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**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA**

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech. (CSBS)

(SEM: 3<sup>rd</sup> SESSIONAL EXAMINATION -I )(2021-2022)

Subject Name: Computational Statistics (CSBS)

Time: 1.15Hours

Max. Marks:30

[SET-B]

**General Instructions:**

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of ...2.....pages & ...5.....questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- **Section A** - Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each. You are expected to answer them as directed.
- **Section B** - Question No-3 is Short answer type questions carrying 5 marks each. You need to attempt any two out of three questions given.
- **Section C** - Question No. 4 & 5 are Long answer type (within unit choice) questions carrying 6 marks each. You need to attempt any one part a or b.
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION -			[3]	
Note : For Normal distribution $P(0 < z < 0.5) = 0.1915$ , $P(0 < z < 0.8) = 0.2881$ , $P(0 < z < 1) = 0.3413$ , $P(0 < z < 1.5) = 0.4332$ , $P(0 < z < 2) = 0.4772$				
1.	Attempt all parts		(4×1=4)	CO
a.	What is efficiency of estimator?		(1)	CO1
b.	Define Normal distribution.		(1)	CO1
c.	If X follows $N_p(\mu, \Sigma)$ , then Squared Mahalanobis distance follows to which distribution?		(1)	CO1
d.	What is the characteristic function for Multivariate normal distribution?		(1)	CO1
2.	Attempt all parts		(2×2=4)	CO
a.	Let X follows $N_3(0, \Sigma)$ with $\Sigma = \begin{bmatrix} 1 & c & 0 \\ c & 1 & c \\ 0 & c & 1 \end{bmatrix}$ find the value of c, such that $(X_1 + X_2 + X_3)$ and $(X_1 - X_2 - X_3)$ are independent.		(2)	CO1
b.	What is quadratic form in Multivariate normal distribution?		(2)	CO1



### SECTION – B

3. Answer any two of the following-

[2×5=10]

CO

a. If X is a normal variate with mean 30 and Standard deviation 5. Find the probabilities that i)  $26 \leq X \leq 40$  ii)  $|x - 30| > 5$

(5)

CO1

b. Question- If X distributed as  $N_3(\mu, \Sigma)$ , where

(5)

CO1

$$\mu = \begin{bmatrix} 3 \\ 1 \\ 4 \end{bmatrix} \text{ and } \Sigma = \begin{bmatrix} 6 & 1 & -2 \\ 1 & 13 & 4 \\ -2 & 4 & 4 \end{bmatrix}$$

i) Find the distribution of  $Z = 2Y_1 - Y_2 + 3Y_3$ .

ii) Find the distribution of  $Z_1 = Y_1 + Y_2 + Y_3$

$$Z_2 = Y_1 - Y_2 + 2Y_3$$

c. Define Multivariate normal distribution and also the different properties of Multivariate normal distribution?

(5)

CO1

### SECTION – C

4. Answer any one of the following-(Any one can be applicative if applicable)

[2×6=12]

CO

a. If X distributed as  $N_3(\mu, \Sigma)$ , where

(6)

CO1

$$\mu = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix} \text{ and } \Sigma = \begin{bmatrix} 4 & 0 & -11 \\ 0 & 5 & 0 \\ -11 & 0 & 2 \end{bmatrix}$$

Check whether i)  $(X_1, X_3)$  and  $X_2$  are independent or not.

ii)  $-X_1$  and  $(-X_1 + X_2 - X_3)$  are independent or not.

iii)  $(X_1)$  and  $(X_1 + 3X_2 + 2X_3)$  are independent or not.

b. What is Multivariate analysis ? what are the objectives of multivariate analysis?

(6)

CO1

5. Answer any one of the following-

a. If X distributed as  $N_3(\mu, \Sigma)$ , where

(6)

CO1

$$\mu = \begin{bmatrix} 5 \\ 3 \\ 7 \end{bmatrix} \text{ and } \Sigma = \begin{bmatrix} 4 & -1 & 0 \\ -1 & 4 & 2 \\ 0 & 2 & 9 \end{bmatrix}$$

i) Find the probability  $P(X_1 > 6)$

ii) Find the  $P(4X_1 - 3X_2 + 5X_3) < 80$

iii) Find the  $P(5X_2 + 4X_3 > 70)$

b. What is likelihood function for Multivariate normal distribution and find out estimate for mean vector and covariance matrix.

(6)

CO1