MMT-007 (P) (Set-2)

M. Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)

M.Sc. (MACS)

Differential Equations and Numerical Solutions

Duration : 1½ hours Maximum Marks : 40

Note: 1. There are two questions in this paper totaling 30 marks.

2. Answer both of them.

3. Remaining 10 marks are for the viva-voce.

1. Write a program in 'C' language to solve the initial value problem

$$\frac{dy}{dx} = y^2 \cos x, \; y(0) = 1$$

in the interval [0, 2] using fourth order Milne's Predictor-Corrector method with h = 0.4. Calculate the starting values using the fourth order Runge-Kutta method with the same step-length. Perform two corrector iterations per steps.

2. Write a program in 'C' language to solve the equation

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, 0 \le x \le a, \ t \ge 0$$

$$u(x, 0) = \frac{x}{2}(1 - x), \ \frac{\partial u}{\partial t}(x, 0) = 0$$

$u(0, t) = 0$, $u(a, t) = B$

Using the explicit method

$$u_i^{n+1} = 2u_i^n - u_i^{n-1} + r^2[u_{i+1}^n - 2u_i^n + u_{i-1}^n]$$

with user input *a*, B, *h* and *r*.

Use the central difference approximations to the derivatives to obtain initial condition. Also, extend your program to integrate for two time steps. Test your program for user input

$a = 1$, $B = 0$, $h = {}^1/_4$, $r = {}^1/_2$.

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