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                                                       Name: ....

Time: 2½ hours   Max. Marks : 80

(Use of Calculator is permitted)

PART A
Each question carries 2 marks.

1. Explain multiplicative model in time series.

2. What is secular trend in time series?

3. Define seasonal variations in time series with example

4. Explain moving averages.

5. What is weighted-aggregate index number

6. What is family budget method?

7. Describe the fitting of Pareto's law.

8. Explain Marshal-Edge worth index number

9. What are the scales of measurements?

10. Define quantity index number

11. Explain any two issues of 'attitude measurements'

12. Explain time-reversal test

13. What is cost of living index?

14. Define Guttman differential scale

15. If the three year moving average is 100 and the first two values are 120 & 89 then the third value is ....

                                        Maximum Mark = 25

PART B
Each question carries 5 marks

16. Explain Link relative methods and its merits and demerits.

17. Show that the ratio (X/Y) and the product XY are log-Normal, if X & Y are two independent Log-Normal variates.

18. Give major applications and limitations of index numbers.

19. Explain Gini's coefficient and Lorentz curve.

20. Construct Laspeyre's & Pasche's Price Index number.

Items	2020		2023	
	Price(Rs)	Quantity(Kg)	Price(Rs)	Quantity(Kg)
A	9	27	10	36
B	12	29	27	45
C	25	36	29	54
D	13	49	15	63

21. Explain different methods to calculate the trends in the series.

22. Describe Base shifting, splicing and deflating of index numbers.

23. Explain Fisher Index number. Why it is mentioned as an ideal index number?

Maximum Mark = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. What are the components of time series, explain each with example.

25. Explain the principle of least square method to fit a linear trend. Fit a linear trend for the data by principle of least square method and estimate the population at 2050.

Year	2011	2012	2013	2014	2015	2016	2017
population	92	83	94	99	92	110	126

26. Explain the different classifications and types of index numbers with example.

27. Explain different attitude measurement scales with example. Describe the advantages and limitations of scales in attitude measurements?

(2 × 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2024

BST6B10 - Design of Experiments

(2019 Admission onwards)

Time: 2 ½ hours　　　　　　　　　　　　　　　　　　　　　　Max. Marks : 80

(Use of Scientific Calculator and Statistical table are permitted)

PART A
Each question carries 2 marks.

1. What is a linear estimation?

2. Explain the concept of estimability of parametric functions.

3. Define ordinary least square estimation

4. Write the linear model of one-way ANOVA

5. State Cochran's theorem

6. Write the use of Post Hoc Tests

7. Define Least Significant Difference (LSD)

8. What are the fundamental principles of experimental design

9. Write the efficiency of a completely randomized design over a randomized block design

10. Define factorial experiment.

11. Define Balanced incomplete block design

12. List all the parameters in a Balanced Incomplete Block Design (BIBD).

13. What is meant by a Partially Balanced Incomplete Block Design.

14. Write yates notation of 2^2 design

15. How does a 2^2 factorial experiment differ from a 2^3 factorial experiment?

Maximum Mark = 25

PART B
Each question carries 5 marks

16. Let $y_1 = \beta_1 + \beta_2 - \beta_3 + \epsilon_1, y_2 = 2\beta_1 - \beta_2 + 3\beta_3 + \epsilon_2$ and $y_3 = \beta_2 - 3\beta_3 + \epsilon_3$ Then check $\beta_1 + 2\beta_2 + 3\beta_3$, is estimable or not. If yes find BLUE for ordinary least square estimator for $\beta_1 + 2\beta_2 + 3\beta_3$.

17. Write a short note on ANCOVA

18. What is the missing plot technique in experimental design, and how is it addressed in RBD?

19. Write the advantages and disadvantages of LSD over RBD.

20. Explain the efficiency of RBD compared to CRD

21. Write a short note on RBD

22. Compose a brief explanation of incomplete block design.

23. Elaborate on the concept of Analysis of Variance (ANOVA) within the framework of a Balanced Incomplete Block Design (BIBD).

Maximum Mark = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. State and prove Gauss-Markov theorem

25. Describe the technique of handling missing plots for a single variable in the LSD, and then structure the ANOVA with the updated information.

26. A company is interested in understanding the factors that might affect the productivity of its employees. They decide to conduct a study to analyze the impact of different training programs on the productivity levels of three departments (A, B, and C). The productivity scores of employees are recorded after the completion of three different training programs for each department. The scores are as follows:

Group A (Training Program 1): 78, 82, 75, 80, 79

Group B (Training Program 2): 85, 88, 90, 82, 87

Group C (Training Program 3): 72, 75, 70, 78, 74

Determine whether there are significant differences in productivity levels among the three departments after undergoing different training programs.

27. Consider a plant growth experiment where researchers are testing the effects of two factors: fertilizer type (A and B) and watering frequency (high and low). Each combination of factors is applied to different plants, and the height of the plants is measured after a specified period.

Fertilizer	Watering Frequency	Plant Height (cm)
A	High	15
B	Low	12
B	High	18
A	Low	14
B	High	17
A	Low	13
A	High	16
B	Low	11
B	Low	10
A	High	19

A) What is the average plant height for each combination of fertilizer type and watering frequency?

B) Are there significant differences in plant height between the two fertilizer types?

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2024

BST6B11 - Population Studies Actuarial Science and Vital statistics

(2019 Admission onwards)

Time: 2 ½ hours   Max. Marks : 80

(Use of Calculator is permitted)

PART A
Each question carries 2 marks

1. What are vital events?

2. What are the different methods for obtaining vital statistics?

3. Define IMR and MMR.

4. In a year, the average population of town was 1, 50,000. The number of live births occurred in that year in the town was 6,000. Find Crude Birth Rate

5. What is the difference between age-specific fertility rate and CBR.

6. Define life table and cohort.

7. Define mortality and radix of the mortality table.

8. Write down any two inter relations between the column of a life table.

9. Define the concept 'force of mortality'.

10. What are the principal methods used for the construction of abridged life tables?

11. Define insurance.

12. Briefly explain the terms loss and peril.

13. Differentiate between hazard and risk.

14. Differentiate between the insurer and insured.

15. Define the term annuity.

                                                           (Maximum Marks = 25)

PART B
Each question carries 5 marks

16. Explain the uses of vital statistics.

17. Give a brief account of the Sample Registration System.

18. In a year, in a community there were 6500 live births. The number of infants died in the year was 350, of the infants' deaths in 18 cases the new born babies died within one month. Among the live births in 30 cases, mother died due to child birth problems. Find IMR, NMR and MMR.

19. What are the different expectations of life? Explain.

20. Discuss the uses of life tables.

21. Write down any two costs and benefits to the society by the insurance system.

22. Differentiate between whole life and term life insurance.

23. Write short note on insurable interest and warranties.

(Maximum Marks =35)

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. Define and compare various measures of fertility.

25. The population figures and number of deaths in the standard town (A) and local town (B) are given below. Calculate CDR and standardized death rates using both the direct and indirect methods of standardization:

Age Group	Town A		Town B	
	Population	Deaths	Population	Deaths
Under 5	5000	150	7500	135
5-25	25000	500	20000	500
25-55	15000	225	20000	400
55 and above	5000	300	2500	125

26. Differentiate between life insurance and general insurance and explain the different branches.

27. Explain the method of calculating the premium of life insurance.

(2 x 10 =20 marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2024

BST6B12 - Operation Research and Statistical Quality Control

(2019 Admission onwards)

Time: 2 ½ hours   Max. Marks : 80

(Use of Scientific Calculator & Quality Control Table are permitted)

Part A
Each Question 2 marks

1. State General Form of LPP.

2. Define Slack and Surplus Variables.

3. Write all possible Basic Solutions of $x + y + z = 10$, $x - 2y + 4z = 16$.

4. Define Artificial Variables.

5. Distinguish between Balanced and Unbalanced Transportation Problem.

6. State Assignment Problem as LPP.

7. Define Non Degenerate BFS of a Transportation Problem.

8. Define "Quality" of a product.

9. Distinguish between "defect' and "defective".

10. Define Product Control.

11. Define LTPD and ASN.

12. State control limits of C Chart.

13. Define OC Function.

14. Define AOQL.

15. State merits and demerits of Single Sampling Plan.

(Ceiling 25 marks)

Part B
Each Question carries 5 marks

16. Solve the following LPP graphically

Maximise $Z = 5X + 8Y$

Subjected to $3X + 5Y \leq 15$, $X - Y \geq 0$, $X, Y \geq 0$.

17. Prove that Dual of Dual is Primal.

18. Briefly explain he Least Cost Cell Method of finding an IBFS to a Transportation Problem.

19. Solve the following AP

Jobs → Machine ↓	I	II	III	IV
M1	32	26	35	38
M2	27	24	26	32
M3	28	22	25	34
M4	10	10	16	16

20. Explain various causes of variation in quality.

21. Derive the central line, control limits of p chart.

22. Explain errors in Acceptance Sampling Plan. Define Producers and Consumers Risk.

23. Explain Double Sampling Plan.

(Ceiling 35 marks)

Part C
Answer any two questions, each question carries 10 marks.

24. Solve the Dual of following LPP

Minimize $Z = 4x + 2y$

Subjected to $x + 2y \geq 20$, $3x + y \geq 30$, $4x + 3y \geq 60$, $x, y \geq 0$

Hence obtain the solution of Primal.

25. Obtain an IBFS to the following Transportation Problem using VAM

Destination Origin	D1	D2	D3	D4	Supply
O1	14	10	9	11	140
O2	12	17	14	17	220
O3	15	13	16	15	180
Demand	190	120	100	80	

26. The following are mean and range of samples of size 7 taken from a production process. Construct appropriate charts and comment on Statistical control.

Sample	1	2	3	4	5	6	7	8	9	10
Mean	37.8	40.2	39.1	38.6	38.9	39.4	41.0	40.8	38.4	39.5
Range	2.5	1.9	1.2	1.7	1.4	1.3	2.4	2.1	1.6	1.1

27. Explain SSP with parameters Lot size $N = 1000$, Sample size $n = 100$ and Acceptance Number $C = 2$. Also, construct OC Curve by taking at least 5 points.

(2 x 10 = 20 marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2024

BST6B16 - Reliability Theory

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

Section A
(Each question carries 2 marks)

1. Define a coherent system

2. What is a dual structure?

3. Define Module of a coherent system

4. What is the use of importance measure ?

5. What is the structure function of a series system?

6. State minimal path sets and minimal cut sets

7. What is reliability importance measure ?

8. Define positive ageing.

9. Define lack of memory property. Which distribution possesses that property?

10. Define Poisson distribution.

11. Distinguish between IFR and DFR distributions.

12. What is the failure rate function of Exponential distribution?

Maximum Marks = 20

Section B
(Each question carries 5 marks)

13. Define Bridge structure with five components. How can you represent the structure as Parallel-series/series-parallel structure.

14. How can you find out more important component in a reliability system?

15. Let $h(\underline{p})$ be a system reliability of a coherent system, then show that $h(\underline{p})$ is strictly increasing in each p_i for $0 < p_i < 1$ for all i.

16. Let $\phi(\underline{x})$ be the structure function of a coherent system of order n. Show that

$$\prod_{i=1}^{n} x_i \leq \phi(x) \leq \coprod_{i=1}^{n} x_i \,.$$

17. Show that dual of a series system is a parallel system.

18. What is the relationship between reliability function and failure rate function? Establish your argument.

19. Explain bathtub shaped failure rate models.

Maximum Marks = 30

Section C
(Answer any one question; each question carries 10 marks)

20. Let ϕ be a coherent structure. Then show that

$(i) \phi(\underline{x} \vee \underline{y}) \geq \phi(\underline{x}) \vee \phi(\underline{y})$ (ii) $\phi(\underline{x}.\underline{y}) \leq \phi(\underline{x}).\phi(\underline{y})$

21. Explain how will you find the bounds on system reliability using minimal paths and cuts

(10 x1=10 Marks)