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CS-71

BACHELOR IN COMPUTER APPLICATIONS

09874

Term-End Examination

June, 2010

CS-71 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 75*

Note : *Question number **1** is **compulsory**. Attempt **any three** questions from the rest. In total you have to answer **four** questions. Calculator is allowed.*

1. (a) Write the following numbers in floating point form : **6x5=30**

48.61416, 2.3748, 0.0436, 1.03092.

Round these numbers to :

(i) 4 significant digits,

(ii) 2 significant digits.

(b) An approximate value of $\sqrt{2} = 1.414214 \ldots$ is given by 1.414. Find the absolute error and the relative error in the approximation.

(c) Prove the following relations :

(i) $\Delta\left(\frac{1}{f_i}\right) = -\frac{\Delta f_i}{f_i f_{i+1}}$

(ii) $\Delta\left(f_i^2\right) = (f_i + f_{i+1})\ \Delta f_i$

(d) Solve the following equations by Jocobi's iteration method.

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3y + 20z = 25$$

(e) Find the Lagrange interpolating polynomial that fits the following data values :

x	2.5	3.5
$f(x)$	6	8

Determine the approximate value of f (3).

(f) Find the cube root of 41, using Newton - Raphson Method.

2. (a) Perform four iterations of the Gauss - Seidal Method to solve the following system of equations : **3x5=15**

$$4x - y + z = 4$$
$$-x + 4y - z = 2$$
$$x - y + 4z = 4.$$

Take initial approximation

$(x_0, y_0, z_0) = (0, 0, 0)$.

(b) Solve the following equations by Gauss - Elimination Method :

$$54x + y + z = 110$$
$$2x + 15y + 6z = 72$$
$$-x + 6y + 27z = 85.$$

(c) Construct the forward difference table for the data :

x	-4	-2	0	2	4	6
$f(x)$	-139	-21	1	23	141	451

Determine the corresponding interpolating polynomial. Also compute the approximate value of $f(3)$.

3. (a) Solve the following equations by Jocobi's method : **3x5=15**

$$2x + y + z = 10$$

$$3x + 2y + 3z = 18$$

$$x + 4y + 9z = 16.$$

(b) Find the Lagrange interpolating polynomial that fits the following data values :

x	1	2	4
$f(x)$	1	7	61

Determine the approximate value of $f(3)$.

(c) Find a real root of the equation

$$x \log_{10} x = 1.2$$

by Regular-Falsi method correct to four decimal places.

4. (a) Using Runge - Kutta method of order 4, find y (0.2) for the equation : **3x5=15**

$$\frac{dy}{dx} = \frac{y - x}{y + x},$$

y (0) = 1. Take $h = 0.2$.

(b) Perform three iterations of the Regula - Falsi method to obtain the smallest positive root of :

$$x^3 - 5x + 1 = 0.$$

(c) Evaluate :

$$\int_0^2 \frac{x^2}{1 + x^3} \text{ using,}$$

the Simpson's $\frac{1}{3}$ rule with $h = \frac{1}{4}$.

5. (a) Find a root of the equation : **3x5=15**

$$x^3 - 4x - 9 = 0,$$

using the Bisection methods in four stages.

(b) Perform three iteration of the Newton - Raphson method to find a root of the equation :

$$x\, e^x - 1 = 0,$$

which is close to 0.5.

(c) For the data :

x	1	1.1	1.2	1.3	1.4
$f(x)$	7.0	8.093	9.384	10.891	12.632

find an approximation of f (1.35) and f (1.25).