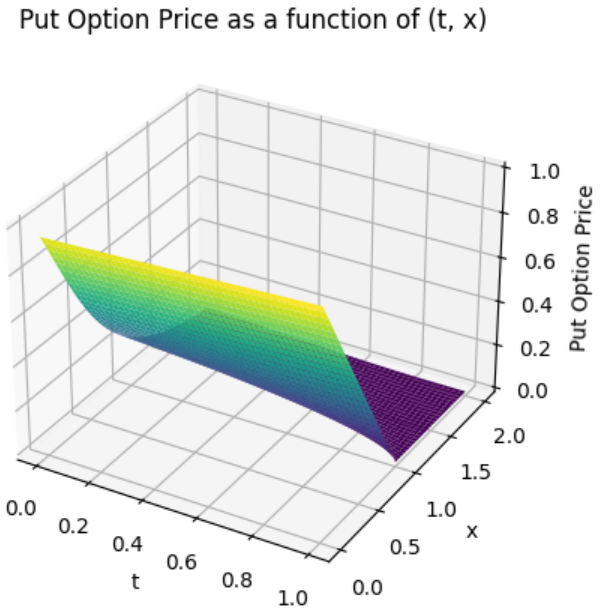




Question 3

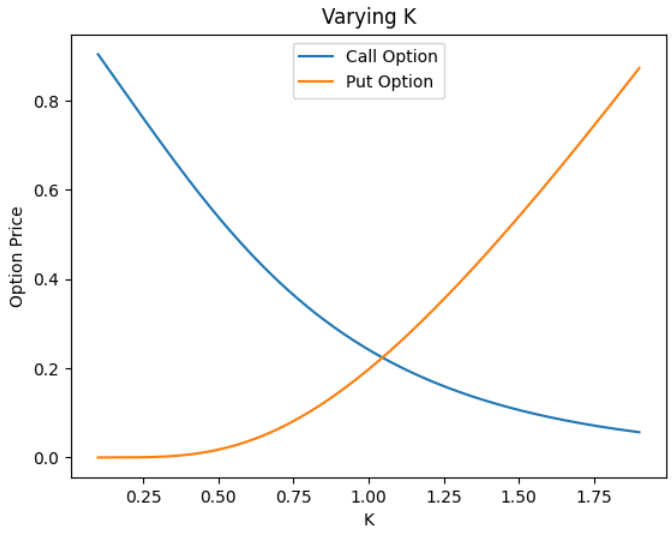
C(t,x) and P(t,x) as smooth surfaces are plotted below -

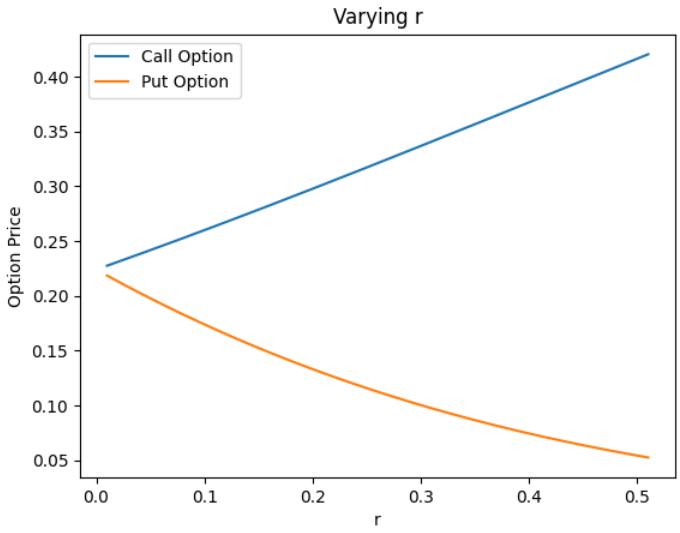


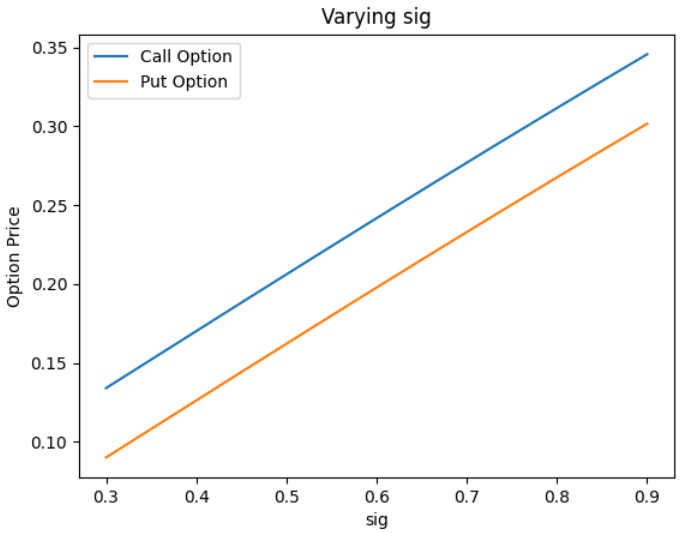


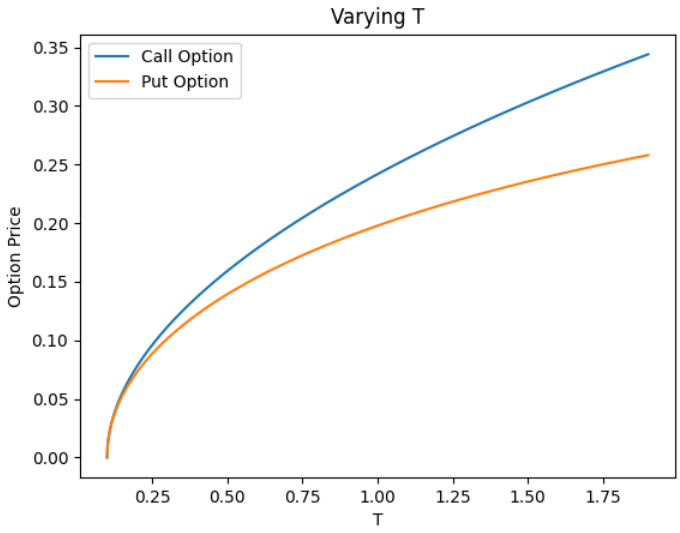
Question 4

The 2-D graphs are -





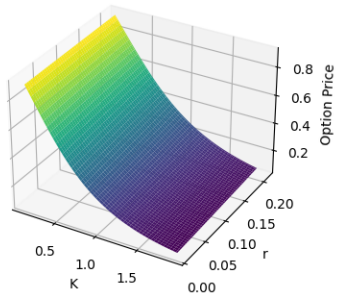




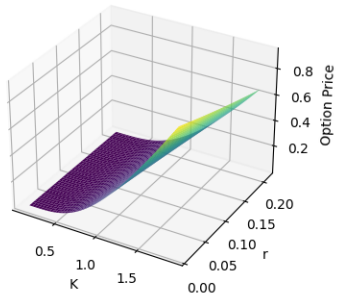
The 3-D graphs are -

Varying K and r

Call Option Price

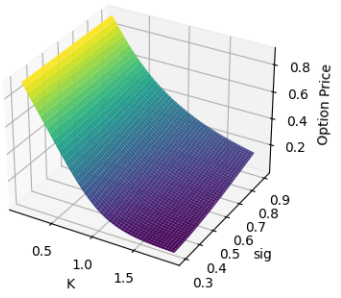


Put Option Price

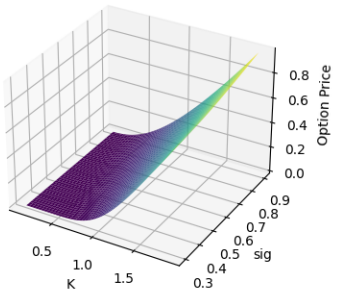


Varying K and sig

Call Option Price

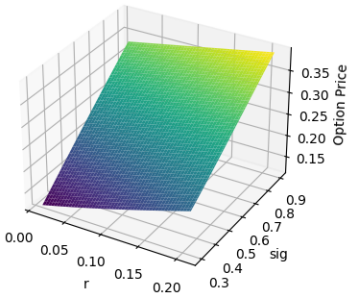


Put Option Price

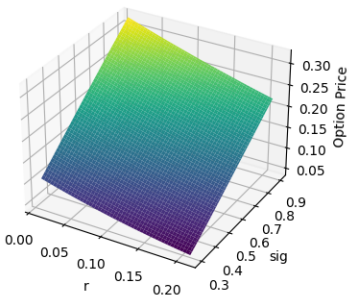


Varying r and sig

Call Option Price

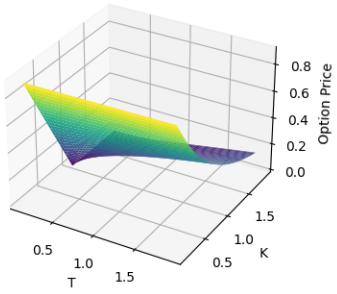


Put Option Price

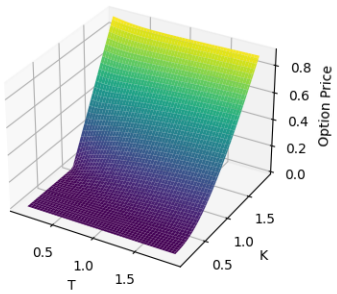


Varying T and K

Call Option Price

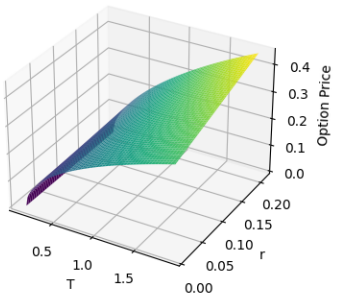


Put Option Price

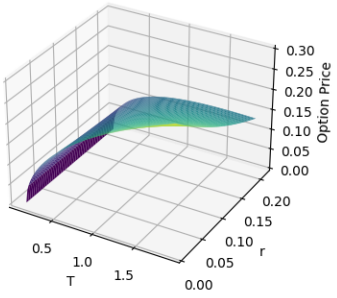


Varying T and r

Call Option Price

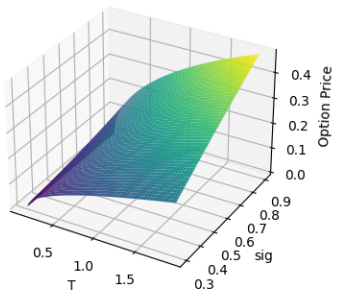


Put Option Price



Varying T and sig

Call Option Price



Put Option Price