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1M3N23119

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Reg. No:.......................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2023

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. What is a time series? Describe seasonal component of a time series.
2. Show that the autocorrelation function (ACF) is an even function of the time lag.
3. Obtain the Yule - Walker equations for AR(2) model.
4. Describe ARIMA(p,d,q) process. Determine the constants (p,d,q) of the model $Y_t = 2Y_{t-1} - Y_{t-2} + \epsilon_t$.
5. Describe the role of residual analysis in model checking.
6. Obtain the spectral density of MA(1) process.
7. Define a GARCH (1,1) process ? Mention its important properties.

(4x2=8 Weightage)

PART B

Answer any four questions. Weightage 3 for each question.

8. Describe the simple exponential smoothing and moving average method of smoothing in time series analysis.
9. Define spectral density $f(\lambda)$ of a stationary time series and show that

$$\gamma(k) = \int_{-\pi}^{\pi} e^{ik\lambda} f(\lambda)\, d\lambda.$$

10. Derive the stationarity conditions of an AR(2) model.
11. Derive the autocorrelation of $\{Y_t\}$, where $Y_t = \epsilon_t - \epsilon_{t-1} + 0.6\, \epsilon_{t-2}$ assuming $\{\epsilon_t\}$ as a white noise process.
12. What do you mean by forecasting in time series? Explain the l-step ahead forecasting procedure in an AR(p) process.
13. Define ARCH(1,1) model. Prove or disprove the statement that an ARCH(1,1) model is stationary.
14. Explain the structure of correlogram of a (i) Stationary series (ii) Non stationary series and (iii) a series with seasonal fluctuations.

(4x3=12 Weightage)

PART C

Answer any 2 questions. Weightage5 for each question.

15. Explain the Holt method and Holt winter method (additive and multiplicative cases) of smoothing techniques in time series.
16. Derive the ACF of an ARMA(p,q) process and obtain the invertibility conditions.
17. Describe the use of maximum likelihood method of finding the parameter estimates of ARMA (1 ,1) model.
18. State and prove Herglotz theorem.

(2x5=10 Weightage)

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Reg. No:......................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2023

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. What do you mean by fixed effect model?
2. Discuss linear hypothesis testing?
3. Write down the basic assumptions of ANOVA
4. What are the characteristics of GLSD?
5. When do we prefer RBD over CRD?
6. Explain Youden square design?
7. Give an example of fractional factorial design?

(4x2 = 8 weightage)

Part B (Answer any four questions, each carries 3 weightage)

8. Differentiate split plot design and strip plot design?
9. Discuss the steps in planning an experiment.
10. Show that for a resolvable BIBD with parameters (v, b, r, k, X), b > v + r -1
11. Describe the intrablock analysis of Balanced Incomplete Block Design.
12. Illustrate confounding of the interaction effect 'ABC' with reference to 2^3 factorial experiments, having A, B, C as factors.
13. Identify the situation where the Duncans's multiple range test has been used for?
14. Compare BIBD with PBIBD.

(4x3 =12 weightage)

Part C (Answer any two questions, each carries 5 weightage)

15. State and prove Gauss Markov's theorem.
16. Derive the analysis procedure of LSD with one and two missing values.
17. Explain the analysis of a partially confounded 2^3 factorial experiment.
18. Discuss the analysis of PBIBD with two associate classes.

(2x5 = 10 weightage)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2023

MST3C12 – Testing of Statistical Hypothesis

(2022 Admission onwards)

Time: 3 hours

Max. Weightage : 30

Part A.

(Answer any 4 questions. Weightage 2 for each question)

1. Compare UMP unbiased and UMP invariant test.
2. Show that Neyman Pearson most powerful test is unbiased.
3. What do you mean by Neyman structure?
4. Explain locally most powerful tests and ∝- similar test.
5. Explain chi-square test for homogeneity.
6. Explain testing procedure of Wilcoxon signed rank test.
7. Define OC function and ASN of SPRT. State its properties.

(4 x 2=8 Weightage)

Part B

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

8. Let $X_1, X_2, \dots, X_5$ be a random sample of size 5 taken from B(1, p). Obtain MP test of size 10% for testing $H_0: p = \frac{1}{2}\ Vs\ H_1: p \neq 1/2$. Find the power of the test.
9. Define consistency of a test. Show that likelihood ratio test is consistent.
10. Show that UMPU exists even if UMP test does not exist.
11. Show that the likelihood ratio test criterion for testing $H_0: \sigma_1^2 = \sigma_2^2$ against $H_0: \sigma_1^2 \neq \sigma_2^2$ where σ_1^2 and σ_2^2 are the variance of two normal populations leads to F statistic.
12. Distinguish between Chi- square goodness of fit and Kolmogorov- Smirnov test. Describe their merits and demerits.
13. a) Explain robustness.

    b) Explain Spearman rank correlation test.
14. Show that SPRT terminates with probability one.

(4 x 3=12 weightage)

Part C

Answer any two ***questions (Weightage 5 for each question)***

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

(b) Obtain the Neyman Pearson most powerful critical region under $H_0: \sigma = \sigma_0$ against $H_1: \sigma = \sigma_1, (\sigma_1 > \sigma_0)$ based on a random sample of size n from $N(\mu, \sigma^2)$ population where μ is known.

16. Consider a random sample of size n from $U(0, \theta)$. Suggest a UMP size α test for testing $H_0: \theta = \theta_0$ against $H_1: \theta \neq \theta_0$.

17. a. Explain median test. Derive null distribution of the test statistic.

b. Define Mann-Whitney test. Find mean, variance and asymptotic distribution of the test statistic.

18. a. Obtain an approximate expression of the O.C. function of SPRT.

b. State and prove Wald's fundamental identity.

(2 x 5 = 10 weightage)

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Reg. No:.......................

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2023

MST3E01 – Operations Research – I

(2022 Admission onwards)

Time: 3 hours

Max. Weightage : 30

Part A

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

1. Define basic feasible solution of a system of linear equations' Differentiate between degenerate and non degenerate basic feasible solution with the help of an example.
2. What you mean by an extreme point of a convex set? Show that optimum feasible solution to a linear programming problem if it exists will always be attained at one of the extreme points of the set of all feasible solutions.
3. Define dual of a linear programming problem. State and prove weak duality theorem.
4. Define a transportation problem. State and prove a necessary and sufficient condition for the existence of a basic feasible solution to a transportation problem.
5. Write note on sensitivity analysis associated with a linear programming problem.
6. Define a two person zero sum game. What you mean by saddle point of a game? Give an example of a game with saddle point and without saddle point.
7. Discuss the algebraic method of solving a 2x2 zero sum game.

Part B

(Answer any four questions. Each question has weightage 3)

8. Show that a basic feasible solution corresponds to an extreme point of the set of feasible solutions of a linear programming problem.
9. In a linear programming problem if all the net evaluations associated with a basic feasible solution are non-negative show that the solution is optimum for a maximization problem.
10. Explain the steps involved in solving a linear programming problem once a basic feasible solution is available
11. State and prove fundamental theorem of duality.
12. Discuss the algorithm of solving an assignment problem.
13. Define an integer programming problem. How an integer programming problem is solved by the branch and bound method.
14. Describe method of solving a 2xn game graphically.

Part C

(Answer any two questions. Weightage 5 for each question)

15. Use Simplex method to solve

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

16.

a)Discuss the algorithm of Gomery's cutting plane method in solving and integer programming problem

b)Solve the following integer programming problem by branch and bound method

Maximize $Z = 2x_1 + 3x_2$

Subject to $-3x_1 + 7x_2 \leq 14$

$7x_1 - 3x_2 \leq 14$

x_1 and x_2 are non-negative integers

17. Obtain the optimum solution to the transportation problem

	D_1	D_2	D_3	D_4	D_5	
O_1	5	3	7	3	8	30
O_2	5	6	12	5	7	40
O_3	2	8	3	4	8	30
O_4	9	6	10	5	9	80
	40	40	60	20	20	

18.

a) Solve the game graphically

	B_1	B_2	B_3	B_4
A_1	7	6	3	5
A_2	3	4	6	6

b) Solve the game using LPP

Player B

$$\text{Player A} \begin{bmatrix} 1 & -1 & -1 \\ -1 & -1 & 3 \\ -1 & 2 & -1 \end{bmatrix}$$

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Statistics Degree Examination, November 2023

MST3E04 – Life Time Data Analysis

(2022 Admission onwards)

Time: 3 hours

Max. Weightage : 30

PART A

Answer any four (2 weightages each)

1. What are the key differences between continuous and discrete lifetime distributions? Provide examples of each.
2. Explain type II censoring.
3. Define Kaplan Meier estimate.
4. What is the significance of p-p plots in lifetime data analysis?
5. What are the methods for estimating the survivor function of left truncated data?
6. Justify Cox likelihood as a partial likelihood.
7. What are the key steps in conducting inference under the exponential model for lifetime data?

(2 x 4=8 weightages)

PART B

Answer any four (3 weightages each)

8. How does the Log-normal distribution model lifetime data, and what are its key parameters?
9. What is the mean residual life function? Obtain its relationship with hazard rate. Also, show that the mean residual life function uniquely determines the distribution.
10. Explain models with threshold parameters and their relevance in lifetime data analysis.
11. Explain the rank test for comparing distributions, specifically the Generalized Wilcoxon test.
12. How do you compare different distributions in lifetime data analysis, and why is it important?
13. Explain the concept of life tables and their significance in survival analysis.
14. Discuss the various descriptive and diagnostic plots used in lifetime data analysis.

(3x 4=12 weightages)

PART C

Answer any two (5 weightages each)

15. Define censoring in the context of lifetime data analysis. What are the statistical methods used to account for censoring
16. Explain the concept of mixture models in the context of lifetime data analysis. When are they used?
17. Explain the inference procedures for the three-parameter Weibull distribution.
18. Explain the concept of proportional hazard models and their applications in modelling survival data.

(5x2=10 weightages)