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Assignment-3

Subject: Mathematics-III

(BT-401)

(Common to CS/IT/EX/EE)

Topic: Numerical Methods-3

1. Use Picard's method to find approximate value of y if:

(i) $\frac{dy}{dx} = 3x + y^2,\ y = 1$ when $x = 0$ *at* $x = 0.1$

(ii) $\frac{dy}{dx} = x - y^2,\ y = 1$ when $x = 0$ *at* $x = 0.1$

2. Find the value of y by Taylor's series method correct to three decimal places from the Differential equation.

(i) $\frac{dy}{dx} = 2y + 3e^x,\ y(0) = 0$ at $x = 0.2$

(ii) $\frac{dy}{dx} = 1 - 2xy,\ y(0) = 0$ *at* $x = 0.1$

3. Using Euler's method to find the value of y, correct to three decimal places from the Differential equation. $\frac{dy}{dx} = x + y,\quad y(0) = 0$ choosing $h = 0.2$ in six steps

4. Using Euler's modified method to find the value of y, correct to three decimal places from the Differential equation.

(i) $\frac{dy}{dx} = x + y, \quad y(0) = 1 \ at \ x = 0.3$

(ii) $\frac{dy}{dx} = \log_e(x + y), \quad y(1) = 2 \ at \ x = 1.2$ and $x = 1.4$ with $h = 0.2$

5. Apply Runge-Kutta method of fourth order to find an approximate value of y, given that

(i) $\frac{dy}{dx} = x + y^2, \ y(0) = 1 \ at \ x = 0.2$ in steps of 0.1

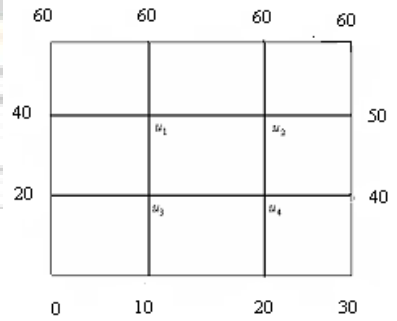
(ii) $\frac{dy}{dx} = 3x + y^2, y(1) = 1.2 \ at \ x = 1.1$

6. Given $\frac{dy}{dx} = x^2(1 + y)$ and $y(1) = 1, y(1.1) = 1.233, \ y(1.2) = 1.548, y(1.3) = 1.979$

Evaluate $y(1.4)$ by Adams-Bashforth method.

7. Given $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$ and the starting values $y(0.1) = 0.90516$, $y(0.2) = 0.82127$, $y(0.3) = 0.74918$ Evaluate $y(0.4)$ using Adams-Bashforth method.

8. Solve the Laplace (i.e. elliptic) equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the square mesh with boundary values as shown figure.



9 Solve the Poisson equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -10(x^2 + y^2 + z^2)$ over the square with sides $x = 0 = y, \ x = 3 = y$ with $u(x, y) = 0$ on the boundary and mesh length $= 1$.

10. Solve the boundary value problem $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions, $u(0, t) = u(1, t) = 0$ and $u(x, 0) = \sin \pi x$, $0 \le x \le 1$ using (a) Schmidt method and (b) Crank-Nicolson method. Carryout computation for two levels, taking $h = \frac{1}{3}$ *and* $k = \frac{1}{36}$

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