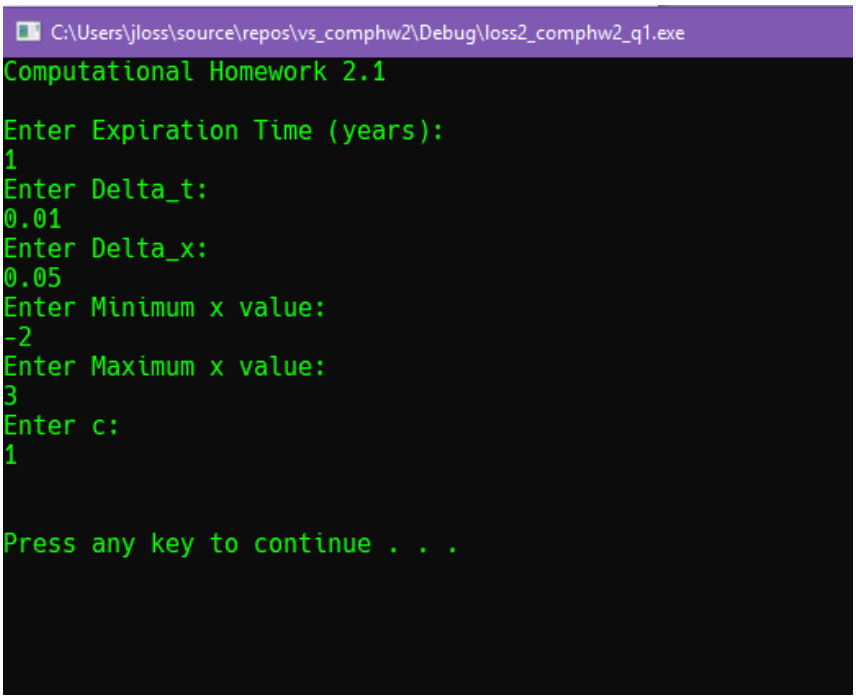
3/27/2019
IE 525
Joseph Loss (loss2)

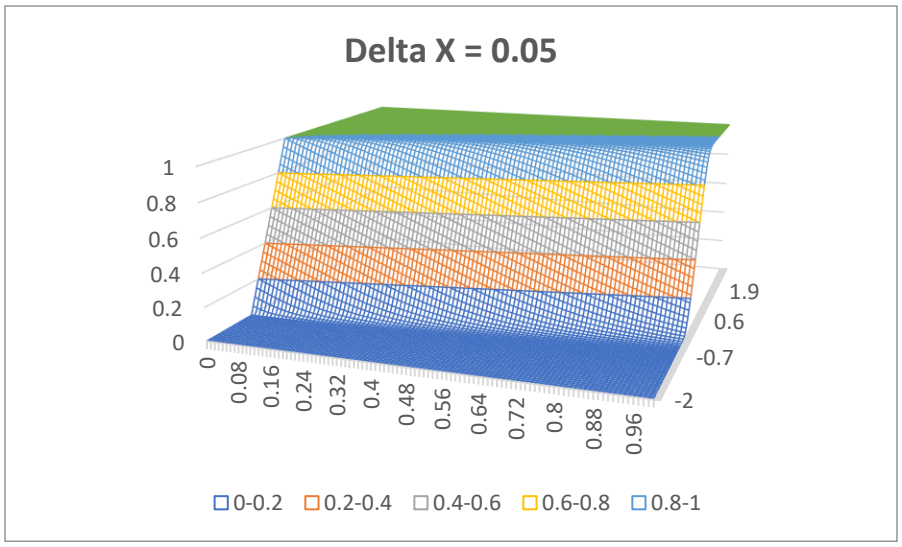
Computational Assignment #2

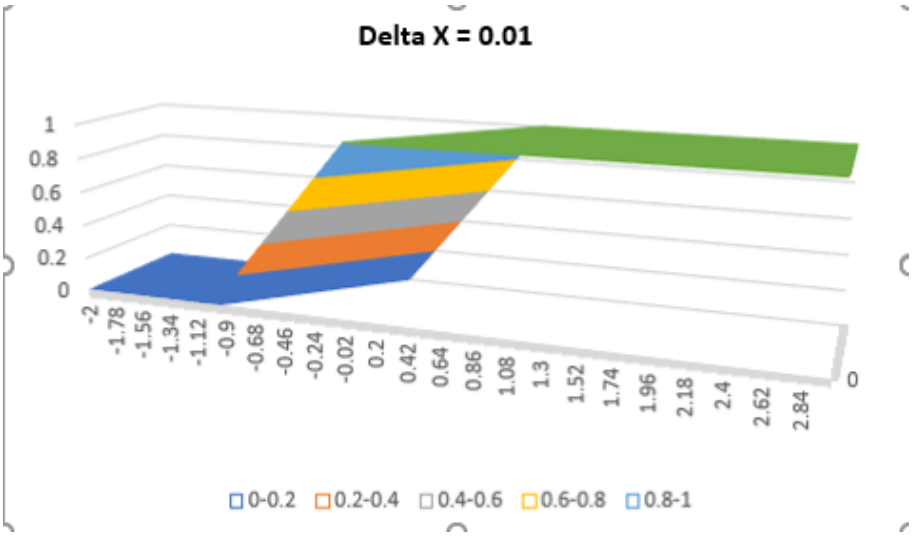
Question 1a: *loss2_comphw2_q1*

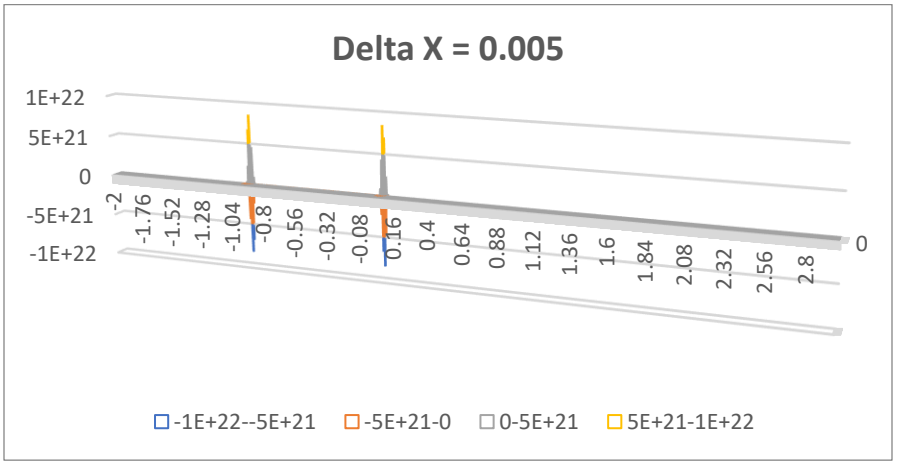


A .csv file will be created and written to upon running loss2_comp2_q1.exe. This data file can then be used to plot the data, as seen in the following graphs for question 1b (continued on following page).

Question 1b


Delta X = 0.05
1
0.8
0.6
0.4
0.2
0
0
0.08
0.16
0.24
0.32
0.4
0.48
0.56
0.64
0.72
0.8
0.88
0.96
1.9
0.6
-0.7
-2
0-0.2
0.2-0.4
0.4-0.6
0.6-0.8
0.8-1


Delta X = 0.01
1
0.8
0.6
0.4
0.2
0
-2
-1.78
-1.56
-1.34
-1.12
-0.9
-0.68
-0.46
-0.24
-0.02
0.2
0.42
0.64
0.86
1.08
1.3
1.52
1.74
1.96
2.18
2.4
2.62
2.84
0
0-0.2
0.2-0.4
0.4-0.6
0.6-0.8
0.8-1


Delta X = 0.005
1E+22
5E+21
0
-5E+21
-1E+22
-2
-1.76
-1.52
-1.28
-1.04
-0.8
-0.56
-0.32
-0.08
0.16
0.4
0.64
0.88
1.12
1.36
1.6
1.84
2.08
2.32
2.56
2.8
0
-1E+22--5E+21
-5E+21-0
0-5E+21
5E+21-1E+22

As we can see from the above plots, the scheme is stable when Delta X = 0.01 or 0.05. However, the scheme is clearly unstable with Delta X = 0.005. The model essentially blows up, and as we can visually see above, it generates incorrect values.

Question 2a

$$PDE: \frac{\partial f}{\partial t} + \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 f}{\partial S_t^2} + rS_t \frac{\partial f}{\partial S_t} - rf = 0$$

$$N\delta S = 4 \cdot S_0; \;\; M\delta t = T;$$

$$Terminal\ Condition: u(x, M) = payoff(x)^*$$

*Note that payoff(x) is given by the payoff function at maturity T, i.e.: $\begin{cases} \max\{K - S, 0\}, & \text{if } S \geq S_b \\ 0, & \text{if } S < S_b \end{cases}$

$$Boundary\ condition: u(0, t) = u(N, t) = 0$$

$$Boundary\ condition: u(X, t) = 0\ where\ X \leq S_b$$

Question 2b: *loss2_comphw2_q2*

```
C:\Users\jloss\source\repos\vs_comphw2\Debug\loss2_comphw2_q2.exe
Computational Homework 2.2

Enter M:
1000
Enter N:
200
Enter Expiration Time (month):
5
Enter Sb:
40
Enter S0:
50
Enter K:
50
Enter sigma:
0.4
Enter r:
0.1


DAO Put Price using Crank-Nicolson scheme = 0.542501
DAO Put Price using exact solution = 0.542415
------------------------------------------
Difference = 8.57095e-05


Press any key to continue . . .
```

Question 3: *loss2_comphw2_q3*