MMT-007 (P) (Set-1)

MASTER IN 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

$y^1 = x^3 + y^3, y(0) = 1$

in the interval [0, 2] using the Predictor-Corrector method:

$$P : y_{n+1} = y_n + \frac{h}{24}[55y'_n - 59y'_{n-1} + 37y'_{n-2} - 9y'_{n-3}]$$

$$C : y_{n+1} = y_n + \frac{h}{24}[9y'_{n+1} - 19y'_n - 5y'_{n-1} + y'_{n-2}]$$ 15

With h = 0.2. Calculate the starting value using the Euler's method with the same step length. Perform two corrector iterations per step.

2. Write a program in 'C' language to find the solution of $\nabla^2 u = G(x, y)$ in R, subject to the given R, G and the boundary conditions, using the five point difference formula

$R : 0 \le x \le 1,\ 0 \le y \le 1$

$G(x, y) = 3x + 4y$

$u(x, y) = \dfrac{x^4 + y^4}{12}$ *on* $x = 0, y = 0, y = 1.$

$12u + \dfrac{\partial u}{\partial x} = x^4 + y^4 + \dfrac{1}{3}x^3$ on $x = 1$

Use central difference approximation in the boundary conditions and take the step length h = $\dfrac{1}{3}$.

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