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Second Semester M.C.A Degree Examination, January/February 2005
Master of Computer Applications
Computational Techniques

Time: 3 hrs.]

[Max.Marks : 100

- Note:** 1. Answer any FIVE full questions.
 2. All questions carry equal marks.

1. (a) Explain with an example each : (8 Marks)
 i) Absolute error iii) Truncation error
 ii) Relative error iv) Round off error.
- (b) If $f = \frac{4xy^2}{z^3}$ and errors in x, y, z are 0.001, compute the relative maximum error in f when $x = y = z = 1$. (6 Marks)
- (c) Find the number of terms of the exponential series such that their sum gives the value of e^x correct to six decimal places at $x = 1$. (6 Marks)
2. (a) Explain the Bisection method for computing a root of $f(x) = 0$ which lies in $[a, b]$. Find a root of the equation $x^3 - 4x - 9 = 0$ that lies between 2 and 3 using Bisection method in four stages. (8 Marks)
- (b) Show that Newton Raphson method is quadratically convergent. (6 Marks)
- (c) Find the root of the equation $xe^x = \cos x$ using the secant method correct to four decimal places. (6 Marks)
3. (a) Find the real root of the equation $x^3 - 2x - 5 = 0$ to three significant digits using Newton Raphson method. (10 Marks)
- (b) Give the algorithmic description of solving an algebraic equation $f(x) = 0$ in (a, b) using method of false position. (10 Marks)
4. (a) Write algorithm to solve a system of algebraic equations of Gauss seidel method. (10 Marks)
- (b) Compute the solution of the following system of equations using Gauss elimination method.

$$\begin{aligned} x + y + z &= 9 \\ x - 2y + 3z &= 8 \\ 2x + y - z &= 3 \end{aligned}$$
(10 Marks)
5. (a) Apply Gauss Jordan method to solve the system of equations :

$$\begin{aligned} x + y + z &= 9 \\ 2x - 3y + 4z &= 13 \\ 3x + 4y + 5z &= 40 \end{aligned}$$
(10 Marks)

Contd... 2

(b) Employ crout's method to solve the following system of equations:

$$\begin{aligned} x + y + z &= 1 \\ 3x + y - 3z &= 5 \\ x - 2y - 5z &= 10 \end{aligned}$$

(10 Marks)

6. (a) Fit a straight line of the form $y = a + bx$ by the method of Least Squares to the following data : (8 Marks)

| | | | | | |
|---|---|---|---|---|---|
| x | 0 | 1 | 3 | 6 | 8 |
| y | 1 | 3 | 2 | 5 | 4 |

(b) Given :

| | | | | |
|------|---|----|----|-----|
| x | 1 | 4 | 3 | 0 |
| f(x) | 0 | 24 | 12 | -12 |

Find the value of $f(2)$ using Lagrange's interpolation formula. (6 Marks)

(c) Using Newton Divided difference formula evaluate y when $x = 2$, given

| | | | |
|---|---|----|-----|
| x | 0 | 1 | 5 |
| y | 8 | 68 | 123 |

(6 Marks)

7. (a) Given :

| | | | | | | | |
|---|------|------|------|------|------|------|------|
| x | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 |
| y | 2.72 | 3.32 | 4.06 | 4.96 | 6.05 | 7.39 | 9.02 |

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.2$ (8 Marks)

(b) Evaluate $\int_7^x f(x) dx$ by Trapezoidal rule using the following table :

| | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|
| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| y | 2.105 | 2.808 | 3.614 | 4.604 | 5.857 | 7.451 | 9.467 |

(6 Marks)

(c) Evaluate $\int_0^6 3x^2 dx$ dividing the interval [0,6] into six equal parts by applying Simpson's 3/8th rule. (6 Marks)

8. (a) Using modified Euler's method find $y(0,2)$ correct to 4 decimal places solving the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$ taking $h = 0.1$ (10 Marks)

(b) Write a algorithm of Runge Kutta method of order four. Use this method to find y at $x = 0.1$ given that $\frac{dy}{dx} = 3e^x + 2y$, $y(0) = 0$ and $h = 0.1$. (10 Marks)

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