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MCSE–004

MASTER OF COMPUTER APPLICATIONS (MCA) (REVISED)

Term-End Examination

December, 2023

MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

Time : 3 Hours *Maximum Marks : 100*

Note : *Question No.* ***1*** *is compulsory. Attempt any* ***three*** *questions from the rest. Use of calculator is allowed.*

1. (a) Let $a = 0.41$, $b = 0.36$ and $c = 0.70$. Prove that : 5

$$\frac{(a-b)}{c} \neq \frac{a}{c} - \frac{b}{c} .$$

(b) What are the pitfalls of Gauss Elimination method ? 5

(c) Find a solution using Simpson's $\frac{3}{8}$ rule : 5

X	$f(x)$
0.0	1.0000
0.1	0.9975
0.2	0.9900
0.3	0.9776
0.4	0.8604

(d) An individual's I. Q. score has a Normal distribution N (100, 15^2). Find the probability that an individual I.Q. score is between 91 and 121. (Given $P_{(Z = -0.6)}$ = 0.2743, $P_{(Z = 1.4)}$ = 0.9192. 5

(e) Evaluate $\int_0^1 \frac{1}{(1+x)} dx$ using composite Trapezoidal rule with h = 0.5 and 0.25. 5

(f) Find the approximate value of the root of the equation $x^3 + x - 1 = 0$, in the interval (0, 1) using Regula-Falsi method, twice. 5

(g) Find positive real root of $x^2 - 5 = 0$ using Newton-Raphson method with initial value 2.1. (Perform 2 iterations). 5

(h) What do you mean by term 'Goodness of fit test' ? What for the said test is required ? 5

2. (a) The tangent of the angles between the lines of regression y on x and x on y is 0.6 and $\sigma_x = \frac{1}{2}\sigma_y$. Find r_{xy}. 6

(b) Solve the following equations by Gauss Elimination method : 6

$$x + 4y - z = -5$$

$$x + y - 6z = -12$$

$$3x - y - z = 4$$

(c) Solve the system of equations :

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

by using LU Decompositing method. 8

3. (a) Solve the initial value problem $u' = -2tu^2$, with $u(0) = 1, h = 0.2$ on the interval [0, 1]. Use the fourth order classical Runge-Kutta method. 8

(b) Find the Lagrange's interpolating polynomial approximating $f(x)$ in the form of the following table of values : 6

x	$f(x)$
–1	3
0	–6
3	39
6	822
7	1611

(c) A farmer buys a quantity of cabbage seeds from a company that claims approximately 90% of the seeds will germinate. If four seeds are planted, what is the probability that exactly two will germinate ? 6

4. (a) In a partially destroyed laboratory record of an analysis of correlation data, the following results are legible :

Variance of X = 9,

Regression equations :

$$8x - 10y + 66 = 0$$

$$40x - 18y - 214 = 0$$

Find : 5

(i) The mean values of X and Y

(ii) Correlation coefficient between X and Y

(iii) Standard deviation of Y

(b) Evaluate $\int_0^1 e^x dx$ by using Simpson's $\frac{1}{3}$ rule. (Take $h = 0.5$). 5

(c) Explain probability formula for Binomial distribution and Normal distribution. Explain with suitable examples for each. 10

5. (a) Apply Gauss-Seidel iteration method to solve the following system of equations : 10

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

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

Perform three iterations with initial approximate (0, 0, 0).

(b) Write short notes on any *two* of the following : 5 each

(i) Euler's method

(ii) Least square estimation

(iii) Chi-square distribution