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Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2024

BST5B05– Mathematical Methods in Statistics

(2022Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A

Each question carries 2 marks.

1. State the principle of mathematical induction.
2. Define supremum and infimum for a set of real numbers.
3. Prove that $||a| - |b|| \leq |a - b|$ for $a, b \in \Re$.
4. Give an example for a nested sequence of intervals.
5. State Bernoulli's inequality.
6. Define limit of a sequence.
7. Show that the sequence $\{\frac{(-1)^n}{n}\}$ converges.
8. State the necessary and sufficient condition for the convergence of an infinite series.
9. If $lim_{x\to a} f(x)$ exists, prove that it must be unique.
10. Give an example for a function which is uniformly continuous on $\mathcal{R}$.
11. State Taylor's theorem.
12. Find the derivative of $f(x) = \sqrt{x}$ at $x = 4$.
13. Prove or disprove $\int_a^b f(x)dx = -\int_b^a f(x)dx$.
14. Define Upper Sum and Lower sum of a function f corresponding to the partition P.
15. Write the necessary and sufficient condition for a bounded function f to be integrable.

Maximum Mark = 25

PART B

Each question carries 5 marks.

16. Show that every open interval (a, b) contains a rational number.
17. Show that the sequence $(log\frac{1}{n})$ is a properly divergent sequence.
18. Find $\lim_{x\to 0}\frac{x-sinx}{x^3}$.
19. Test for convergence of the series $\sum\frac{n^2-1}{n^2+1}x^n, x > 0$.
20. What are the different types of discontinuities? Explain.
21. Verify Lagrange's Mean Value theorem for the function $f(x) = (|x|^2)$ on [-1,1].
22. If P is a partition of interval $[a, b]$ and f is a bounded function defined on $[a, b]$. Show that $M(b-a) \geq U(P,f) \geq L(P,f) \geq m(b-a)$where $M = supf, m = inf\ f$.
23. Show that a function continuous on $[a, b]$ is Riemann integrable on $[a, b]$.

Maximum Mark = 35

PART C

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

24. Show that the set of rational numbers is not order-complete.
25. State and Prove Cauchy's general principle of convergence.
26. Test the continuity of the function $f(x)$ at $x = 0$ where

$$f(x) = \begin{cases} xsin\left(\frac{1}{x}\right), x \neq 0 \\ 0, x = 0 \end{cases}$$

27. State and prove second fundamental theorem on integral Calculus.

(2 x 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2024

BST5B06 – Sample Surveys

(2022 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A
Each question carries 2marks

1. Define Statistical population and sample. Give examples
2. Explain the different methods of collecting data.
3. Write any four properties of a good questionnaire.
4. What are the disadvantages of Census?
5. Write about Lottery method.
6. Differentiate between Sampling units and frame.
7. Write about Random number table method.
8. How can we estimate population total and what is its variance?
9. Explain the relation between sample size and sampling error with the help of a graph.
10. A simple random sample of size 16 is drawn from a population with 50 members. What is the standard error of sample mean if the population variance is known to be 25 given that the sampling is done with replacement?
11. Give any three advantages of systematic sampling.
12. Write about Proportional allocation in stratified sampling. Write its variance also.
13. Prove that the probability of selecting a specified unit of the population at any given draw is equal to the probability of its being selected at the first draw.
14. What is the difference between one-stage and two-stage cluster sampling with the help of an example.
15. Explain Judgement sampling?

(Maximum Mark = 25)

PART B

Each question carries 5 marks

16. What are non-sampling errors? Explain its sources
17. Distinguish between SRSWOR and SRSWR and compare their efficiencies
18. What you mean by precision of an estimate? Show that mean of a systematic sample is more precise than mean of simple random sample.
19. Show that sample proportion, p is an unbiased estimate of population proportion P.
20. What are sampling errors?
21. Write about circular systematic sampling. Explain it with the help of an example.
22. Compare the efficiencies of the Neyman and proportional allocations.
23. Differentiate between Sampling and Census.

(Maximum Mark = 35)

PART C

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

24. Explain in detail the principal steps in a sample survey.
25. What is Simple Random Sampling? Derive the expression for the variance of sample mean under SRSWOR
26. Derive the mean and variance in case of cluster sampling.
27. (a)Write about Stratified sampling. (b)There are 80 primary schools, 25 secondary schools and 5 colleges in a district. A stratified sample of 20 educational institutions are to be taken, taking each type of educational institution as a stratum. Find the number of primary schools, secondary schools and colleges to be included in the sample if proportional allocation is to be adopted.

(2 x 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2024

BST5B07 – Linear Regression Analysis

(2022 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A
(Each question carries 2 marks)

1. What are the assumptions made in a linear regression?
2. What is a scatter diagram?
3. Prove that the residuals are uncorrelated with the predicted Y_i.
4. Write the confidence interval for the slope and intercept in simple linear regression model.
5. What is the importance of ANOVA in multiple linear regression?
6. What is meant by dependent and independent variables?
7. Write the hypotheses and test statistic for testing the significance of slope coefficient in multiple linear regression model.
8. Discuss R^2 and adjusted R^2.
9. Briefly explain the graph of ideal Normal Probability plot.
10. Write down the expression for studentized residuals.
11. Obtain the expression for R^2 for prediction based on PRESS.
12. What do you mean by plot of residuals against regressor?
13. What is ill-Conditioning II?
14. What is meant by Hierarchy in polynomial regression model?
15. Write a situation where logistic regression is applicable.

Maximum – 25 marks

PART B
(Each question carries 5 marks)

16. Explain the test for significance of regression in a simple linear regression model.
17. Derive the covariance of slope and intercept coefficients in regression analysis.
18. A study on the effect of the molar ratio of sebacic acid (the regressor) on the intrinsic viscosity of copolyesters (the response), following data is obtained

Ratio	1	0.9	0.8	0.7	0.6
viscosity	0.5	0.4	0.3	0.6	0.7

Construct a 95% confidence interval for the slope of the simple regression model.

19. Discuss the properties of least square estimators in multiple linear regression.
20. Obtain an estimate of σ^2 for multiple linear regression model.
21. Explain PRESS residuals.
22. Explain K^{th} order polynomial model in one variable.
23. Explain the logistic regression model with a Binary response variable.

Maximum – 35 marks

PART C
Each question carries 10 marks (Answer any TWO questions)

24. Explain the least square estimates of simple linear regression coefficients and show that they are unbiased.
25. Fit a multiple linear regression model to the following data:

y	10	17	9	16	26
x1	2	3	7	8	6
x2	1	2	3	4	4

26. Explain various residual plots.
27. Describe the interpretation of regression coefficients in logistic regression model.

(2 × 10 = 20 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2024

(Open Course)

BST5D03 – Basic Statistics

(2022 Admission onwards)

Time: 2 hours Max. Marks : 60

Part A
Each question carries 2 marks

1. Define population and sample.
2. Define probability sampling.
3. Distinguish between sampling and non-sampling errors.
4. Write any four desirable properties of a measure of central tendency.
5. Define median and mode.
6. Give formulas of mean deviation and standard deviation of n observations.
7. Briefly explain correlation between two variables.
8. Explain the principle of least squares.
9. Define sample space and events.
10. Describe classical definition of probability with suitable example.
11. State the addition theorem of probability of two events.
12. Give an example for a random experiment.

(Maximum Mark = 20)

Part B
Each question carries 5 marks

13. What are the advantages of sampling over census?
14. State the empirical relationships between mean, median and mode.
15. The mean weight of 25 students is 78.4. It was later found that the weight of one student was misread as 60 instead of 96. Calculate the correct average.
16. Explain the absolute measures of dispersion.
17. Establish the limits of correlation coefficient.
18. Define conditional probability. Explain the multiplication theorem of probability for two events.
19. Explain independence of three events.

(Maximum Mark = 30)

Part C
Each question carries 10 marks (Answer any One question)

20. The runs scored by two batters in 9 innings are given below. Find who is the more consistent.

    A: 62 5 81 97 22 11 16 1 88

    B: 74 101 4 82 36 71 14 0 77

21. Explain different definitions of probability with examples.

(1 x 10 = 10 marks)