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# MCSE-004

## MASTER OF COMPUTER APPLICATIONS (MCA) (REVISED)

## Term-End Examination

## June, 2022

### 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) Solve the quadratic equation :

$$x^2 + 9.9x - 1 = 0$$

using two decimal digit arithmetic with rounding. 5





(b) Find the root of the equation $x^3 - 2x - 5 = 0$, correct to three decimal digits, by using Bisection method. 5

(c) Solve the following linear system of equations : 5

$$x + y + z = 3$$

$$4x + 3y + 4z = 11$$

$$9x + 3y + 4z = 16$$

by using Gauss Elimination method.

(d) Evaluate $\int_0^1 \frac{1}{1+x} dx$ by using Simpson 3/8 rule, with $h = 1/3$. 5

(e) Compare the term Accuracy and Precision. How does error measure accuracy ? 5

(f) Using the data $\sin(0.1) = 0.09983$ and $\sin(0.2) = 0.19867$, find the value of $\sin(0.16)$ by using Lagrange Interpolation. Also, obtain the truncation error. 5

(g) If a bank receives on an average $\lambda = 6$ bad cheques per day, what is the probability that it will receive 4 bad cheques on any given day ? 5

(h) Write short notes on the following : 5

(i) Residual plots

(ii) Goodness of fit

2. (a) Solve the initial value problem $u' = -2tu^2$ with $u(0) = 1$ and $h = 0.2$ on the interval [0, 1]. Use the fourth order classical Runge-Kutta method. 10

(b) Solve the following system of equations :

$$x + y - z = 0$$

$$-x + 3y = 2$$

$$x - 2z = -3$$

by using Jacobi method.

Assume the initial solution vector as $[0.8, 0.8, 2.1]^T$. 5

(c) Discuss the pitfalls of Gauss Elimination method. 5





3. (a) Find the Newton's interpolating polynomial $f(x)$ by using the following table :

| $x$ | $f(x)$ |
|---|---|
| $-1$ | 3 |
| 0 | $-6$ |
| 3 | 39 |
| 6 | 822 |
| 7 | 1611 |

Also find the approximate value of the function $f(x)$ at $x = 2$. 7

(b) A farmer buys a quantity of cabbage seeds from a company that claims that approximately 90% of the seeds will germinate if planted properly. If four seeds are planted, what is the probability that exactly two will germinate ? 5

(c) Solve the following system of equations using LU decomposition method : 8

$$6x_1 - 2x_2 = 14$$

$$9x_1 - x_2 + x_3 = 21$$

$$3x_1 + 7x_2 + 5x_3 = 9.$$

4. (a) Determine the interpolating polynomial for $f(x) = x^2 + \sin \pi x$ through (0, 0); (1, 1); (2, 4). What is the error when $x = \frac{1}{2}$ ? What is the maximum error ? 10

(b) Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) : 10

| X | Y |
|---|---|
| 65 | 67 |
| 66 | 68 |
| 67 | 65 |
| 67 | 68 |
| 68 | 72 |
| 69 | 72 |
| 70 | 69 |
| 72 | 71 |





Also, obtain the equation of lines of regression and estimate the value of X for Y = 70.

5. (a) An irregular six-faced die is thrown and the expectation that in 10 throws it will give five even numbers is twice the expectation that it will give four even numbers. How many times in 10000 sets of 10 throws would you expect it to give only odd number ? 8

(b) Apply Gauss-Seidel iteration method to solve the following system of equations : 7

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

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

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

Perform three iterations.

(c) What do you mean by Pseudo random number generation ? What is advantage of the concept of the random number generation ? 5