(3 Hours)   **Total Marks: 80**

N.B. :   **(1)** Question No. 1 is compulsory.

(2) Attempt any three questions out of remaining five questions

Q.1.   (a)   By using matrices, Solve the following system of linear equation   **(5)**
$x+y+z=9$, $2x+5y+7z=52$, $2x+y-z=0$.

(b)   Differentiate between Simple Random Sampling and Stratified Random   **(5)**
Sampling

(c)   Explain Scatter plots.   **(5)**

(d)   Compare constrained and non constrained optimization Techniques   **(5)**

Q.2.   (a)   **(10)**
Find Singular Value of Decomposition of matrix $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$

(b)   A company gave an intensive training to its salesmen to increase the sales. A   **(10)**
random sample of 10 salesmen was selected and the value (in lakhs of Rupees)
of their sales per month, made before and after the training is recorded in the
following table.

Salesman	1	2	3	4	5	6	7	8	9	10
Before	15	22	6	17	12	20	18	14	10	16
After	17	23	16	20	14	21	18	20	10	11

Test whether there is any increase in mean sales at 5% level of significance.
Table Values:t(α,df,test type)
t(0.05,10,one-tailed)=1.812
t(0.05,9,one-tailed)=1.833
t(0.05,10,two-tailed)=2.228
t(0.05,9,two-tailed)=2.262

Q.3.   (a)   A survey was conducted with 500 female students of which 60% were   **(10)**
intelligent, 40% had uneducated fathers, while 30 % of the not intelligent
female students had educated fathers. Test the hypothesis that the education of
fathers and intelligence of female students are independent at 5% level of
significance. (Given $\chi^2(1,0.05) = 3.841$)

(b)   What is a Graph? Explain any four   types of Graph along with its uses.   **(10)**

Q.4.   (a)   Explain types of data. Compare and contrast quantitative and qualitative   **(10)**
data.

(b)   Discuss the need for   exploratory data analysis   and explain types of   **(10)**
Exploratory data analysis.

Q.5.   (a)   Minimize the function $f(x_1, x_2) = 4x_1 + 8x_2 - x_1^2 - x_2^2$ **(10)**
subject to $x_1 + x_2 = 4$, $x_1, x_2 \geq 0$

(b)   Find the minimizer of $f(x) = x^2 + \frac{54}{x}$ using bisection method in (2,5) within a   **(10)**
range of 0.3

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Q.6.   Write short notes on (any four)   **(20)**
- (a)   Four Fundamental Subspaces   **(5)**
- (b)   Principal Component Analysis (PCA) algorithm.   **(5)**
- (c)   Benefits of Dimensionality Reduction.   **(5)**
- (d)   5 Number Summary (the box and whisker plot.)   **(5)**
- (e)   Gradient based optimization Techniques   **(5)**
- (f)   Exponential function and their graph.   **(5)**

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