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Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2023

BST6B09 – Time Series and Index Numbers

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A

Each question carries 2 marks.

1. Define Time series.
2. Explain multiplicative model in time series.
3. Define cyclic variations in time series with example.
4. Explain factor-reversal test.
5. Define simple average method.
6. What is family budget method?
7. Describe the fitting of Pareto'slaw.
8. What is Gini's coefficient?
9. Explain Marshal-Edgeworth index number.
10. What are the scales of measurements?
11. Explain any two issues of 'attitude measurements'
12. Explain consumer price index.
13. Define Semantic differential scale.
14. What is simple-aggregate index number ?
15. Write the name of any two methods to find seasonal variation.

Maximum Marks = 25

PART B

Each question carries 5 marks

16. Describe the Link Relative Method of measuring seasonal variation.
17. What is secular trend? A trend equation is $Y = 270 + 1.5X$ with origin 2022, write the new trend equation if the origin is shifted to 2017.

18. Fit a straight line trend to the data. Find the sales at 2025.

year	2006	2007	2008	2009	2010	2011	2012	2013
Sales	125	128	133	135	140	141	143	145

19. Describe base shifting, splicing and deflating of index numbers.

20. Explain Ratio to moving average method.

21. Write a note on Log-Normal distribution

22. Explain Lorentz curve

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

Items	2015		2020	
	Price(Rs)	Quantity(Kg)	Price(Rs)	Quantity(Kg)
A	5	5	10	6
B	1	10	2	12
C	2	20	5	15
D	4	4	8	5

Maximum Marks = 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 Pareto distribution and its applications.

26. Explain different methods to find the secular trend with example.

27. Show that Fisher's index number is an ideal index number.

(2 × 10 = 20 marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2023

BST6B10 – Design of Experiments

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A
Each question carries 2 marks.

1. Define BLUE.
2. Write a linear hypothesis.
3. Write necessary and sufficient condition for estimability of parametric functions
4. What are the uses of Post Hoc Tests ?
5. In a LSD with 4 treatments and error sum of squares is 16, find the Mean error sum of squares.
6. Write the linear model for Analysis of covariance with a single observation per cell
7. Write any two methods for Post Hoc Tests.
8. Explain use of local control in design of experiment.
9. State relative efficiency of RBD over CRD.
10. Draw the layout of 3 × 3 Greco-Latin square design.
11. Write the linear model for RBD.
12. Define incidence matrix.
13. Write estimator for single estimator from a LSD.
14. Draw the layout of 2^3 factorial design
15. When do we use BIBD over RBD ?

Maximum Mark = 25

PART B
Each question carries 5 marks

16. Let $E(Y_1) = \beta_1 - 2\beta_2 + \beta_3$, $E(Y_2) = \beta_1 + 3\beta_2$ and $E(Y_3) = 2\beta_1 + \beta_2 + 3\beta_3$ are expected values of three linear models. Then check that $\beta_1 + \beta_2 + \beta_3$estimable parametricfunction or not.
17. Explain the decomposition of total sum of square of two way ANOVA.
18. Write a short note on one way ANOVA.

19. Explain the working of Duncan's multiple range test.

20. Derive the missing value of a LSD. Then write its ANOVA.

21. Find the efficiency of LSD over CRD.

22. Write the advantages and disadvantages of RBD over CRD.

23. Define the main effects and interaction effects in a 2^3 factorial experiment.

Maximum Mark = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. State and prove Gauss-Markov theorem.

25. Derive the ANOVA table for Least Significant Difference (LSD)

26. Explain Randomized block design(RBD) and write advantages of BIBD over RBD

27. What is Yates notation of 2^3 design? Derive ANOVA table of 2^3 design.

(2 x 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2023

BST6B11 – Population Studies, Actuarial Science and Vital Statistics

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A

Each question carries 2 marks.

1. What do you mean by peril?
2. Define crude birth rate.
3. What is sex ratio?
4. What do you mean by proximate cause?
5. Define insurable loss.
6. Crude death rate is not a good indicator for mortality comparisons. Why?
7. How does an abridged life table differ from a complete life table?
8. Differentiate between NRR and GRR.
9. Write any two characteristics of complete life tables.
10. In a population of 183450 individuals in a year there were 5400 births and 4730 deaths. Calculate the crude death rate.
11. What do you mean by fertility of a population?
12. Which are the main branches of general insurance?
13. Describe the difference between direct and indirect losses.
14. How is population growth measured?
15. What are the methods of obtaining vital statistics?

PART B

Each question carries 5 marks

16. Discuss the costs of insurance to society.
17. What are the assumptions of life table?
18. Define gross and net reproduction rates. What interpretation can be made if the NRR is 1, less than 1 or greater than 1?
19. Distinguish between stable and stationary population.
20. Briefly explain fire insurance.
21. Explain the principle methods of construction of abridged life tables.
22. Distinguish between life insurance and general insurance.
23. Briefly explain the direct and indirect method of standardizing death rates.

Maximum Mark =35

PART C

Each question carries 10 marks (Answer any **TWO** Questions)

24. Define and compare various measures of fertility.
25. Calculate crude and Standardized death rates for the Local population from the following data and compare them with crude death rate of the standard population (use both direct and indirect method).

Age group	Standard Population	Deaths	Local Population	Deaths
0 - 10	600	18	400	16
10 - 20	1000	5	1500	6
20 - 60	3000	24	2400	24
60 - 100	400	20	700	21

26. Explain the meaning of the following rates in vital statistics and discuss their importance: (a) Specific death rate, (b) General fertility rate, (c) Net reproduction rate.
27. Complete the life table of the population of a certain types of insects, x being the age in days and $l_x = 1{,}000$ for x = 0:

x :	0	1	2	3	4	5	6	7	8
q_x :	0.120	0.005	0.010	0.050	0.100	0.500	0.800	0.900	0.950

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2023

BST6B12 – Operations Research and Statistical Quality Control

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A
Each Question Carries 2 Marks

1. Define Non Degenerate Basic Feasible Solution of a LPP.
2. State the assumptions of a LPP.
3. Define Slack and Surplus Variables.
4. Define Dual and Primal LPP.
5. State Balanced and Unbalanced Transportation Problem.
6. Define Assignment Problem mathematically.
7. State merits and demerits of Least Cost Cell Method.
8. Define Process Control and Product Control.
9. State the Statistical theories supporting 3σ limits in Control Charts.
10. State the CL, UCL and LCL of number of defectives chart.
11. Define Incoming Quality and Outgoing Quality.
12. Define AOQL and ASN.
13. Define type 1 and type 2 errors in an ASP.
14. Define OC function of a Sampling Inspection Plan.
15. Define AQL and LTPD.

Maximum: 25 marks

PART B
Each Question Carries 5 Marks

16. Explain Graphical method of solving LPP.
17. Explain the role artificial variables in Simplex Procedure of solving LPP.
18. Solve the following LPP using Simplex Method

    Maximize $Z = 22x + 18y$

    Subjected to $3x + 2y \leq 48, x + y \leq 20$

    $x, y \geq 0$

19. Briefly explain Hungarian method of solving AP.

20. The following are no. of defectives found in random samples of size 500 taken from a production process.24, 22, 20, 19, 21, 26, 23, 28, 17,18, 24, 25. Construct Proportion defective chart and verify process control.

21. Explain Producer's Risk and Consumer's Risk.

22. Write short notes on ASN and ATI.

23. Explain Single Sampling Plan.

Maximum: 35 marks

PART C

Answer any two questions. Each question carries 10 marks

24. Using Simplex method, show that the LPP Maximize $Z = 9x + 10y$

Subjected to $x + 2y \leq 20$, $4x + 3y \geq 12$

$x, y \geq 0$

has no feasible solution.

25. The following data gives mean and range of samples of size 7 taken randomly from a process. Verify Process Control.

Sample	1	2	3	4	5	6	7	8	9	10
Mean	47	44	49	51	43	48	50	45	46	46
Range	5	7	3	6	9	4	3	7	8	7

26. Obtain an IBFS to the given TP using Vogel's Approximation Method

From↓ To→	D1	D2	D3	D4	Supply
O1	9	14	12	18	250
O2	11	15	12	8	150
O3	16	14	11	8	200
Demand	140	180	220	130	

27. Explain Double Sampling Plan.

(2 x 10 = 20 marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2023

BST6B16 (E1) – Reliability Theory

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

Section A
(Each question carries 2 marks)

1. Define structure function of a system.
2. What is k-out-of-n system
3. Define a coherent structure.
4. Which component is more important to a series system?
5. Give structure function of a series system and a parallel system, with n components.
6. Define minimal path.
7. Distinguish between path and minimal path.
8. Define module of a coherent system.
9. What is the failure rate of exponential distribution.
10. Define Poisson distribution.
11. Define IFR distributions.
12. Define bathtub shaped failure rate model.

Maximum Marks = 20

Section B
(Each question carries 5 marks)

13. Define Bridge structure. Represent a bridge structure as parallel-series/series-parallel structure.
14. Explain inclusion exclusion method of computing exact system reliability.
15. Show that, $h(\underline{p})$, system reliability of a coherent system, is increasing.
16. Let $\phi(\underline{x})$ be the structure function of a coherent system of order n. Then show that $\prod_{i=1}^{n} p_i \leq P(\varphi(\bar{x}) = 1) \leq \coprod_{i=1}^{n} p_i$
17. Obtain the bounds on system reliability, when components are associated.
18. Show that the hazard function uniquely determines the reliability function.
19. How can we say about the failure pattern when the distribution function is not differentiable? .

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*) $\phi(\underline{x} \vee \underline{y}) \geq \phi(\underline{x}) \vee \phi(\underline{y})$, for a parallel system

    (ii) $\phi(\underline{x}.\underline{y}) \leq \phi(\underline{x}).\phi(\underline{y})$, for a series system.

21. Show that exponential distribution is the only distribution with constant failure rate.

(1 x10 =10 marks)