MA473: Computational Finance: LAB 7
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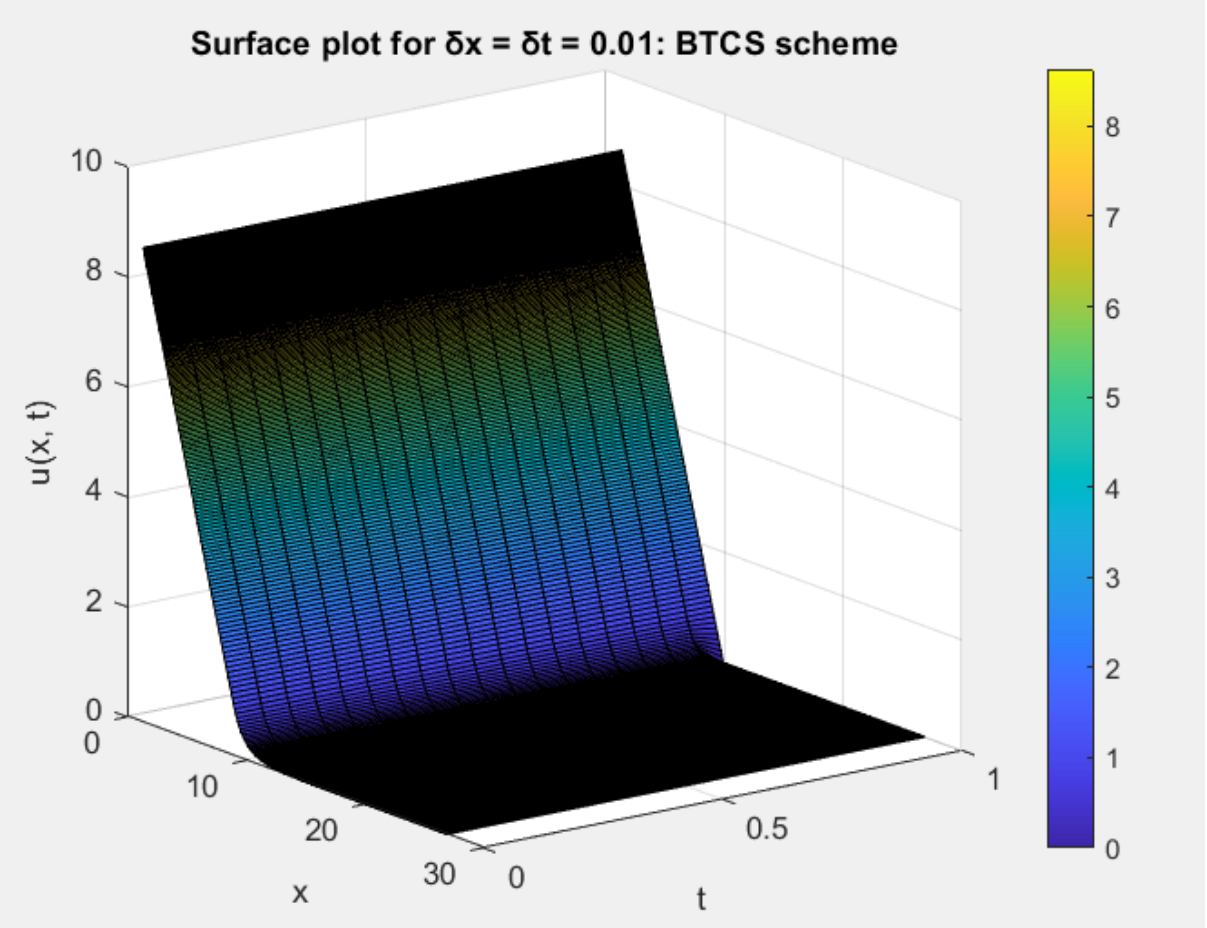
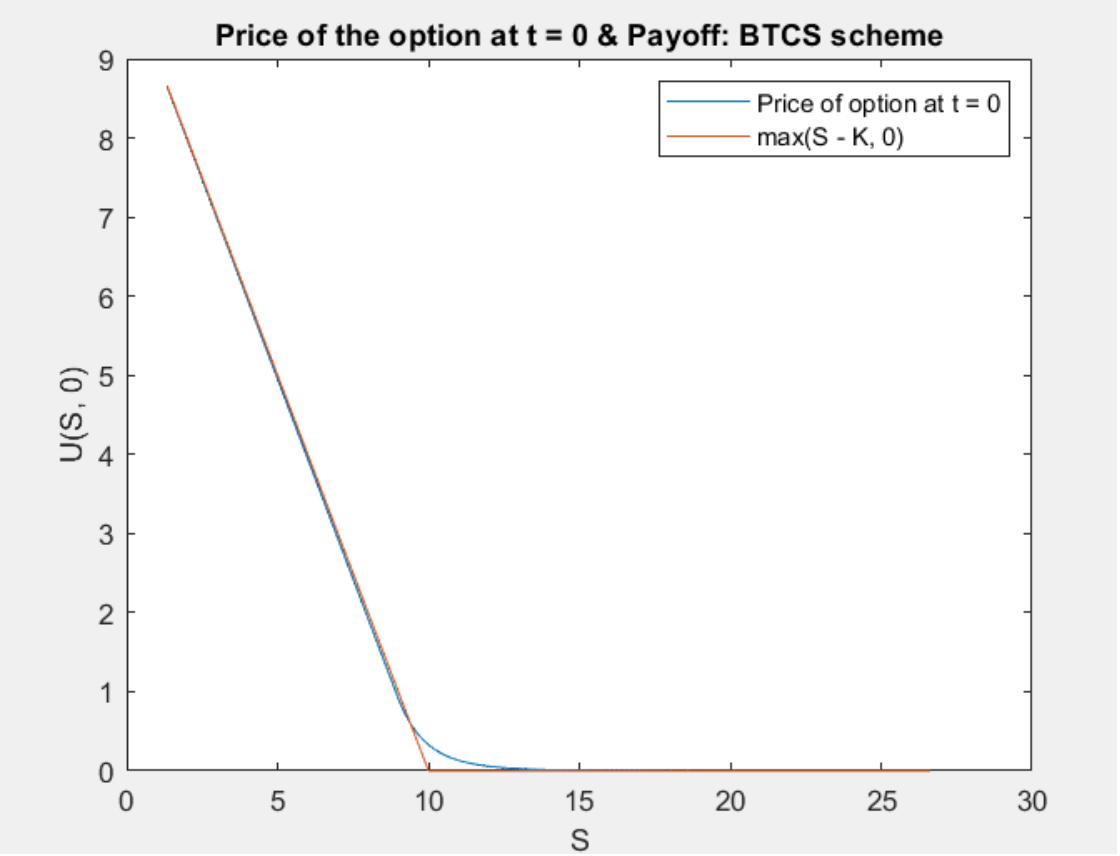
Question 1:

The surface plots for the solution of the Black Scholes PDE for American Put using different schemes are:

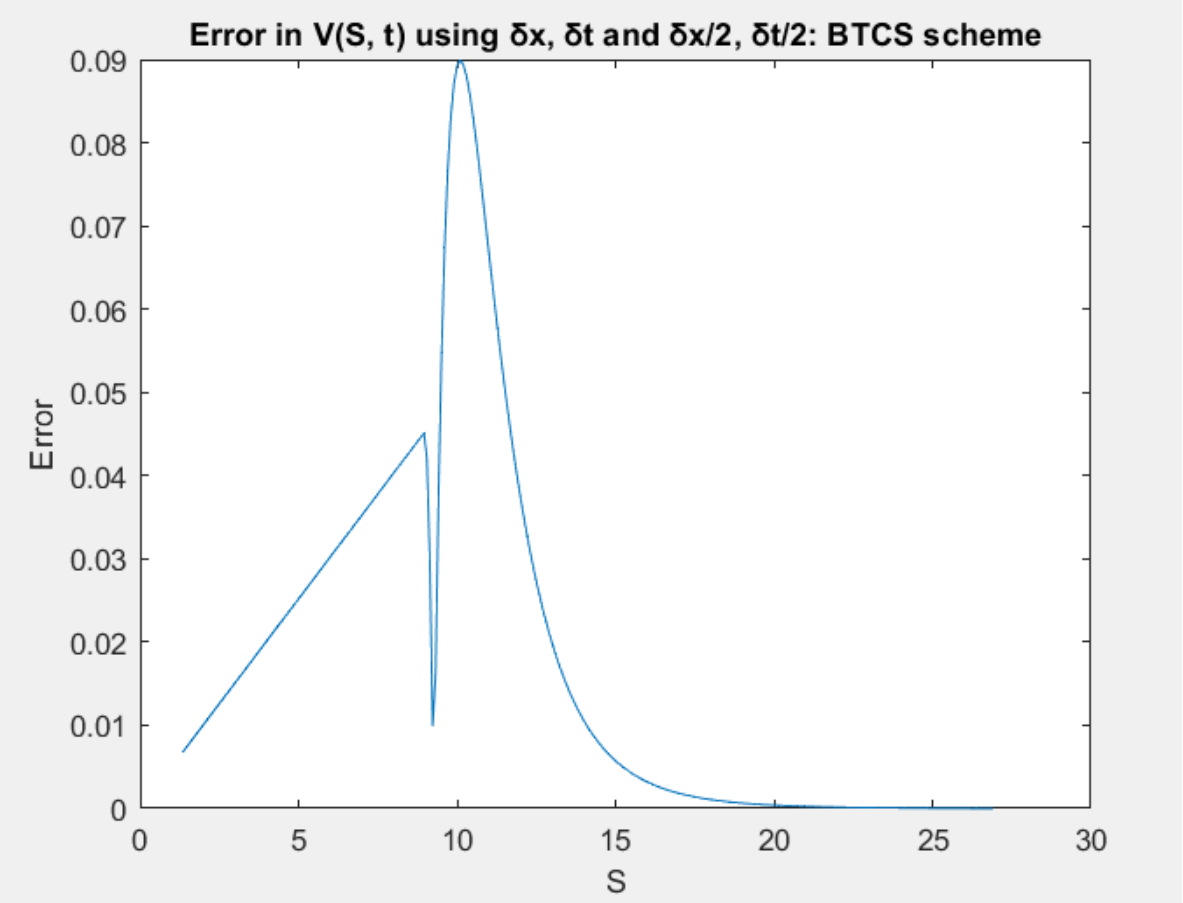
1. **BTCS Scheme:**

   Part A & B:




Price of the option at t = 0 & Payoff: BTCS scheme
Price of option at t = 0
max(S - K, 0)
U(S, 0)
S
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30

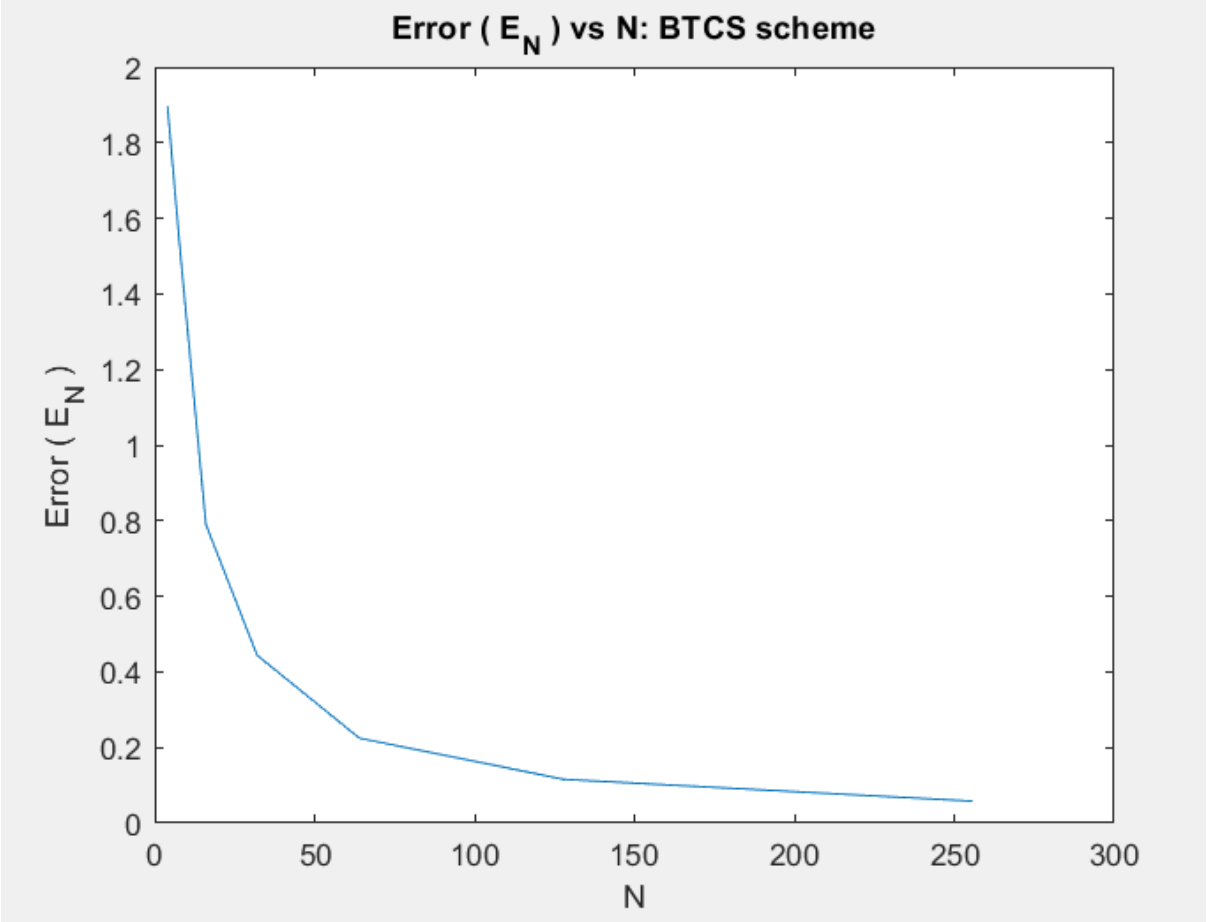
Part C:


Error in V(S, t) using δx, δt and δx/2, δt/2: BTCS scheme
Error
S
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0
5
10
15
20
25
30

Part D:

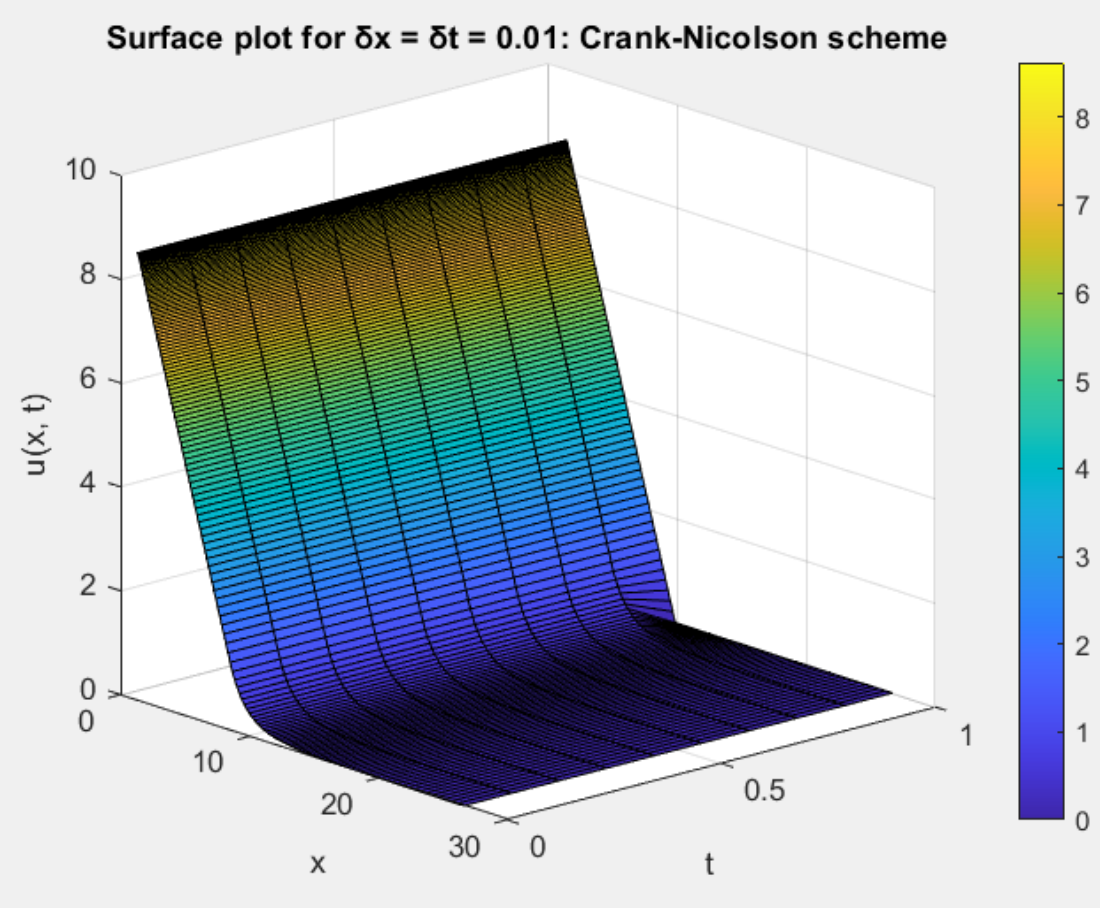
******** BTCS Scheme ********

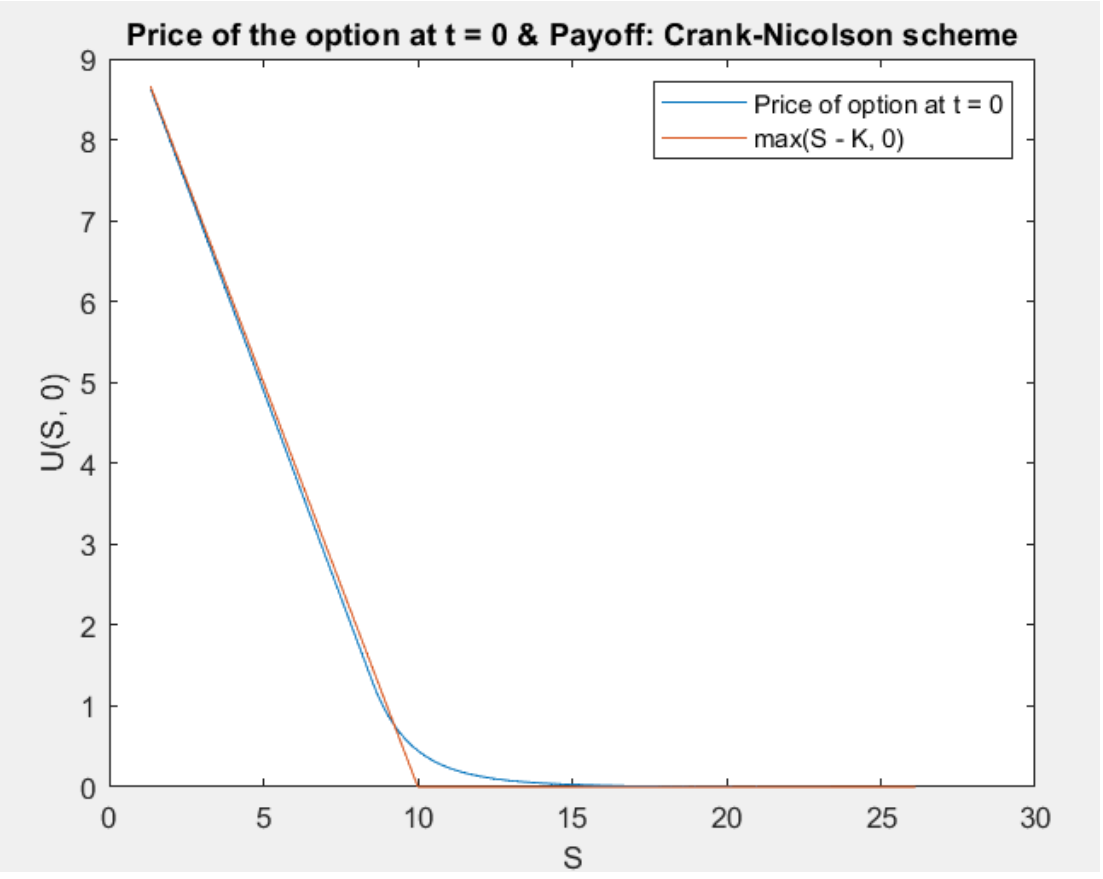
SI No.	N	δx	δt	δx/2	δt/2	Max error (En)
1	4	0.75	0.045	0.375	0.0225	1.8967
2	8	0.375	0.0225	0.1875	0.01125	1.5088
3	16	0.1875	0.01125	0.09375	0.005625	0.78974
4	32	0.09375	0.005625	0.046875	0.0028125	0.44384
5	64	0.046875	0.0028125	0.023438	0.0014062	0.22452
6	128	0.023438	0.0014062	0.011719	0.00070312	0.1156
7	256	0.011719	0.00070312	0.0058594	0.00035156	0.057968



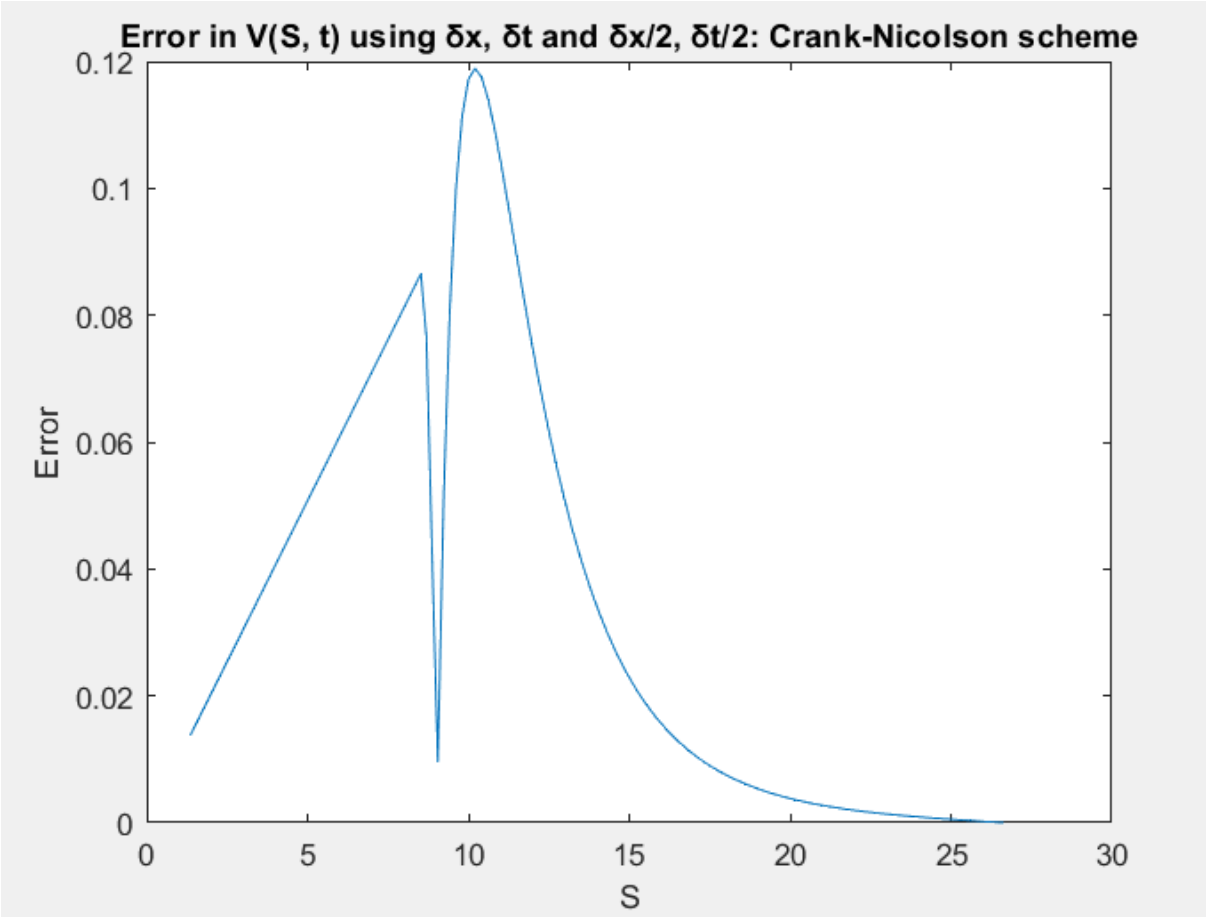
2. Crank Nicolson Scheme:

Part A & B:


Surface plot for δx = δt = 0.01: Crank-Nicolson scheme
u(x, t)
10
8
6
4
2
0
0
10
20
30
x
0
0.5
1
t
8
7
6
5
4
3
2
1
0


Price of the option at t = 0 & Payoff: Crank-Nicolson scheme
Price of option at t = 0
max(S - K, 0)
U(S, 0)
9
8
7
6
5
4
3
2
1
0
0
5
10
15
20
25
30
S

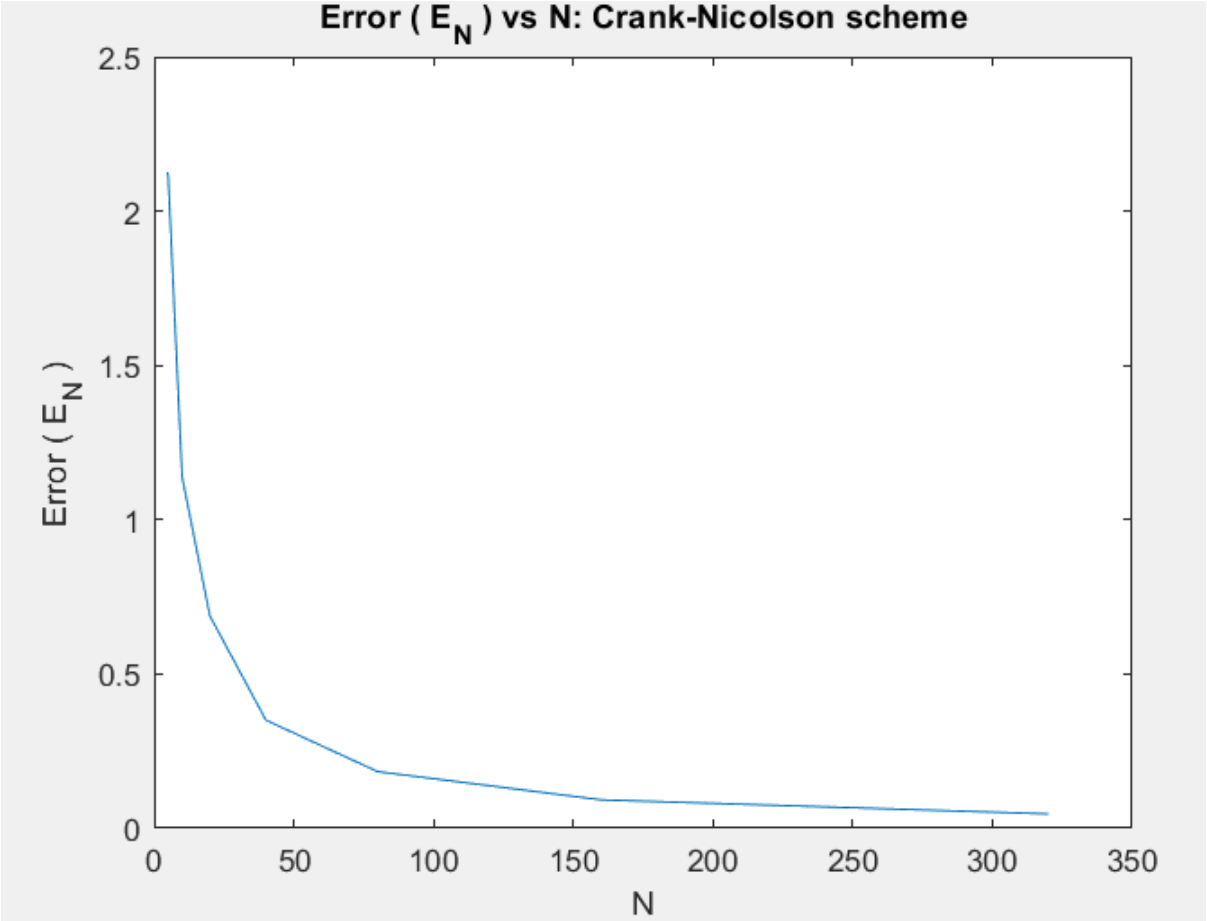
Part C:



Part D:

******** Crank-Nicolson Scheme ********

SI No.	N	δx	δt	δx/2	δt/2	Max error (En)
1	5	0.6	0.036	0.3	0.018	2.122
2	10	0.3	0.018	0.15	0.009	1.1404
3	20	0.15	0.009	0.075	0.0045	0.68733
4	40	0.075	0.0045	0.0375	0.00225	0.35011
5	80	0.0375	0.00225	0.01875	0.001125	0.18345
6	160	0.01875	0.001125	0.009375	0.0005625	0.092153
7	320	0.009375	0.0005625	0.0046875	0.00028125	0.046619


Error (E_N) vs N: Crank-Nicolson scheme
Error (E_N)
N
0
0.5
1
1.5
2
2.5
0
50
100
150
200
250
300
350