

## Finite Volume Methods

### Assignment 5

#### Problem 1

Prove that SSP2 fulfills the SSP condition under the same time step restriction as the explicit Euler method.

#### Problem 2

Consider the shallow water equation with  $g = 1$  as in problem 1 on assignment 4. Discretize this using the explicit Euler method with constant mesh width  $\Delta t$  in time and a finite volume method with constant mesh width  $\Delta x$  in space. As a flux function, use Roe's approximate Riemann solver with the entropy fix. Implement the following boundary conditions via a ghost cell approach

- A fixed wall at the right hand side and an inflow boundary at the left
- Outflow on both ends
- inflow on the left (use a constant inflow for the Riemann problem) and outflow on the right

Test the results for

- The Riemann problem with a jump from 2 down to 1 in both components
- The initial data  $h_0(x) = 2 + \sin x$ ,  $v_0 = 2$  on  $x \in [0, 4]$  and boundary data on the left hand side  $h(0, t) = 2 - \sin t$ ,  $v = 2$ .

**Return: Thursday, May 9th, in class**