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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2025

MST3C10 - Time Series Analysis

(2022 Admission onwards)

Time: 3 hours Max. Weightage : 30

PART A

(Answer any four Questions. Weightage 2 for each question)

1. Define time series and explain the benefits of analyzing the time series data.
2. What do you mean by stationary time series?
3. Write the general formula for the spectral density of a time series model.
4. What is seasonal component of a time series? How it can be removed from time series?
5. Explain non-linear time series models with examples.
6. Distinguish between stationary and non-stationary time series?
7. Define periodogram.

PART B

(Answer any four questions. Weightage 3 for each question)

8. When will you say that a stochastic process is invertible. What is the invertibility condition of an $AR(1)$ model?
9. What is autocorrelation function? Discuss its properties.
10. What is Holt-Winter Smoothing?
11. Write short notes on any four models of time series.
12. Derive the autocorrelation function of a $MA(q)$ process.
13. Discuss any one test for stationarity of time series.
14. What are the diagnostic checking methods in time series analysis? Explain.

PART C

(Answer any Two question. Weightage 5 for each question)

15. Explain in detail various methods for determining trend in a time series.
16. Describe the ARIMA model. Explain the memory of each parameter (p,d,q) and discuss how differencing converts a non stationary series into a stationary one.
17. Find the Yule Walker and Least square estimate of the parameters of an AR(2) model.
18. a)State and Prove Herglotz theorem

    b)Define GARCH(1,1) MODEL. Write its properties.

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2025

MST3C11 - Design and Analysis of Experiments

(2022 Admission onwards)

Time: 3 hours

Max. Weightage : 30

Part A

(Answer **any four** questions, each carries **2** weightage)

1. Discuss Normal equation.
2. What does model adequacy checking involved in ANOVA?
3. Construct a 3×3 Latin Square layout using treatments A, B and C.
4. Define Duncan's multiple range test.
5. What is the difference between complete and incomplete block designs?
6. Show that in a BIBD, $\lambda(v-1) = r(k-1)$
7. Mention any three uses of factorial experiments.

(4x2 = 8 weightage)

Part B

(Answer **any four** questions, each carries **3** weightage)

8. Define estimable functions in a linear model. State the condition for estimability.
9. Explain the three basic principles of design of experiments. Describe its importance?
10. Define blocking. Why is it important in experimental designs like RBD and LSD?
11. What is ANCOVA? How does it differ from ANOVA?
12. What are associate classes in a PBIBD? Give an example?
13. If a BIBD has parameters v=6,b=10,r=5,k=3, find λ and verify BIBD conditions.
14. Discuss the principles of confounding in factorial designs. Why is it necessary?

(4x3 =12 weightage)

PartC

(Answer **any two** questions, each carries **5** weightage)

15. Explain the fixed effects one-way ANOVA model. Derive the ANOVA table, state the assumptions, and describe how to test for equality of treatment means. Also discuss how model adequacy is checked.
16. Explain the layout and analysis of a Randomized Block Design (RBD). Also discuss Two missing observations in RBD.
17. Compare Youden Square, and Lattice designs in terms of Structure, Parameters, Advantages and Limitations.
18. Explain the basic principles and structure of a 2^n factorial design. How is the analysis of such experiments carried out?

(2x5 = 10 weightage)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2025

MST3C12 - Testing of Statistical hypothesis

(2022 Admission onwards)

Time: 3 hours Max. Weightage : 30

PART A

Answer any four (2 weightages each)

1. Discuss p value and level of significance.
2. a) What do you mean by Neyman structure?

   b) Explain Bayesian tests.
3. Compare locally most powerful test and likelihood ratio test.
4. Define sign test. Present its applications.
5. Explain chi-square test for homogeneity.
6. Define a sequential probability ratio test. What are its advantages over fixed sample tests?
7. Define OC and ASN function of the SPRT.

(4 x 2=8 Weightage)

Part B.

Answer any four (3 weightages each)

8. A sample of size 1 is taken from a population distribution P(λ). To test $H_0: \lambda = 1$ against $H_1: \lambda = 2$, consider the nonrandomized test $\varphi(x) = 1$ if x > 3, and = 0, if x ≤ 3. Find the probabilities of type I and type II errors and the power of the test.
9. Let X be a random sample of size one. Consider test of the null hypothesis H_0 : X is a sample from $U(0,1)$ population against the alternative hypothesis H_1 : X is a sample from a beta $B(2,1)$ distribution with pdf $f(x) = 2x, 0 \leq x \leq 1$. Find UMP test of size $\alpha(\alpha = 0.05)$.
10. a) What do you mean by maximal invariant test?

    b) Show that φ is invariant under G if and only if φ is a function of T.
11. a) Describe median test.

    b) Explain Kendall's correlation and Spearman's rank correlation and give their properties.

12. Explain Wilcoxon signed rank test. How do you modify the test when there are tied observations?

13. a) How do you determine stopping bounds of SPRT?

    b) Obtain the OC function with respect to the SPRT for testing $H_0: \lambda = \lambda_0$against $H_1: \lambda = \lambda_1$ based on observations from Poisson distribution at strength (α, β).

14. State and prove Wald's fundamental identity.

(4 x 3=12 weightage)

Part C

Answer any two (5 weightages each)

15. (a) State and Prove Neyman Pearson lemma.

    (b) Obtain the Neyman Pearson most powerful critical region under $H_0: \mu = \mu_0$ against $H_1: \mu = \mu_1, (\mu_1 < \mu_0)$ based on a random sample of size n from $N(\mu, \sigma^2)$ population where σ^2 is known.

16. a) Let a random sample of size n drawn from a normal population with mean μ and variance σ^2 and are unknown. Obtain likelihood ratio test of $H_0: \sigma^2 = \sigma_0^2$ against $H_1: \sigma^2 \neq \sigma_0^2$.

    b) State asymptotic property of likelihood ratio test.

17. a) Explain Kolmogrov - Smirnov two sample tests.

    (b) Show that the Kolmogorov test statistic is distribution free if the distribution function of the population is continuous.

18. Derive the SPRT of strength (a, β) for testing $H_0 : p = p_o$ against $H_1 : p = p_1 (> p_0)$ based on observations drawn sequentially from Bernoulli population with parameter p.

(2 x 5 =10 weightage)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2025

MST3E01 - Operations Research - I

(2022 Admission onwards)

Time: 3 hours Max. Weightage : 30

(Use of Scientific Calculator is Permitted)

PART A

Answer any 4 questions. Weightage 2 for each question.

1. With the help of an example differentiate between nondegenerate and degenerate basic feasible solution of LPP.
2. Show that region of feasible solution to a linear programming problem is convex set.
3. Define the dual of a linear programming problem. Explain its economic interpretation.
4. State and prove weak duality theorem
5. State and prove a necessary and sufficient condition for the existence of a feasible solution to a transportation problem.
6. Justify your statement: An assignment problem can be considered as a special case of a transportation problem.
7. What you mean by a two-person zero sum game. Give examples of game with and without saddle point.

PART B

Answer any four questions. Each question has weightage 3.

8. Show that optimum solution to a linear programming problem if it exists will always be attained at one of the extreme points of the region of feasible solutions.
9. Given a basic feasible solution to a linear programming problem, explain the iterative steps for solving it.
10. Explain sensitivity analysis. Discuss the changes in cost vector C.
11. Define a transportation problem. Explain Vogel's approximation method and least cost method for finding initial basic feasible solution for transportation problem.
12. What is the difference between 2 machine – n- job and 3 machine – n- job.
13. Discuss branch and bound method for solving an integer programming problem.
14. State and prove minimax-maximum theorem.

PART C

Answer any two questions. Each question has weightage 5.

15. Use two phase simplex method to solve: Maximize $Z=6x_1+4x_2$

Subject to $2x_1+3x_2 \leq 30$

$3x_1+2x_2 \leq 24$

$x_1+x_2 \geq 3$

$x_1 \geq 0,\ x_2 \geq 0.$

16. Use Gomery's cutting plane algorithm to solve Maximize $Z=x_1+4x_2$

Subject to the constraints $2x_1+4x_2 \leq 7$

$5x_1+3x_2 \leq 15$

x_1, x_2 are nonnegative integers.

17. Explain iterative steps to solve a transportation problem. Also solve the transportation problem

	W_1	W_2	W_3	
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
	180	120	150	

18. a. Solve the assignment problem

18	26	17	11
13	28	14	26
38	19	18	15
19	26	24	10

b. Derive game problem as a linear programming problem.

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2025

MST3E04 - Life Time Data Analysis

(2022 Admission onwards)

Time: 3 hours Max. Weightage : 30

PART A

Answer any four (2 weightages each)

1. Define the Gamma distribution and explain its relevance in reliability analysis.
2. Discuss the shape of Lazard function and properties of the Weibull distribution.
3. Define the Kaplan – Meier estimator. Explain how it is computed for left truncated data.
4. Compare two exponential distributions using a likelihood ratio test.
5. Explain right censoring and provide an example from medical studies.
6. Define the Accelerated Failure Time (AFT) model.
7. What is the mean residual life function? Obtain its relationship with hazard rate.

(2 x 4=8 weightages)

PART B

Answer any four (3 weightages each)

8. Explain life tables.
9. Explain log rank test.
10. What is the role of quantile plots in assessing model fit in survival analysis? Explain.
11. Differentiate between Type I and Type II censoring with examples.
12. How are confidence intervals for survival probabilities computed under the KM estimator?
13. What is the significance of p-p plots in lifetime data analysis?
14. Explain how interval-censored lifetime data are handled using nonparametric methods.

(3x 4=12 weightages)

PART C

Answer any two (5 weightages each)

15. For the given lifetime data: 2, 3, 5*, 6, 8*, 10, 12*, 15, 18, 20* (* = censored), Identify the type of censoring and compute the empirical survival probabilities at each event time.
16. Explain the concept of mixture models in the context of lifetime data analysis. When are they used?
17. Explain Proportional Hazard models in the context of modelling survival data.
18. How is inference carried out under the exponential model in lifetime data analysis? Discuss the large sample theory.

(5x2=10 weightages)