S.S JAIN SUBODH P.G.(AUTONOMOUS) COLLEGE JAIPUR

M.SC. (STATISTICS) I SEMESTER 2024-25

ASSIGNMENT

Subject:- MSST-101: Statistical Mathematics

UNIT: I

Question: 1

Find the rank of given matrix

$$\begin{bmatrix} 1 & 3 & 2 \\ 4 & 1 & -2 \\ 2 & -3 & 1 \end{bmatrix}$$

Question: 2

Check the consistency of following system of linear equations and solve if the system is consistent

$$\begin{cases} 4x + 3y - 6z = 10 \\ -x + 2y - 5z = 6 \\ 7x - y + z = 8 \end{cases}$$

UNIT: II

Question: 3

Verify Caleys Hamilton theorem for the following matrix

$$\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$

Question: 4

Find the corresponding matrix which transforms the following matrix to a diagonal form.

$$\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$$

UNIT: III

Question: 5

Find the extreme values of the function. $f(x, y) = x^3 + y^3 - 3x - 12y + 2$

Question: 6

Check the continuity of the following function at the point 1 and -1

$$f(x) = |x + 1| + |x - 1|$$

UNIT: IV

Question: 7

State and prove Rolle's Theorem.

Question: 8

(a) If *a be any finite positive number quantity, evaluate*

$$\int_0^\infty \frac{e^{-x} sinmx}{x} dx \ \textit{ and hence deduce the value of } \int_0^\infty \frac{sinmx}{x} dx$$

M.Sc. Statistics

Semester -1

Third Paper

Probability Distributions

Assignment

Attempt any two questions.

Unit- I

Q1. (a) For any continuous distribution, show that the mean deviation is least when measured from the median.

(b) Derive the formula of mode.

Q2. (a)Verify that standard deviation is greater than mean deviation.

(b) Define moment generating function and find moment generating function of normal variate with mean μ and variance σ^2.

Unit - II

Q3. (a) Derive recurrence relation for cumulants and hence find γ_1 and γ_2 for binomial distribution.

(b) Define Binomial Distribution. Find its moment generating function(m.g.f.) and hence first four moments.

Q4. (a) If X is Poisson variate with parameter λ then find the moment generating function of $(X-\lambda)/\sqrt{\lambda}$ and show that it approaches $\exp(t^2/2)$ as $\lambda \to \infty$. Also interpret the result.

(b) If X~B(n,p) and Y has negative binomial distribution with parameters r and p, prove that- $F_X(r-1) = 1-F_Y(n-r)$.

Unit – III

Q5. (a) For Normal distribution show that:-

QD: MD : SD :: 10 :12 : 15

(b) If X is Normal distribution with mean u and variance σ then find the distribution of:-

$$\frac{1}{2}\left(\frac{x-u}{\sigma}\right)^2$$

Q6. (a) Define Lacks memory property of a distribution. Show that this property holds for exponential distribution.

(b) If X has a uniform distribution in [0,1], find the distribution (p.d.f.) of -2log X. Identify the distribution also.

Unit - IV

Q7. (a) Explain truncated distribution. Obtain the mean and variance of a standard Cauchy distribution truncated at both ends, with relevant range of variation as $(-\beta, \beta)$.

(b) Let $X \sim \beta(\mu, v)$ and $Y \sim \gamma(\lambda, \mu+v)$ be independent random variables $(\mu, \lambda, \nu > 0)$. Find a probability density function of XY and identify its distribution.

Q8. (a) Define Gamma Distribution. Derive the additive property of gamma distribution.

(b)The random variable X has mean m and standard deviation r. If Y=log X is normally distributed with mean M and standard deviation S, prove that:-

(i) $M = \exp(M + S^2/2)$

(ii) $1 + (s^2/m^2) = \exp(S^2)$

M.Sc. FIRST SEMESTER

STATISTICS

FOURTH PAPER

STATISTICAL QUALITY CONTROL

Assignment

Attempt any two questions.

UNIT 1

Q1. What is Statistical Quality Control? What are the advantages of quality control?

Q2. What do you understand by process control and product control? What is process capability analysis?

UNIT 2

Q3. Describe in detail the construction of p- chart. What are the modified control limits?

Q4. What do you understand by specification limits, natural tolerance limits and control limits? Obtain an expression for modified control limits for x-bar chart.

UNIT 3

Q5. What is cumulative sum control chart? Describe this using V-mask procedure.

Q6. Explain about the Exponentially Weighted Moving Average Control Chart.

UNIT 4

Q7. Explain clearly the following in sampling inspection:

i. AQL
ii. AOQL
iii. LTPD
iv. OC curve
v. ASN curve

Q8. Describe Double Sampling Plan. Obtain the OC and ASN curve for this plan. Also describe the salient features of Dodge-Romig accepting sampling plans.

M.Sc. First Semester
STATISTICS
SECOND PAPER
Probability Theory
Assignment

Attempt any two questions

UNIT-I

Q.1) Define probability and conditional probability. State and Prove Multiplication law of probability.

Q.2) State and prove Bayes theorem and $P\left(\bigcup_{i=1}^{n} A_i\right) \leq \sum_{i=1}^{n} P(A_i)$

UNIT-II

Q.3) What do you understand by random variables, probability mass function, probability density function, joint distribution and conditional distributions.

Q.4) A random variable X has the following probability distribution:

x :	0	1	2	3	4	5	6	7
$p(x)$:	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i) Find k, (ii) Evaluate $P(X<6)$, $P(X \geq 6)$ and $P(0<X<5)$, (iii) if $P(X \leq c) > \frac{1}{2}$, find the minimum value of c and (iv) Determine the distribution function of X .

UNIT-III

Q.5) What is mathematical expectation and state and proof addition theorem of expectation. If X is a random variable and $'a'$ is constant, then

(i) $E\left[a\Psi(X)\right] = a\,E\left[\Psi(X)\right]$

(ii) $E\left[\Psi(X)+a\right] = E\left[\Psi(X)\right]+a$

where $\Psi(X)$, a function of X , is a r.v. and all the expectations exist.

Q.6) Define moment generating function, cumulative generating function and characteristic function. State and proof Chebyshev Inequality.

UNIT-IV

Q.7) Define convergence in probability and Weak law of large numbers.

Q.8) State and prove Central limit theorem for a sequence of independent and Borel-Cantelli Lemma.