2604E191

Candidate's Seat No :_____

Integ. MSc AIML Semester-2 Examination

CC 112

Numerical & Statistical Methods

April-2024

Time : 2-30 Hours] **[Max. Marks : 70**

Instructions: All questions are compulsory. Use of non-programmable scientific calculator is allowed.

Q.1 **(a)** Perform the five iterations of the bisection method to obtain a root of the equation $f(x) := x^3 - 9x + 1 = 0$

(b) Apply Budan's theorem to find the number of roots of the equation $x^5 - x^4 - 4x^3 + 9x^2 - x + 5$ in the intervals $[-3, -2] and [-2, -1]$.

OR

(a) Derive an iterative formula to find $\sqrt{N}$ and hence find approximate value of $\sqrt{15}$ correct up to three decimal places.

(b) Use Newton-Raphson method to find the positive root of $f(x) = x^3 - 5x + 1 = 0$ correct to three decimals.

Q.2 **(a)** Estimate the production for the year 1985 with the help of the following table.

Year	Production (in tonnes)
1960	20
1965	22
1970	26
1975	30
1980	35
1985	?
1990	43

(b) Determine the percentage of criminals under 35 years of age. (Using Lagrange's method)

Age	Percentage of criminals
Under 25 years	52.0
Under 25 years	67.3
Under 25 years	84.1
Under 25 years	94.4

OR

(P.T.O)

(a) Extrapolate the business done in 1999 from the following data: (07)

Year	Business done (Rs. Lakhs)
1994	150
1995	235
1996	365
1997	525
1998	780

(b) Below are given the wages earned by workers per week in a certain factory. Calculate the number of workers earning more than Rs. 750 per week. (07)

Weekly wages	No. of workers
Up to Rs. 500	50
Up to Rs. 600	150
Up to Rs. 700	300
Up to Rs. 800	500
Up to Rs. 900	700
Up to Rs. 1000	800

Q.3 **(a)** Explain in brief: The Method of Least squares. (07)

(b) Fit the transcendental equation $y = ax^b$ to the data given below. (07)

x	2	4	6	8
y	1.4	2.0	2.4	2.6

OR

(a) Fit a parabola of the form $y = ax^2 + bx + c$ to the following data: (07)

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(b) Fit the exponential curve $y = ae^{bx}$ to the data given below. (07)

x	0.4	0.8	1.2	1.6	2.0	2.4
y	75	100	140	200	270	375

Q.4 **(a)** A department of transportation's study on driving speed and miles per gallon for midsize automobiles resulted in the following data: (07)

SPEED	30	50	40	55	30	25	60	25	50	55
Miles Per Gallon	28	25	25	23	30	32	21	35	26	25

Compute and interpret the sample correlation coefficient.

(b) Given are five observations for two variables x and y. (07)

x	3	12	6	20	14
y	55	40	55	10	15

(a) Develop a scatter diagram for these data.

(b) Develop the estimated regression equation by computing the values of $b0$ and $b1$ using equations.

Use regression equation to predict the value of y when $x = 10$.

OR

(a) Discuss all types of linear regression with giving at least one example. (07)

(b) The daily high and low temperatures for 14 cities around the world are shown: (07)

City	High	Low
Ahmedabad	68	50
Baroda	70	49
Junagadh	65	44
Bhavnagar	96	64
Surat	57	46
Rajkot	70	45
Kutch	80	73
Palanpur	67	45
Mehsana	44	29
Dang	69	44
Panchmahal	76	69
Patan	69	51
Kheda	70	58
Nadiad	44	39

(a) What is the sample mean high temperature?

(b) What is the sample mean low temperature?

(c) What is the correlation between the high and low temperatures? Discuss.

Q.5 Attempt any **SEVEN** out of **TWELVE:** (14)

(1) State Descartes' rule of signs with suitable example.

(2) Find the number of the positive roots of the polynomial $x^3 + 3x^2 - x - x^4 - 2$

(3) Give normal equations of a Geometric curve $y = ab^x$

(4) Give normal equations of the exponential curve $y = ae^{bx}$

(5) Define: Interpolation and Extrapolation with suitable example.

(6) Prepare a table of divided differences of different orders.

Year (x)	2011	2015	2017	2020
Amount of Pension (y)	105	191	309	487

(7) What is Correlation? State its types.

(8) Define: Relative and Percentage error with suitable example.

(9) Write the formula of Lagrange's interpolation method.

(10) For regression line $Y = 3.76 + 0.4\,X$, what is the estimated value of Y for $X = 12$?

(11) If two variables are having ranks in reverse order, write the value of correlation coefficient.

(12) What is the order of convergence of Newton-Raphson's iterative method.

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