Homework #11 **Computational Fluid Dynamics I** Prof. V. Esfahanian
Due Date: 13/3/97 TA: A.Bahrami & M.Fazli

1. Find the modified equation for Lax-Wendroff and Leapfrog scheme and compare the numerical properties of these schemes. Derive each modified equations to the term u_{xxxx}.

2. Write a computer code to solve linear first-order wave equation:

$$u_1 + au_x = 0, \quad t > 0$$

$$u(x,0) = \begin{cases} 1, & 0 < x \leq 10 \\ 0, & 10 < x \leq L \end{cases}$$

and

$$u(0,t) = 1$$

Find the exact solution. Then Solve the problem with these numerical schemes:

(a) Lax method

(b) Lax-Wendroff method

(c) Mac-Cormack method

for $\Delta x = 1$ and $L = 50$ with 51 grid points. Adopt proper numerical boundary condition at $x = L$ if it is necessary for any of these methods.