

Note: Answer ALL questions by choosing any two parts from each question. ALL questions carry equal marks. Assume suitable missing data, if any.

1-272

1. a) Use Newton's method to find the smallest root of the equation $e^x = x^3 + \cos 25x$ to four places of decimal.

b) Using Gauss elimination method solve

$$5x_1 + x_2 + x_3 = 7$$

$$x_1 + x_2 + 6x_3 = 8; \quad x_1 + x_2 + x_3 = 3$$

c) Solve the following equations by Gauss-Seidal method:

$$10x_1 - 2x_2 - x_3 = 10; \quad -2x_1 + 10x_2 - x_3 = -14$$

$$-x_1 - x_2 + 10x_3 = 20$$

2. a) Using Euler's method solve $y' = x + y + xy, y(0) = 1$ and find $y(0.1)$ by taking $h = 0.025$

b) Using R-K method, solve $y' = \frac{y^2 - x^2}{y^2 + x^2}$

with $y(0) = 1$ at $x = 0.2, 0.4$.

c) Solve the boundary value problem for $x = 0.5$:

$$y'' + y + 1 = 0, \quad y(0) = y(1) = 0,$$

using finite difference method.

3. a) Calculate the correlation coefficient and the lines of regression from the following data:

x	57	58	59	59	60	61	62	64
y	77	78	75	78	82	82	79	81

b) A controlled manufacturing process is 0.2% defective. What is the probability of taking 2 or more defectives from a lot of 100 pieces? (I) By using binomial distribution. (II) By using Poisson approximation.

c) In a large institution 2.28% of employees receive income below Rs. 4500 and 15.8% of employees receive income above Rs. 7500 p.m.

Assuming the income follows normal distribution. Find the mean and S. D of the distribution.

4. a) The nicotine content in milligrams of two samples of tobacco were found to be as follows:

Sample A	24	27	26	21	25	
Sample B	27	30	28	31	22	36

Can it be said that two samples come from the same normal population ($t_{0.05} = 2.26, F_{0.05} = 6.26$).

b) The following figures show the distribution of digits in numbers chosen at random from a telephone directory.

Digits	0	1	2	3	4	5	6	7	8	9
frequency	1126	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be taken to occur equally frequently in the directory ($\chi^2_{0.05} = 16.919$)

c) Two groups of 100 people each were taken for testing the use of a vaccine 15 persons contracted the disease out of the inoculated persons, while 25 contacted the disease in the other group. Test the efficacy of the vaccine using χ^2 value ($\chi^2_{0.05} = 3.184$).

5. a) Using graphical method solve the following LPP:

Minimize $z = 2x_1 + 3x_2$ s.t

$$x_2 - x_1 \geq 2; \quad 5x_1 + 3x_2 \leq 15; \quad 2x_1 \geq 1; \quad x_2 \leq 4,$$

$$x_1, x_2 \geq 0$$

b) Solve the following LPP by simplex method:

$$\text{Maximize } z = 3x_1 + 2x_2 + 2x_3 \text{ s.t.}$$

$$2x_1 - x_2 + 3x_3 \leq 18; \quad x_1 + x_2 + 2x_3 \leq 12; \quad x_1, x_2, x_3 \geq 0.$$

c) Solve the following LPP by simplex method:

$$\text{Maximize } z = 5x_1 + 3x_2 + 3x_3 \text{ s.t.}$$

$$4x_1 + 4x_2 + 3x_3 \leq 12000; \quad 0.4x_1 + 0.5x_2 + 0.3x_3 \leq 1800;$$

$$0.2x_1 + 0.2x_2 + 0.1x_3 \leq 12000; \quad x_1, x_2, x_3 \geq 0.$$