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MCSE-004

MASTER OF COMPUTER APPLICATIONS (MCA) (REVISED)

Term-End Examination

June, 2021

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) If 1/3 approximates to 0.333, determine absolute, relative and percentage error. Differentiate between the terms precision and accuracy. 5

   (b) Find the root of the equation $2x = \cos x + 3$ correct to three decimal places by using iteration method. 5

(c) Solve the following system of equations by using Gauss elimination method : 5

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

$$2x + 3y + 3z = 10$$

$$3x - y + 2z = 13$$

(d) Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$. 5

(e) Find the value of $\Delta \tan^{-1} x$, the interval of differencing being h. 3

(f) Determine the constants a and b by the method of least squares, such that $y = ae^{bx}$ fits the following data : 7

x	y
2	4.077
4	11.084
6	30.128
8	81.897
10	222.62

(g) Write formula ton Lagrange's interpolation and use it to find the value of $\sin(\pi / 6)$, using the data for $y = \sin x$ as given below : 5

x	$\sin x$
0	0
$\frac{\pi}{4}$	0.707
$\frac{\pi}{2}$	1.0

(h) Evaluate the integral $\int_4^{5.2} \log x \, dx$ using Simpson's 1/3 rule. 5

2. (a) Write the formulas for the following distributions : 3

(i) Binomial distribution

(ii) Poisson distribution

(iii) Normal distribution

(b) Find the probability that an individual's IQ score is between 91 and 121, provided the individual's IQ score has normal distribution N (100, 152). 5

(c) Statistical parameters for marks in subject A and B of a certain examination are given below :

	A	B
Mean	36	85
Standard Deviation	11	8

Given the coefficient of correlation between A and B = ± 0.66 . 7

(i) Determine the two equations of regression.

(ii) Calculate the expected marks in A, corresponding to 75 marks obtained in B.

(d) Find the real root for the equation $x^3 - 3x - 5 = 0$ by using Newton-Raphson method, correct to three decimal places. 5

3. (a) Solve the following system of equations by using LU Decomposition method : 5

$$x + y = 2$$

$$2x + 3y = 5$$

(b) Perform two iterations, to solve the following system of equations using Gauss-Seidel method. Take initial point as (0, 0, 0) : 7

$$8x - 3y + 2z = 20$$

$$6x + 3y + 12z = 35$$

$$4x + 11y - z = 33$$

(c) Using Runge-Kutta method, determine $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$; $y(0) = 1$. Take $h = 0.2$. 8

4. (a) What is 'Goodness to fit test' ? What for the said test is required ? 5

(b) A book contains 100 misprints, distributed randomly, throughout its 100 pages. What is the probability that a page observed at random contains at least two misprints ? 5

(c) What are residual plots ? Discuss the utility of residual plots. Also give one disadvantage of residual plots. 5

(d) Using Newton's forward interpolation, determine the equation of the polynomial, which passes through the following set of points : 5

x	y
1	–1
2	–1
3	1
4	5

5. (a) What are the two pitfalls of Gauss-Elimination method ? 5

(b) Find the approximate value of root of the equation $x^3 + x - 1 = 0$, near $x = 1$. Using Regula-Falsi method, twice. 5

(c) Evaluate the integral $I = \int_0^1 \frac{dx}{1 + x}$ by using composite trapzoidal rule, with 5 subintervals.

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

(i) Acceptance-Rejection method

(ii) Non-linear Regression

(iii) Bisection method