

## Lab sheet - 6

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1. Consider the partial differential equation

$$\frac{\partial u}{\partial t} + v \frac{\partial u}{\partial x} = 0, \quad 0 \leq x \leq 1, t \geq 0$$

With  $v = 1.0$  and set  $u(x, 0) = 1$ . Use the Central difference and upwind schemes for solving the equation. [Hint: choose,  $\Delta x = 0.01$  and  $\Delta t = \Delta x/2$ ].

2. Solve the Heat Conduction Equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 \leq x \leq 1, t \geq 0$$

subject to the boundary conditions  $u(x = 0, t) = 0$  and  $\partial u / \partial x = 0$  at  $x = 1$  for all  $t$ . The initial condition is  $u(x, t = 0) = \sin(3\pi x/2)$ .

- (a) Using Explicit method, choosing  $\Delta x = 0.1$  and  $\Delta t = 0.0025$ , obtain the solution for and compare with the exact solution,

$$u(x, t) = e^{\frac{-9\pi^2 t}{4}} \sin(3\pi x/2).$$

- (b) Try the same with Implicit method.