



VIT
Vellore Institute of Technology
Deemed to be University under Section 3 of Act 1956

School of Advanced Sciences

Fall Semester 2024-2025

Continuous Assessment Test – I

Programme Name & Branch: B.Tech Computer Science and Engineering and Business systems

Slot: B1

Course Name & code: Computational Statistics & CBS1009

Class Number (s): 5573 & 5574

Faculty Name (s): Dr. Sujatha V & Dr. Sripathy

Exam Duration: 90 Min.

Maximum Marks: 50

General instruction(s):

Q.No.	Question	Max Marks
1.	The variance covariance matrix of a 3 dimensional random vector $X=(X_1, X_2, X_3)$ is given by $\Sigma = \begin{pmatrix} 25 & -2 & 4 \\ -2 & 4 & 1 \\ 4 & 1 & 9 \end{pmatrix}$ a. Find the correlation matrix b. Find the correlation between X_1 and $\frac{X_2}{2} + \frac{X_3}{2}$	10
2.	Consider the normal distribution $N_3(\mu, \Sigma)$ with $\mu = \begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$ and $\Sigma = \begin{pmatrix} 2 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 4 \end{pmatrix}$ (a) Find the normal density function for the distribution. (b) Write out the squared generalized distance expression $(x-\mu)^T \Sigma^{-1}(x-\mu)$ as a function of X_1 and X_2	10

3.	Let X be $N_3(\mu, \Sigma)$ with $\mu^T = (2, -3, 1)$ and $\Sigma = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 3 & 2 \\ 1 & 2 & 2 \end{pmatrix}$ (a) Find the distribution of $3X_1 - 2X_2 + X_3$ Relabel the variables if necessary and find a 2×1 vector a such that X_2 and $X_2 - a^T \begin{pmatrix} X_1 \\ X_3 \end{pmatrix}$ are independent	10															
4.	Let (X_1, X_2, X_3) be a tri-variate normal random vector with mean vector $(-3, 1, 4)$ and covariance matrix $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & 3 & -3 \\ 0 & -3 & \frac{1}{2} \end{bmatrix}$ (a) Check (X_2, X_3) and X_1 are independent (b) $\frac{1}{2}(X_2 + X_3)$ and X_1 are independent	10															
5.	Fit a multiple linear regression line model to the following data and also Predict the value of Y when $X_1=5$ and $X_2=10$. <table border="1"> <thead> <tr> <th>X_1 Product 1 Sales</th><th>X_2 Product 2 Sales</th><th>Y Weekly Sales</th></tr> </thead> <tbody> <tr> <td>1</td><td>4</td><td>1</td></tr> <tr> <td>2</td><td>5</td><td>6</td></tr> <tr> <td>3</td><td>8</td><td>8</td></tr> <tr> <td>4</td><td>2</td><td>12</td></tr> </tbody> </table>	X_1 Product 1 Sales	X_2 Product 2 Sales	Y Weekly Sales	1	4	1	2	5	6	3	8	8	4	2	12	10
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