

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

M.SC. (STATISTICS) I SEMESTER

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 Cayley's 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

$$\int_0^\infty \frac{e^{-x} \sin mx}{x} dx \text{ and hence deduce the value of } \int_0^\infty \frac{\sin mx}{x} dx$$

S.S. Jain Subodh P.G. College, Jaipur
(Autonomous)
M.Sc. Statistics I Semester
Paper: Probability Theory
Assignment

Attempt any four questions, selecting one from each unit.

UNIT- I

Q1. Define the term mutually exclusive events. Explain the axiomatic approach to probability. Using this, prove that the probability of an impossible event is zero.

Q2. Define the term equally likely events. Explain the classical and statistical definitions of probability along with their merits and demerits.

UNIT –II

Q3. Define a joint probability distribution. If the joint probability distribution function of X and Y is given by $F(x,y) = 1 - e^{-x} - e^{-y} + e^{-(x+y)}$; $x>0, y>0$

1. Find the marginal densities of X and Y.
2. Are X and Y independent?
3. Find $P(X \leq 1 \cap Y \leq 1)$ and $P(X+Y \leq 1)$

Q4. Define a random variable. Differentiate between discrete and continuous random variables. The joint p.d.f. of two random variables X and Y is given by:

$$f(x,y) = \frac{9(1+x+y)}{2(1+x)^4(1+y)^4}; 0 \leq x < \infty, 0 \leq y < \infty$$

find the marginal distributions of X and Y, and the conditional distribution of Y for $X=x$.

UNIT-III

Q5. Define moment generating function, cumulative generating function and characteristic function. State and prove Chebychev's Inequality.

Q6. State and prove addition and multiplication theorem of expectation and generalise to n terms.

UNIT- IV

Q7. Define convergence in probability and Weak law of large numbers and prove it.

Q8. State and prove Bernoulli's law of large numbers and Borel-Cantelli Lemma.

S.S. Jain Subodh P.G. College, Jaipur (Autonomous)
Assignment Oct. 2026
Programme - M.Sc. Semester I
Paper- MASTMSST-103: Probability Distributions

Attempt any 4 questions, selecting at question from each unit.

Unit – I

- Q1. Explain measures of dispersion in detail.
- Q2. Explain: (a) Sheppard's correction. (b) Probability generating function.

Unit – II

- Q3. Explain Poisson distribution in detail.
- Q4. (a) Explain Negative Binomial distribution.
(b) Explain Hyper Geometric distribution.

Unit – III

- Q5. (a) Derive the Normal Probability Distribution.
(b) Write down the chief characteristic of Normal Probability Distribution.
- Q6. (a) Explain Rectangular Distribution. Derive the mean and variance of Rectangular Distribution.
(b) If X_1 and X_2 are independent rectangular variates on $[0, 1]$, find the distribution of (i) $X_1 + X_2$ and (ii) $\frac{X_1}{X_2}$.

Unit – IV

- Q7. (a) Explain Cauchy distribution. Derive the characteristic function of Cauchy Distribution.
(b) Let X have a standard Cauchy Distribution. Find the p.d.f. of X^2 and identify its distribution.
- Q8. (a) Explain Gamma Distribution and find the Cumulant Generating Function of Gamma Distribution and hence otherwise obtain mean, variance, coefficient of Skewness and Kurtosis.
(b) State and prove the additive property of Gamma distribution.

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ASSIGNMENT Oct. 2026

Programme – M.Sc. Statistics Semester I

Paper – Statistical Quality Control

Attempt any 4 questions, selecting one question from each unit.

UNIT – I

1. (a) Discuss Statistical Process Control (SPC) and Product Control. Explain the need, and primary objectives of Quality Control.
- (b) Define Process Capability. Derive the expressions for process capability indices C_p and C_{pk} , and explain how process capability analysis is conducted during continuous process monitoring.

OR

1. (a) Differentiate clearly between Process Monitoring, Process Control, and Product Control with suitable practical examples.
- (b) What do you understand by specification limits, natural tolerance limits and control limits.

UNIT – II

2. (a) Describe the construction of control charts for variables ($\bar{X}$, R) and defects. Derive their 3-sigma control limits.
- (b) Define Average Run Length (A.R.L.) of a control chart. Explain the construction & interpretation of CUSUM charts using V-masks.

OR

2. (a) What are Modified Control Limits? Explain in detail. When do the modified control limits are preferred over standard 3-sigma limits.
- (b) Describe Moving Average and Exponentially Weighted Moving Average (EWMA) control charts.

UNIT – III

3. (a) What do you understand by Acceptance Plan.
- (b) Explain the terms Average Outgoing Quality Level (AOQL), Average Total Inspections (ATI) and Rectification of Lots.

OR

Discuss in detail: (i) Single Sampling Plan (ii) Double Sampling Plan.

UNIT -IV

4. Explain in detail sequential inspection plan. Why it is needed? How it is used? Is it more efficient than Double sampling inspection plan.

OR

Discuss any two:

- (a) Consumer's and producer's risks
- (b) Operative characteristic function
- (c) ASN function

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ASSIGNMENT Oct. 2026

Programme – M.Sc. Statistics Semester III

Paper – Design of Experiment–II

Attempt any 4 questions, selecting one question from each unit.

UNIT – I

- Q1. State and prove Gauss-Markoff's Theorem for independent variables.
- Q2. (a) Explain Estimation Space and Error Space. Show that the error space and estimation space are orthogonal vector spaces.
- (b) Define estimable parametric functions. Obtain the necessary and sufficient condition for a linear parametric function to be estimable.

UNIT – II

- Q3. Explain in detail the general theory of analysis of incomplete block designs.
- Q4(a) Explain orthogonality and balancing properties in incomplete block designs.
- (b) Define Duality, Resolvability, and Affine Resolvability in block designs with suitable mathematical expressions.

UNIT – III

- Q5 Explain various group divisible designs and also prove its parametric relationships.
- Q6 Explain two-way elimination of heterogeneity and its analysis.

UNIT – IV

- Q7. Construct the Mutually Orthogonal Latin Squares (MOLS) of order 12.
- Q8. Construct the BIBD with parameters $v = b = 11, r = k = 5, \lambda = 2$

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M.Sc. Statistics III Semester
Statistical Inference- II
Assignment 2026

Attempt any four questions, selecting one from each unit.

UNIT-I

- Q1. State and prove Huzur Bazaar theorem.
- Q2. State and prove that MLE's are consistent.

UNIT- II

- Q3. Obtain the asymptotic distribution of likelihood ratio criterion statistic.
- Q4. State and prove Lehman Scheffe theorem. Define complete statistic.

UNIT-III

- Q5. State and prove generalised Neyman -Pearson Lemma.
- Q6. Explain the concept of UMPU tests for the exponential family of distributions.

UNIT- IV

- Q7. Write detail notes on Generalised Baye's Rule and Randomization optimal decision rules.
- Q8. Explain a two- person zero sum game. When it becomes a decision problem?

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Assignment Oct. 2026
Programme - M.Sc. Semester III
Paper-MASTMSST 303: Sample Surveys-I

Attempt any 4 questions, selecting one question from each unit.

Unit -I

Q1. Explain the terms: - (a) Sampling error, (b) Non sampling error, (c) Variance & Mean Square error of an estimator and (d) Sample size

Q2. Describe Sampling and complete Census. and write limitations and types of Sampling.

Unit - II

Q3. What are the merits and drawbacks of simple random sampling? The variance of the sample mean in simple random sampling without replacement is $\left(\frac{N-n}{nN}\right) S^2$, prove it.

Q4. (a) Explain different allocation used in allocating sample to different strata.
(b) Describe stratified random sampling.

Unit – III

Q5. Explain systematic sampling while showing that it is more precise than the SRS, if the variance within systematic sampling is larger than the population variance as a whole.

Q6. Explain two stage sampling with (a) Equal and (b) Unequal number of second stage unit.

Unit – IV

Q7. Explain Ratio estimator. Is it unbiased? If not, then give expression for its bias under SRSWOR. For large sample obtain approximate variance of ratio estimator and compare it with the sample mean of variable under study.

Q8. Describe regression method of estimation. Obtain the regression estimator for population mean, obtain expression for its bias and variance. Will it be always more efficient than SRSWOR estimator?

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ASSIGNMENT Oct. 2026

Programme – M.Sc. Statistics III Semester

Paper – Econometrics

Attempt any 4 questions, selecting one question from each unit.

UNIT – I

Q1. What is General Linear Model (GLM)? Explain the difference between OLS and GLS.

Q2. Derive the OLS estimators for parameters in a simple linear regression model. State the assumptions underlying them.

UNIT – II

Q3. What are heteroscedastic disturbances? Discuss their causes, consequences and methods of detection.

Q4. Explain the concept of autocorrelation. Discuss the methods of dealing with autocorrelation in time series regression.

UNIT – III

Q5. Discuss simultaneous equation models. Also describe the identification problem in simultaneous equation models.

Q6. Explain stochastic regression and instrumental variable estimation.

UNIT – IV

Q7. Describe the 3SLS estimator and its properties.

Q8. Explain the estimation of parameters in a simultaneous equation model using 2SLS.

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Programme: M.A./M.Sc. Semester III

Paper: MAST\MSST 305 - Numerical Analysis

ASSIGNMENT

Instructions: Attempt any four questions selecting one from each unit.

UNIT- I

Q.1 Explain Lagrange's interpolation formula with remainder term. Derive the formula and illustrate it with a suitable numerical example.

Q.2 Derive Divided difference formula for unequal intervals.

UNIT- II

Q.3 Derive the Trapezoidal rule and Simpson's $1/3$ rule and Simpson's $3/8$ for numerical integration.

Q.4 Explain Euler's method and fourth-order Runge-Kutta method for solving first-order ordinary differential equations.

UNIT- III

Q.5 State and derive Euler-Maclaurin's summation formula. Explain its use in the summation of a series.

Q.6 Explain inverse interpolation. Derive the formula for inverse interpolation and discuss its applications with a suitable example.

UNIT- IV

Q.7 Explain the Bisection, Regula-Falsi and Newton-Raphson methods for finding the roots of a non-linear equation.

Q.8 Explain Gauss elimination, Jacobi's iterative method and Gauss-Seidel iterative method for solving simultaneous linear equations.