MCSE-004

MCA (Revised)

Term-End Examination

February, 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) What is precision ? How does precision differ from accuracy ? Give suitable example in support of your answer. *5*

(b) Estimate the missing term in the following data, using forward differences : *5*

x	1	2	3	4	5
f(x)	3	7	?	21	31

(c) Evaluate the integral $I = \int_1^4 x^2 \, dx$, using Simpson's $\frac{1}{3}$ rule with h = 0·5. *5*

(d) 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 ? λ denotes the average arrival rate per day. *5*

(e) Solve the following system of linear equations using the Gauss Elimination method : *5*

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

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

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

(f) Determine the constants a and b by the method of least squares such that $y = a\, e^{bx}$ fits the following data : *5*

x	y
2	4·077
4	11·084
6	30·128
8	81·897
10	222·62

(g) Find the Lagrange's interpolating polynomial of degree 2, approximating the function $y = ln\ x$. Hence determine the value of $ln\ 2{\cdot}7$ where $x = 2, 2{\cdot}5, 3$. *5*

(h) Explain Bisection method. Apply the method to determine the roots of the equation. Perform 3 iterations. *5*

$$f(x) = 0{\cdot}5\ e^x - 5x + 2$$

2. (a) What is "Goodness of fit test" ? What is the utility of this test ? Consider the following data and perform "Goodness of fit test" over it :

x	y
100	45
110	51
120	54
130	61
140	66
150	70
160	74
170	78
180	85
190	89

Now comment, whether the data is fitted well or not. *10*

(b) Use Runge-Kutta method to solve the initial value problem $y' = (t - y)/2$ on $[0, 0{\cdot}2]$ with $y(0) = 1$. Compare the solution when $h = 0{\cdot}2$ and $h = 0{\cdot}1$. *10*

3. (a) Three bags of same type have the following balls :

Bag 1 : 2 black 1 white

Bag 2 : 1 black 2 white

Bag 3 : 2 black 2 white

Randomly one bag is selected and one ball is drawn. It turns out to be white. What is the probability of drawing a white ball again provided the first ball is not returned to the bag ? *7*

(b) What are residual plots ? What is the utility of residual plots ? *5*

(c) Show that the moment generating function of a random variable X which is Chi-square distributed with v degrees of freedom is

$$M(t) = (1 - 2t)^{-v/2}$$ *8*

4. (a) Find an approximate value of the root of the equation $x^3 + x - 1 = 0$, near $x = 1$. Using Regula-Falsi method, perform two iterations. *6*

(b) Solve the system of equations by using Gauss-Seidel iteration method, perform two iterations. Use (0, 0, 0) as initial approximation. *7*

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

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

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

(c) The following data is given for marks in subject A and B of a certain examination :

	Subject A	Subject B
Mean Marks	36	85
Standard deviation	11	8

Coefficient of correlation between A and B = $\pm$ 0·66.

(i) Determine the two equations of regression.

(ii) Calculate the expected marks in A corresponding to 75. *7*

5. (a) How does error measure accuracy ? Discuss the different types of errors used to determine the accuracy. *5*

(b) Calculate the value of the integral $I = \int_{4}^{5\cdot2} \log x \, dx$ using Weddle's rule.

Use h = 0·6. *5*

(c) Write short notes on any ***two*** of the following : *10*

(i) Chi-square distribution

(ii) Acceptance-Rejection method

(iii) Newton-Cotes formula