भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

MA 473: Computational Finance Lab

Lab 05 - 06

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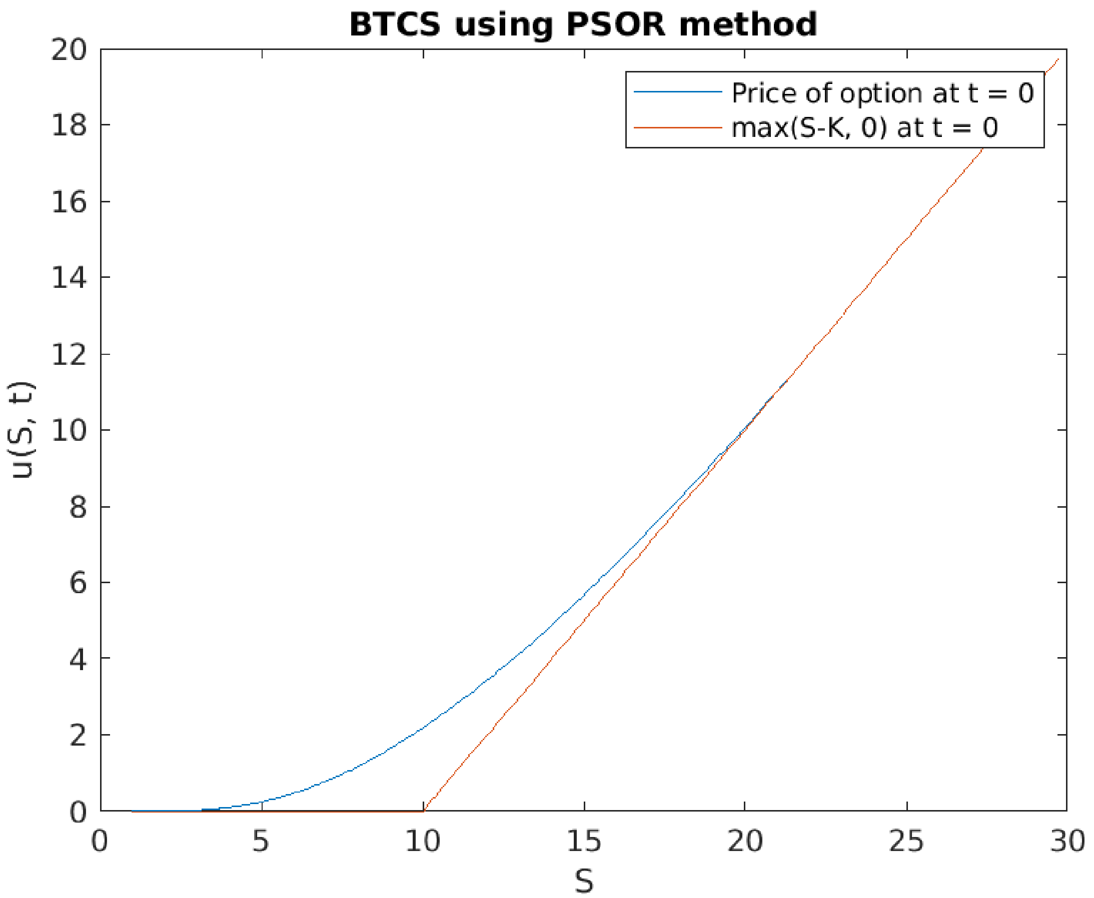
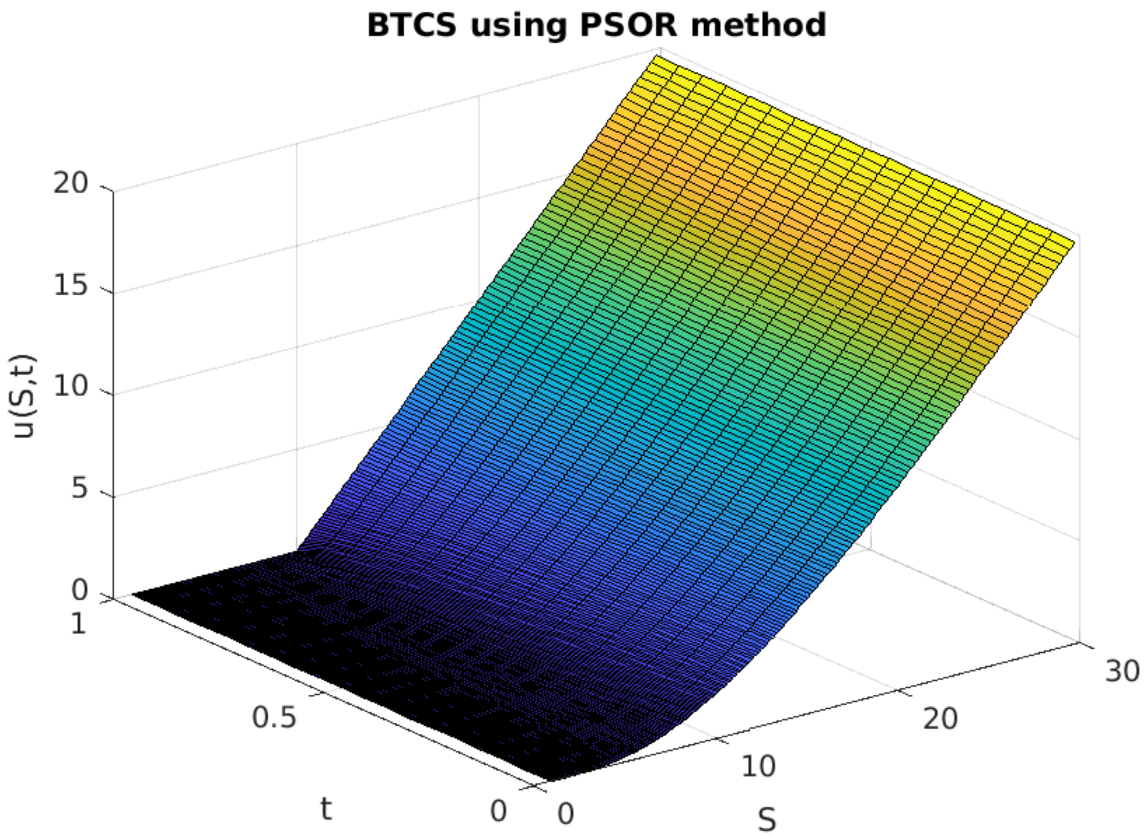
30 Sept 2021

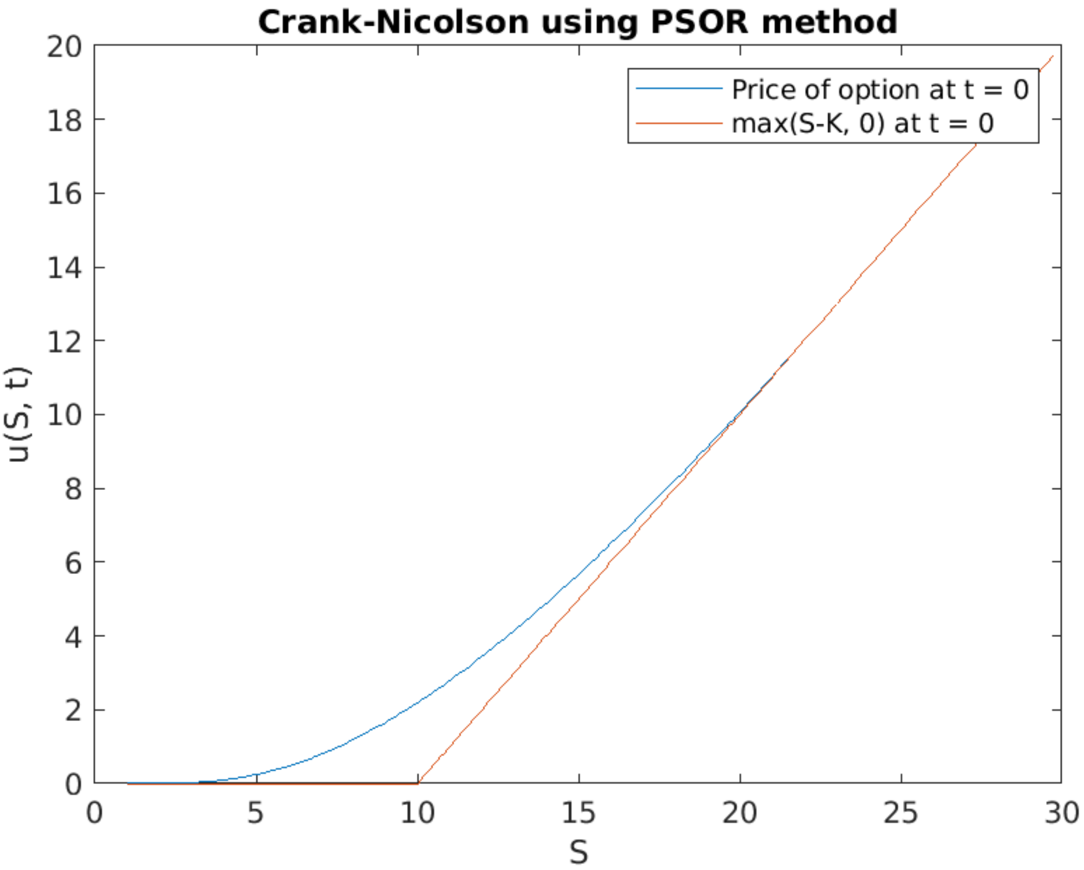
For extreme values of S (or x) the error in the plots is mainly due to the error in computing the boundary condition because we don't have $x = \infty$ and $-\infty$ as required. Our x has a small range −5 to 1.

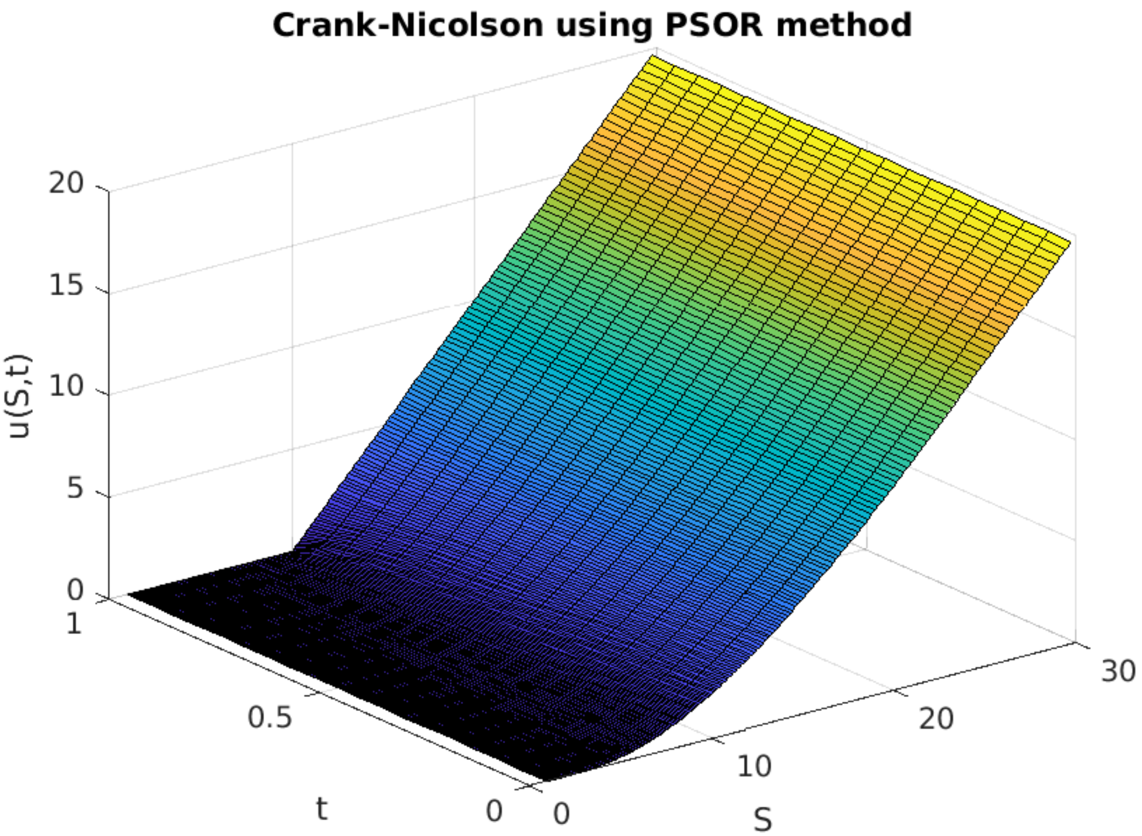
Question 01.

Pricing American Call using BTCS and Crank-Nicolson along with PSOR method.

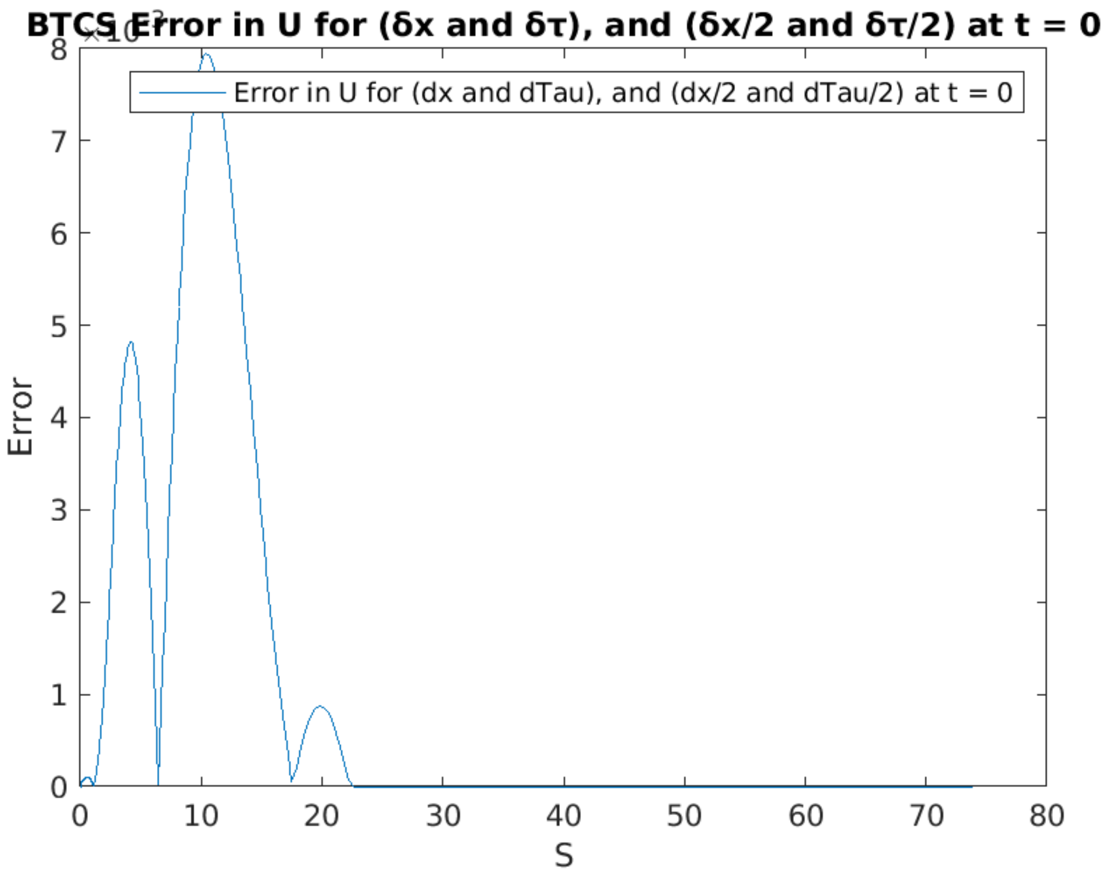


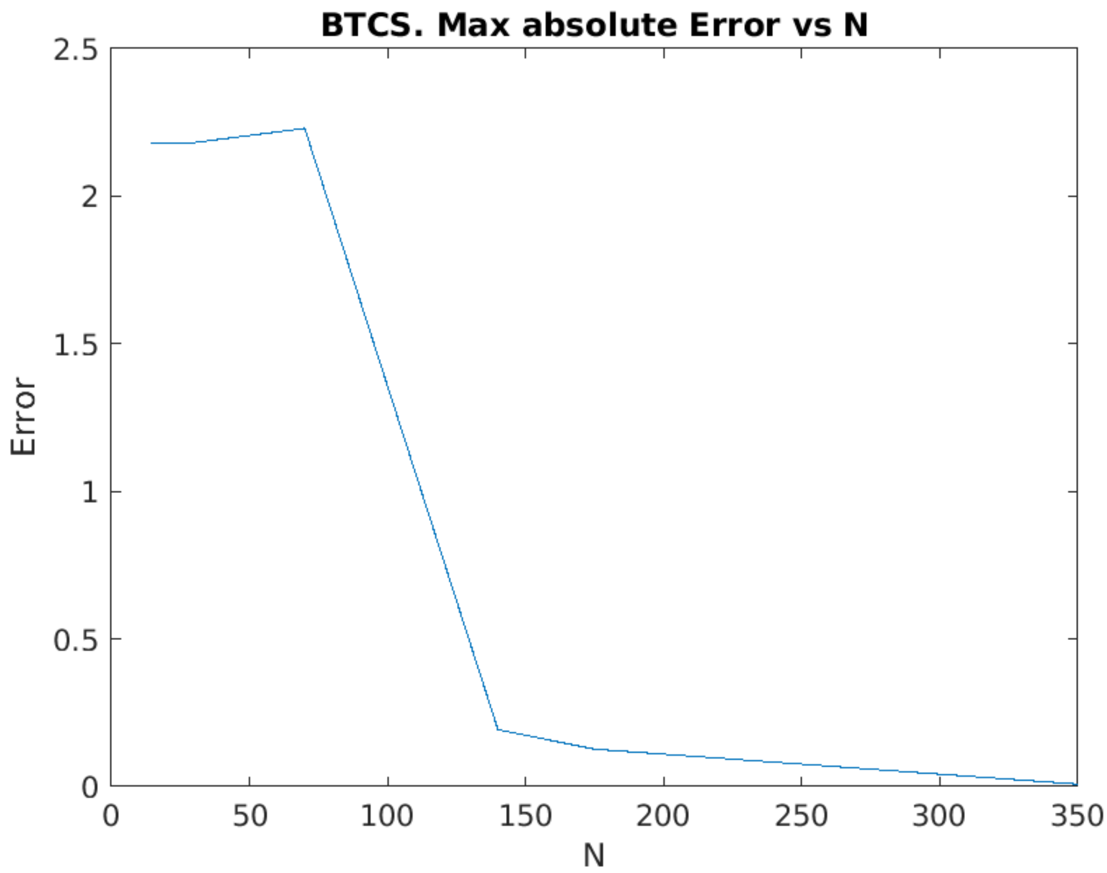

BTCS using PSOR method
u(S,t)
20
15
10
5
0
1
0.5
t
0
0
10
20
30
S

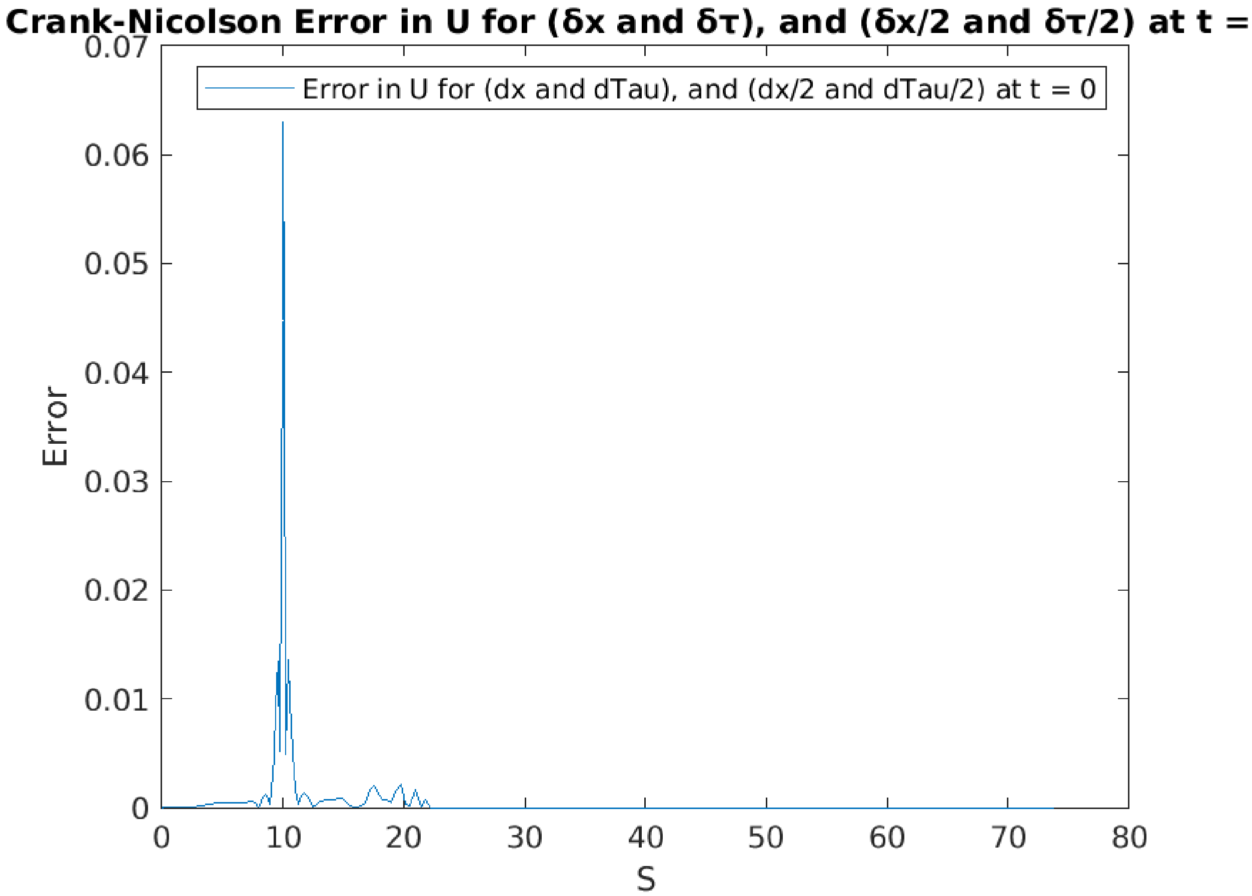

Crank-Nicolson using PSOR method
Price of option at t = 0
max(S-K, 0) at t = 0
u(S, t)
S
20
18
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30

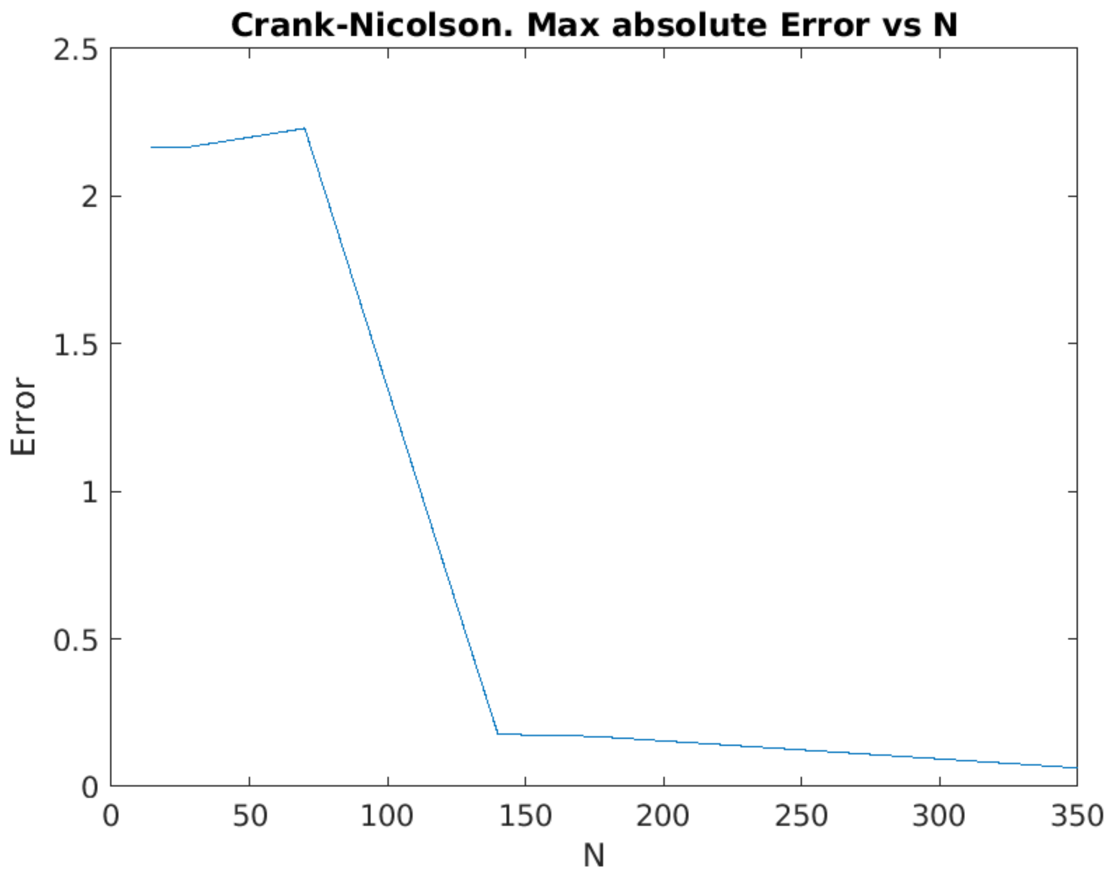


Crank-Nicolson using PSOR method
u(S,t)
20
15
10
5
0
1
0.5
0
t
0
10
20
30
S


BTCS Error in U for (δx and δτ), and (δx/2 and δτ/2) at t = 0
Error in U for (dx and dTau), and (dx/2 and dTau/2) at t = 0
Error
S
0
10
20
30
40
50
60
70
80
1
2
3
4
5
6
7
8

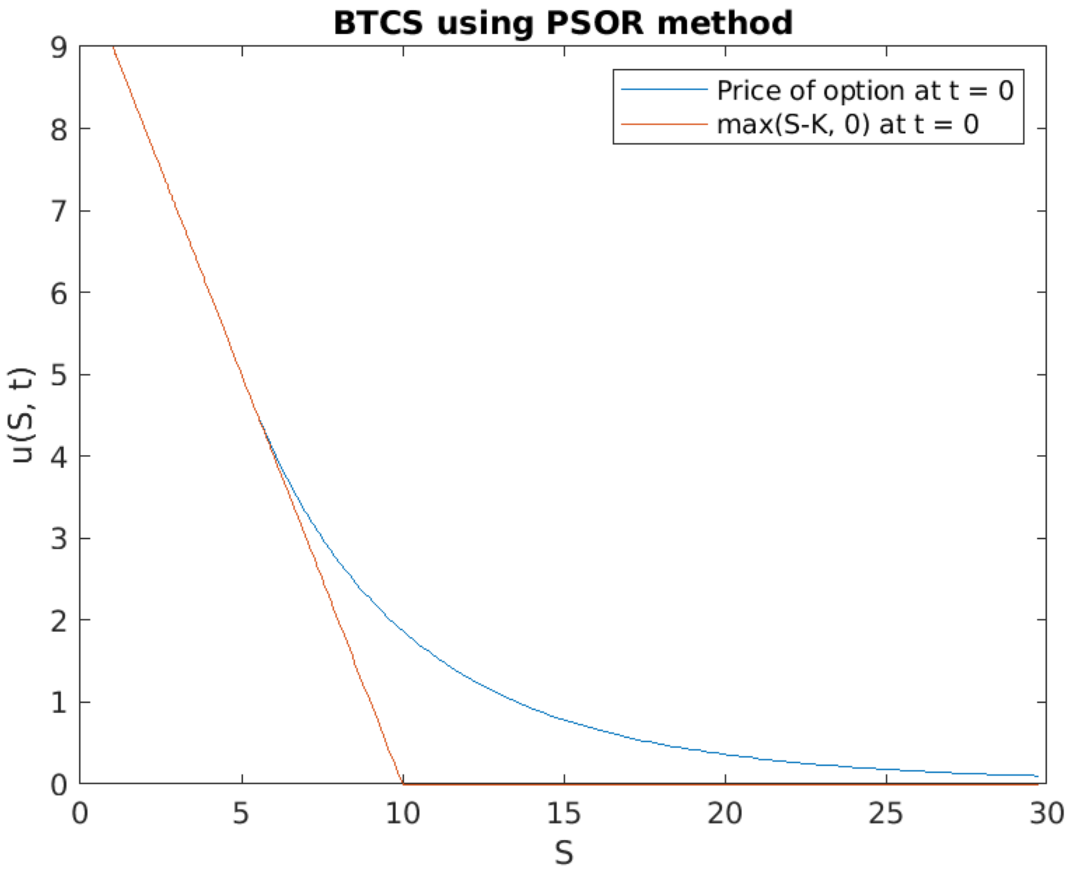

BTCS. Max absolute Error vs N
Error
N
2.5
2
1.5
1
0.5
0
0
50
100
150
200
250
300
350

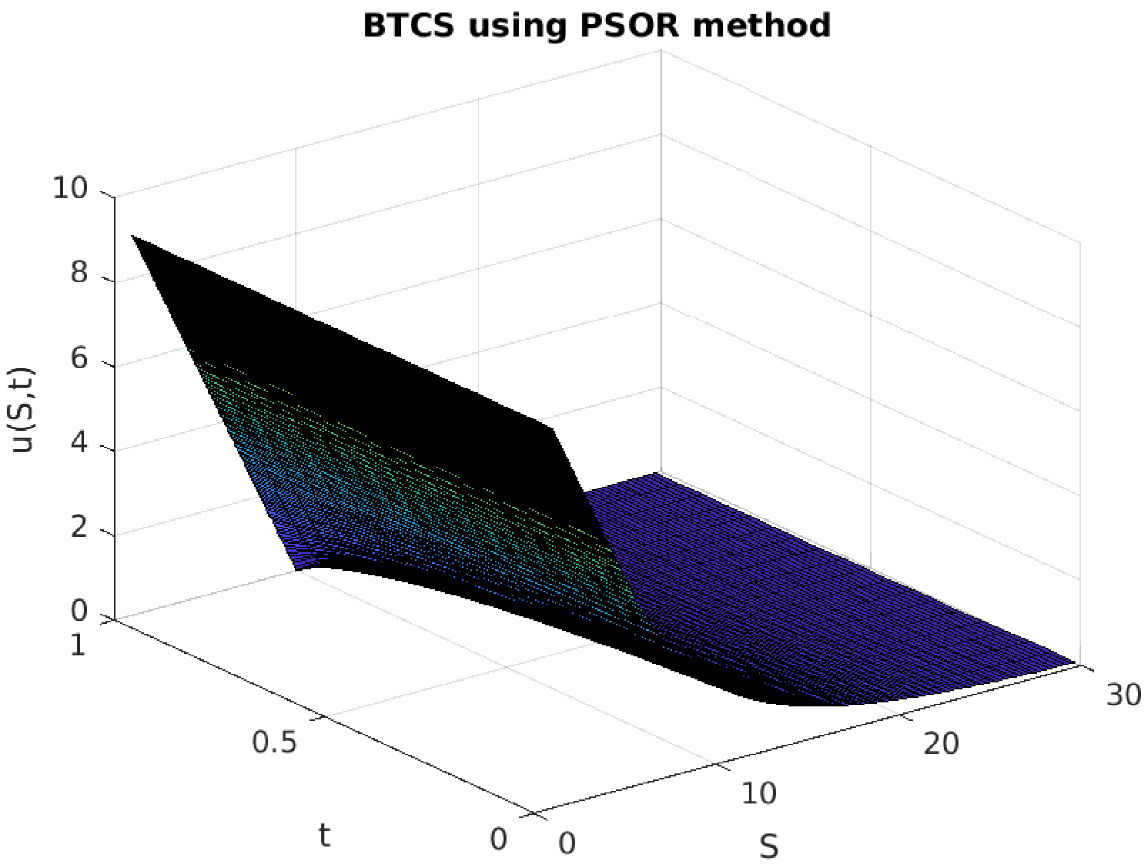

Crank-Nicolson Error in U for (δx and δτ), and (δx/2 and δτ/2) at t =
Error in U for (dx and dTau), and (dx/2 and dTau/2) at t = 0
Error
S
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0
10
20
30
40
50
60
70
80

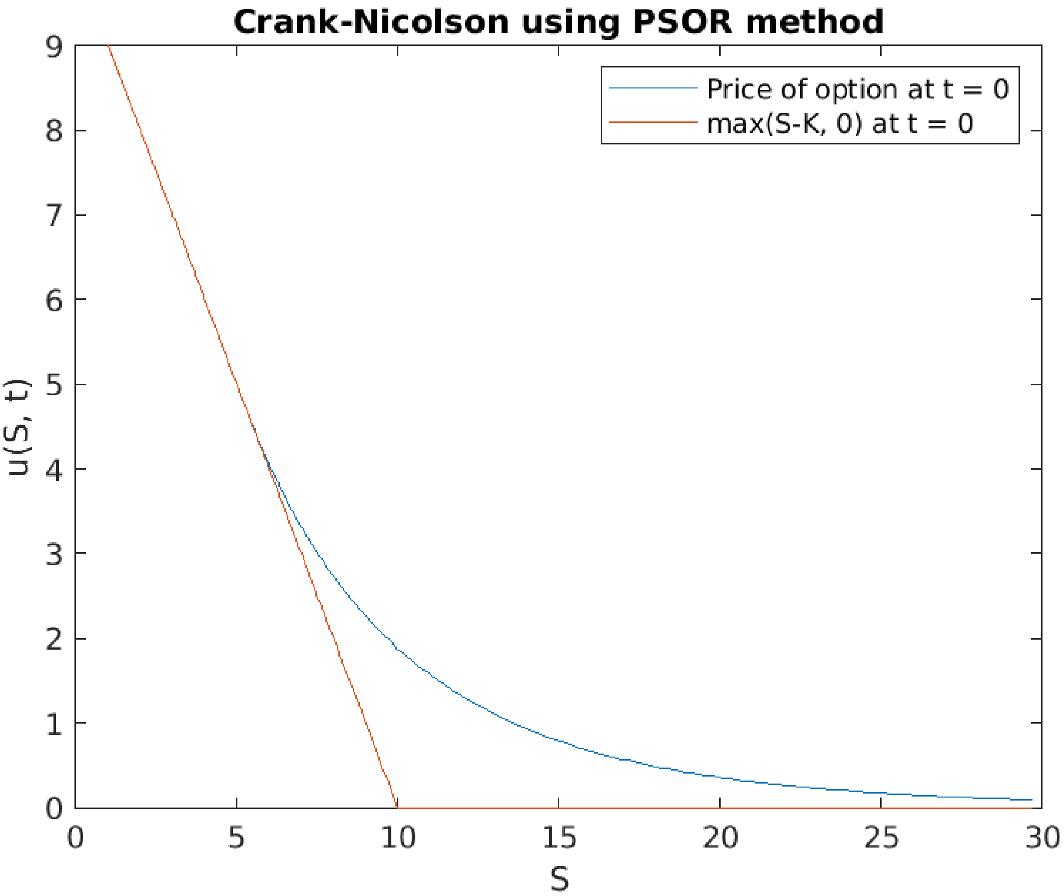

Crank-Nicolson. Max absolute Error vs N
Error
N
0
0.5
1
1.5
2
2.5
50
100
150
200
250
300
350

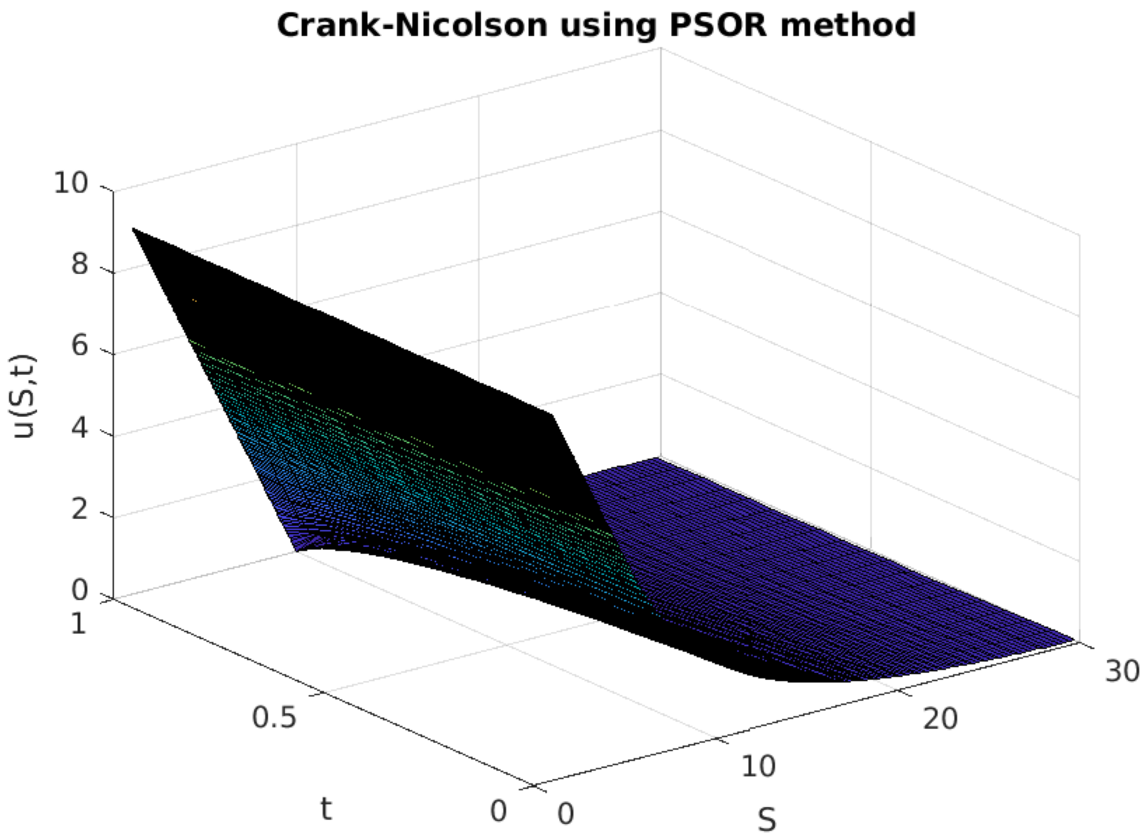
Question 02.

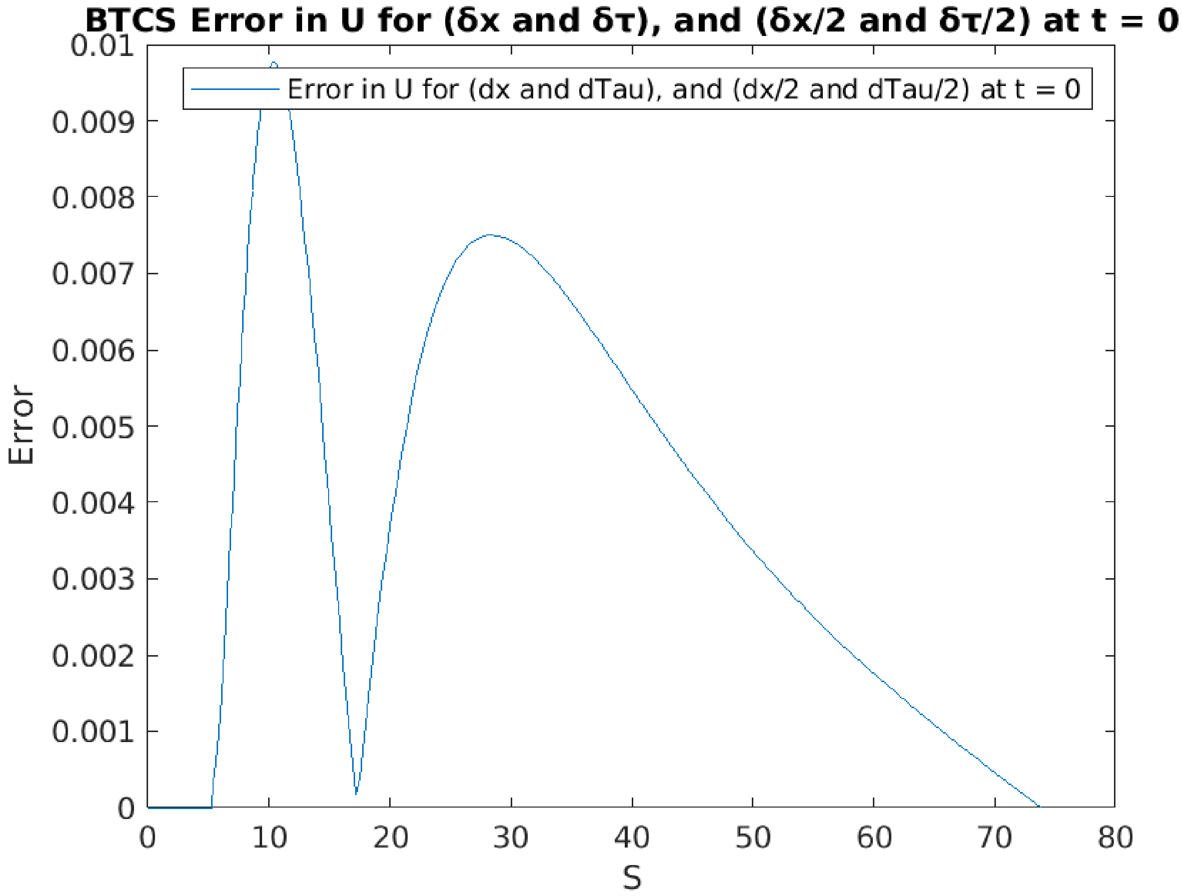
Pricing American Put using BTCS and Crank-Nicolson along with PSOR method.

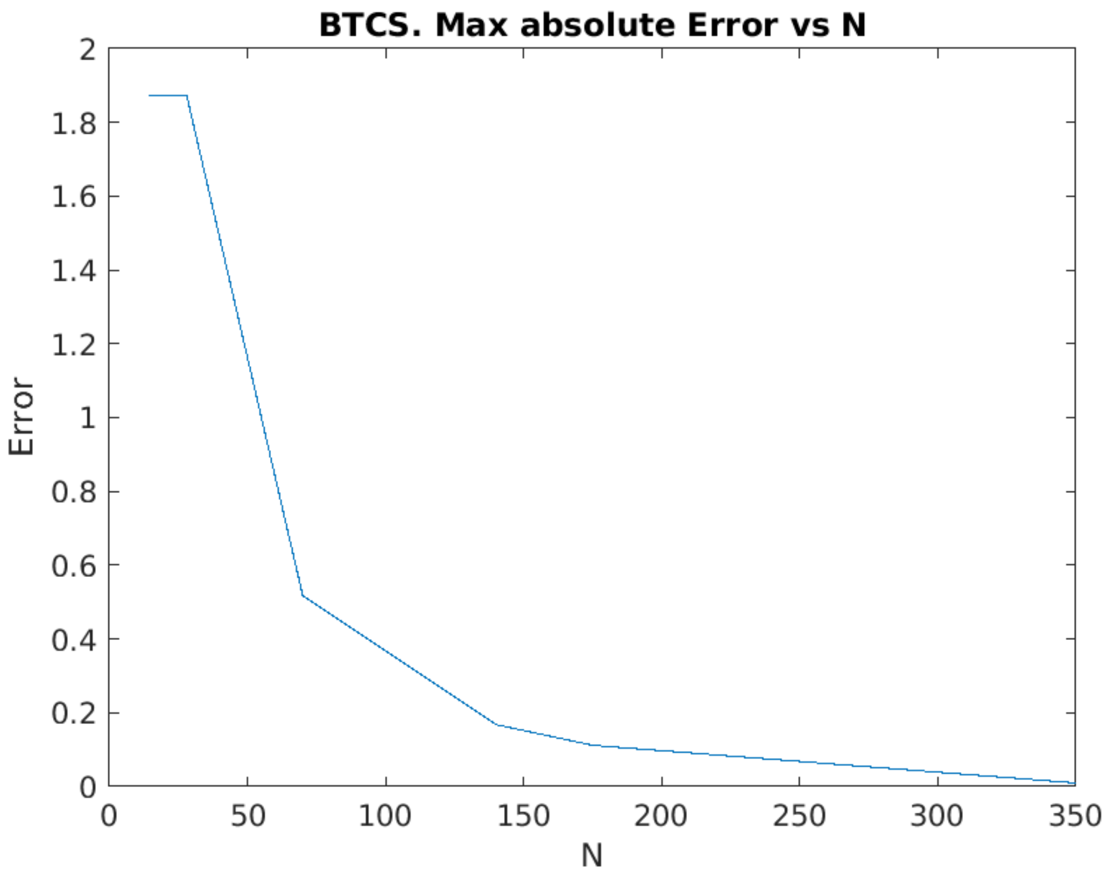


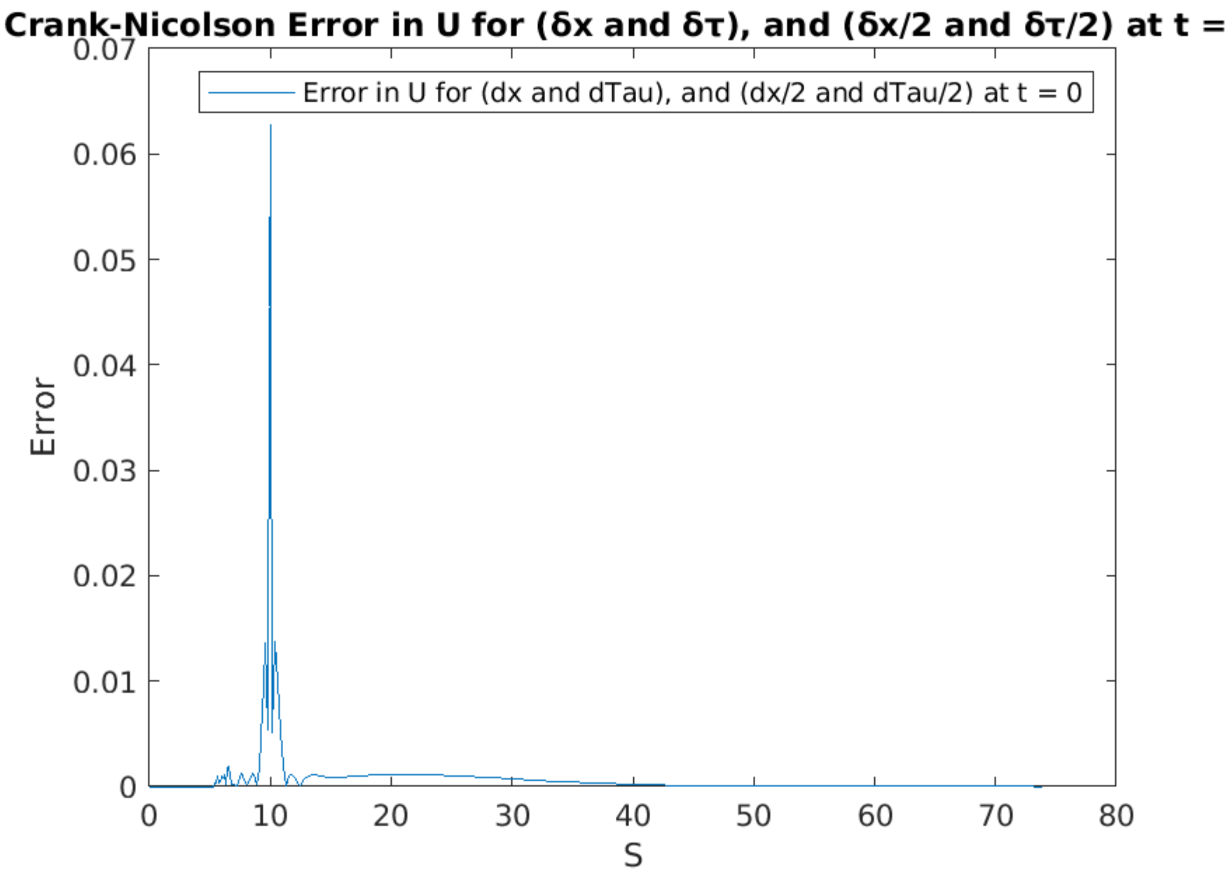

BTCS using PSOR method
u(S,t)
10
8
6
4
2
0
1
0.5
t
0
0
10
20
30
S

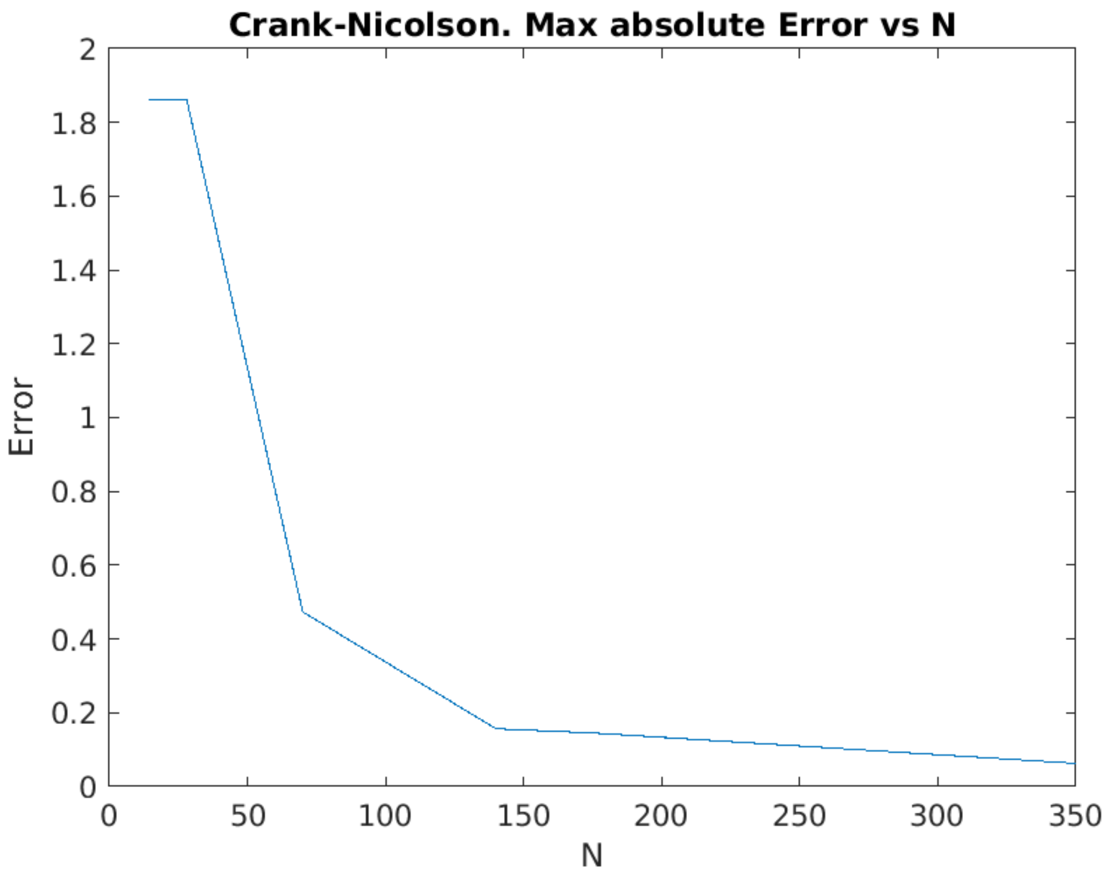

Crank-Nicolson using PSOR method
Price of option at t = 0
max(S-K, 0) at t = 0
u(S, t)
S
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30


Crank-Nicolson using PSOR method
u(S,t)
t
S
0
2
4
6
8
10
0
0.5
1
0
10
20
30


BTCS Error in U for (δx and δτ), and (δx/2 and δτ/2) at t = 0
Error in U for (dx and dTau), and (dx/2 and dTau/2) at t = 0
Error
S
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
10
20
30
40
50
60
70
80


BTCS. Max absolute Error vs N
Error
N
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
300
350


Crank-Nicolson Error in U for (δx and δτ), and (δx/2 and δτ/2) at t =
Error in U for (dx and dTau), and (dx/2 and dTau/2) at t = 0
Error
S
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50
60
70
80


Crank-Nicolson. Max absolute Error vs N
Error
N
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
300
350