

# CS 205b / CME 306

## Application Track

### Homework 7

Solve Burger's equation numerically using 3<sup>rd</sup> order ENO-LLF in space and 3<sup>rd</sup> order TVD Runge-Kutta in time. The programs should be written in Matlab or Octave. Then, use your program to solve each of the following problems numerically. Note that many of these have simple analytic solutions that may be useful in testing. For each problem, submit a plot of  $u(x, t)$  over the specified interval for  $x$  at each of the five times  $0, \frac{1}{4}T, \frac{1}{2}T, \frac{3}{4}T,$  and  $T$ , where  $T$  is the final time specified in the problem. The snapshots should be superimposed on a single plot. You should submit all source (including the parts for each of the individual problems) as well as a single image for each problem (eight images total).

Each problem consists of a set of initial conditions, an interval for  $x$ , the boundary conditions that should be applied at the ends of the interval, and a list of times at which snapshots should be taken. Time starts at  $t = 0$  and ends at the last snapshot.

#	Initial Conditions	Domain	Boundary Conditions	$T$
1.	$u(x, 0) = 1$	$x \in [0, 1]$	constant	1
2.	$u(x, 0) = \begin{cases} 1 & x \leq 1 \\ 3 & x > 1 \end{cases}$	$x \in [0, 2]$	constant	$\frac{1}{4}$
3.	$u(x, 0) = \begin{cases} -1 & x \leq 1 \\ -3 & x > 1 \end{cases}$	$x \in [0, 2]$	constant	$\frac{1}{4}$
4.	$u(x, 0) = \begin{cases} -1 & x \leq 1 \\ 1 & x > 1 \end{cases}$	$x \in [0, 2]$	constant	$\frac{1}{2}$
5.	$u(x, 0) = \begin{cases} 1 & x \leq 1 \\ -1 & x > 1 \end{cases}$	$x \in [0, 2]$	constant	$\frac{1}{2}$
6.	$u(x, 0) = x$	$x \in [-1, 1]$	extrapolation	$\frac{1}{2}$
7.	$u(x, 0) = -x$	$x \in [-1, 1]$	extrapolation	$\frac{1}{2}$
8.	$u(x, 0) = \sin(x)$	$x \in [-\pi, \pi]$	periodic	1