Homework 9

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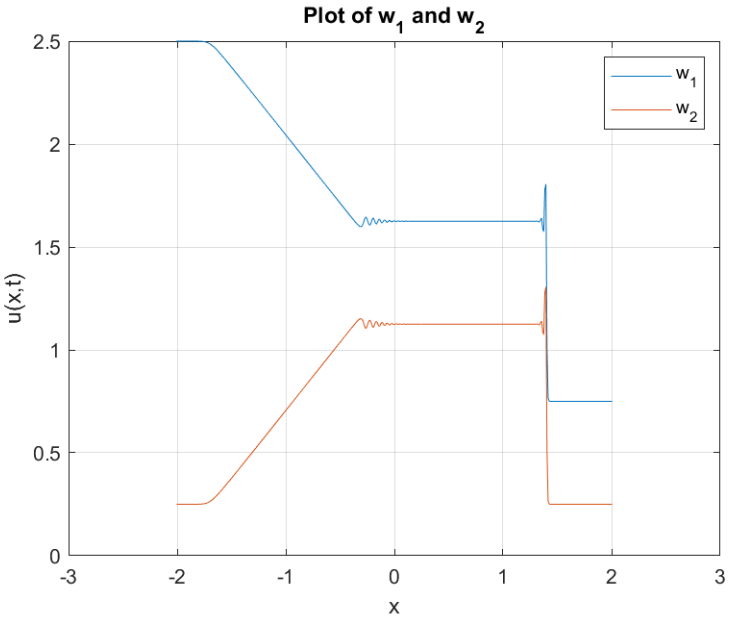
Problem 1

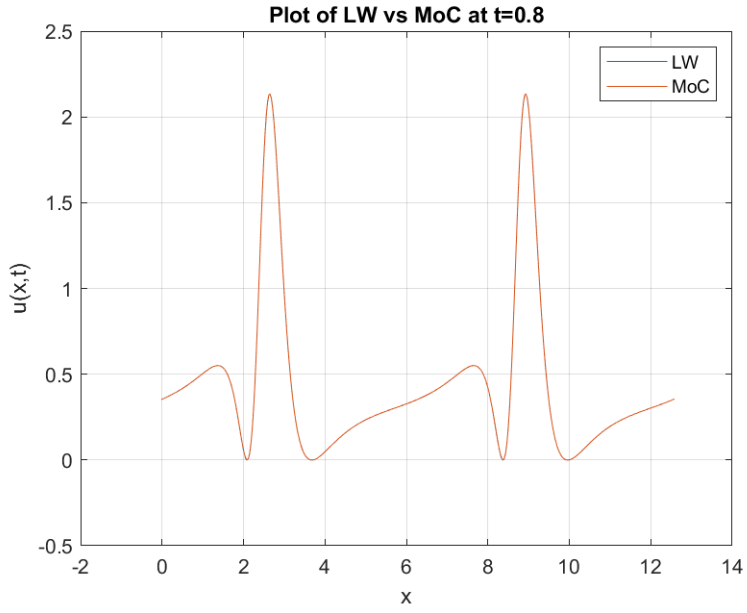
For problem 1 we consider the IVP of a system of conservation laws

We are asked to implement the richtmyer 2-step Lax-Wendroff method then plot $w_1(x,t)$ and $w_2(x,t)$ vs x.



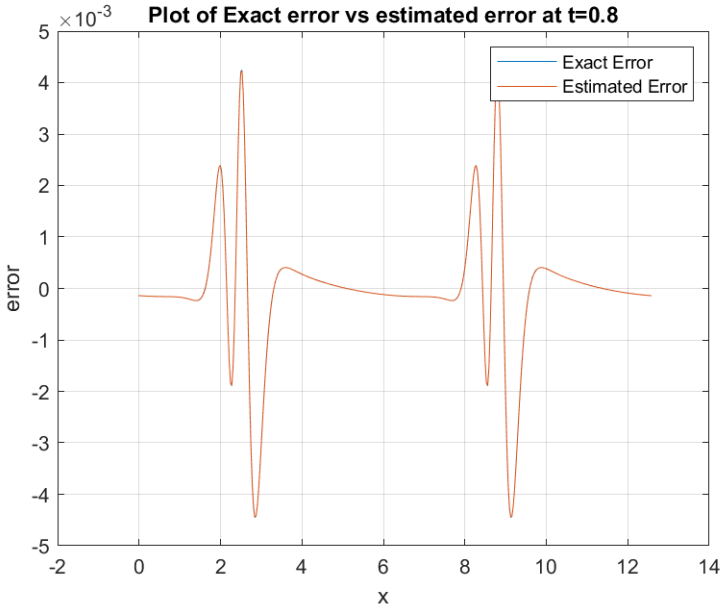
Problem 2

Problem 2 we consider the IVP of a linear conservation law with variable coefficients. First we want to program 'LW_1dt.m' which is the Richtmyer 2-step Lax-Wendroff method using that function we can compute at each time step. We then plot the solution of 2s-LW vs x and the method of characteristic (MoC) vs x for $t = 0.8$



Problem 3

Problem 3 we continue with the IVP from problem 2 we treat MoC as the exact solution and use it to find the exact error. We then use N=800 and find the estimated error and plot both errors in 1 figure at time $t = 0.8$

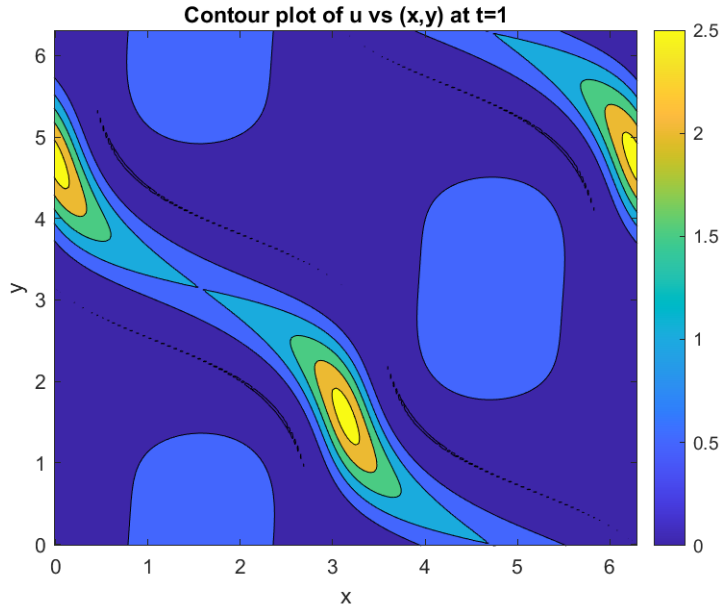


Problem 4

Next Problem 4 asks us to solve a 2D IVP by making it virtually one-dimensional.

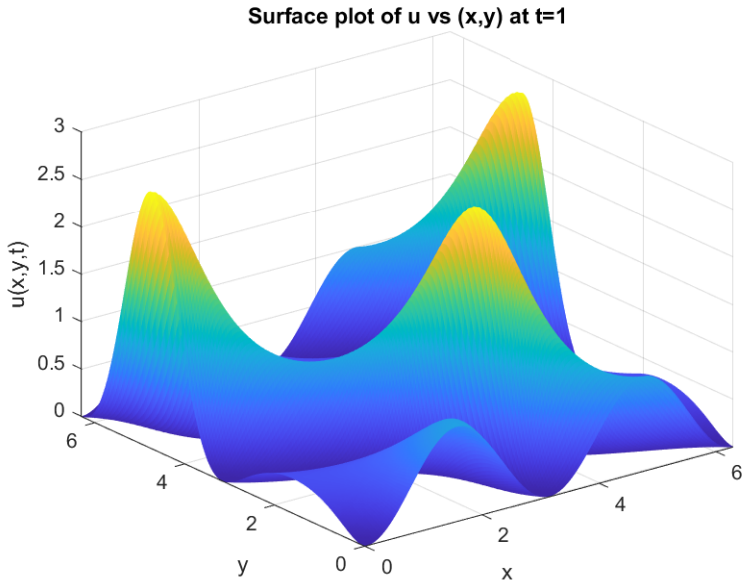
Part 1

Part 1 we are asked to plot a contour of $u(x, y, t)$ vs (x, y) at $t = 1.0$.



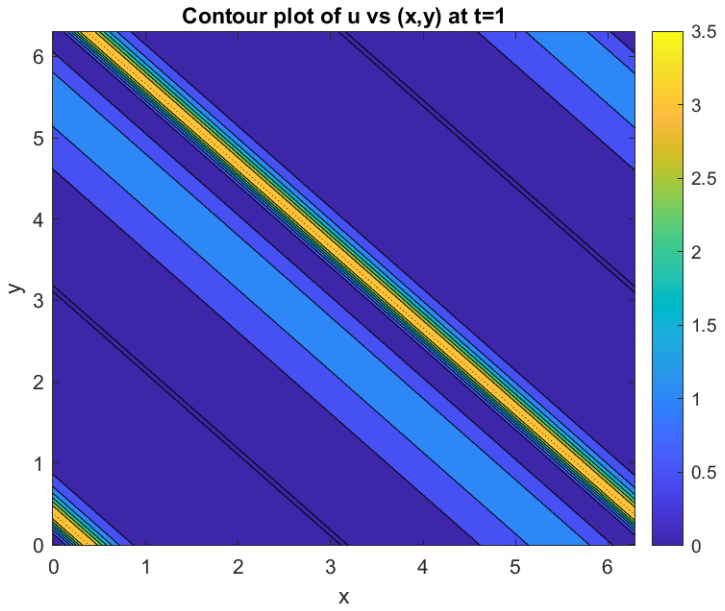
Part 2

Part 2 asks us for a surface plot of $u(x, y, t)$ vs (x, y) at $t = 1.0$.



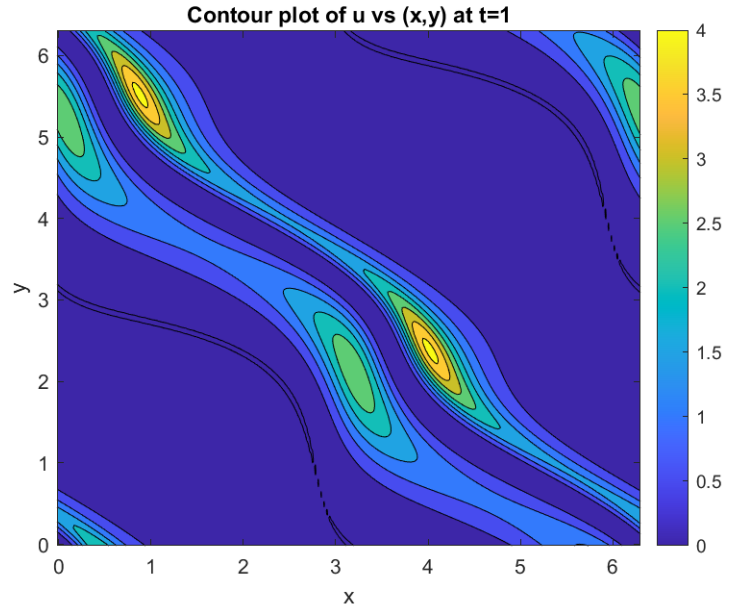
Problem 5

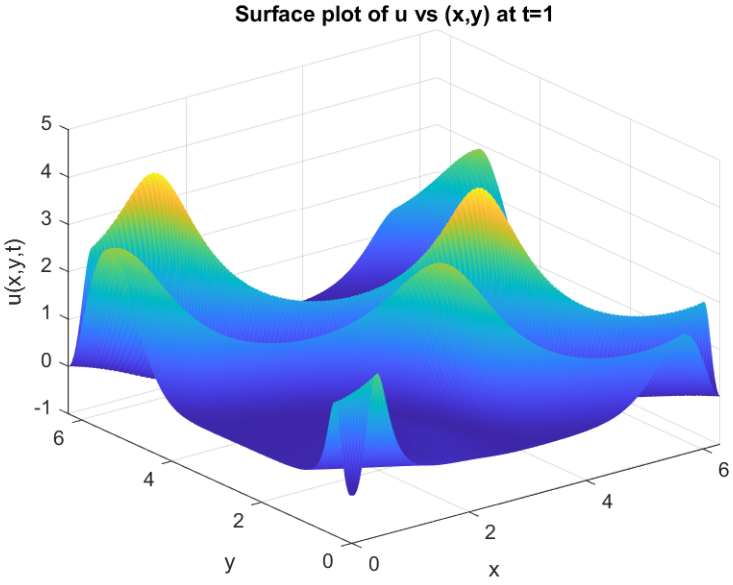
Problem 5 is almost identical to problem 4 with a slight modifications to the problem. This time insted of asking for both a surface plot and contour plot we only need the contour plot.



Problem 6

Problem 6 is a combination of problem 4 and 5 where we first loop over x then loop over y each time step. We then do a contour plot and surface plot for of $u(x, y, t)$ vs (x, y) at $t = 1.0$.


Contour plot of u vs (x,y) at t=1
y
x
0
1
2
3
4
5
6
0.5
1.5
2.5
3.5


Surface plot of u vs (x,y) at t=1
u(x,y,t)
-1
y
x