

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2021

BST5B05 – Mathematical Methods in Statistics

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks: 80

PART A**Each question carries 2 marks.**

1. Define suprema and infima of a set of real numbers.
2. Define nested intervals.
3. State the completeness property of R .
4. Show that $|a - b| \leq |a| + |b|$, for $a, b \in R$.
5. Find all $x \in R$, that satisfy the equation $|x + 1| + |x - 2| = 7$.
6. Define Cauchy Sequence.
7. Define limit of a function.
8. Give an example for a monotonically increasing sequence.
9. Show that $\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 0$.
10. Give an example of a continuous function which is not differentiable.
11. State Mean Value Theorem.
12. Define removable discontinuity.
13. If f and g are bounded and integrable on $[a, b]$, such that $f \geq g$, then prove that

$$\int_a^b f dx \geq \int_a^b g dx, \text{ when } b \geq a.$$
14. Define Norm of a partition.
15. State second fundamental theorem of integral calculus.

Maximum Marks = 25**PART B****Each question carries 5 marks.**

16. State and prove nested interval property.
17. Prove that there does not exist a rational number r such that $r^2 = 2$
18. Show that every convergent sequence is bounded.
19. Show that $\lim_{n \rightarrow \infty} \frac{1}{n} \left[1 + 2^{\frac{1}{2}} + 3^{\frac{1}{3}} + \dots + n^{\frac{1}{n}} \right] = 1$

20. Examine the validity of the hypothesis and the conclusion of Rolle's Theorem for the following function:

$$f(x) = x^3 - 4x \text{ On } [-2, 2].$$

21. State and Prove Boundedness theorem.
22. Show that x^2 is integrable on any interval $[0, k]$.
23. If f is bounded and integrable on $[a, b]$, then show that $|f|$ is also bounded and integrable on $[a, b]$.

Maximum Marks = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. Show that the function f defined on R by

$$f(x) = \begin{cases} x, & \text{if } x \text{ is rational} \\ 0, & \text{if } x \text{ is irrational} \end{cases}$$

is continuous only at $x = 0$.

25. State and Prove D'Alembert's ratio test.
26. State and Prove Location of roots theorem.
27. Show that the necessary and sufficient condition for the integrability of a bounded function f is that $U(P, f) - L(P, f) < \varepsilon$

(2 x 10 = 20 Marks)

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Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2021

BST5B07 – Linear Regression Analysis

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks: 80

PART A

Each question carries 2 marks.

1. How do you identify the correlation between two random variables using scatterdiagram?
2. Write the hypothesis and the test statistic for testing the significance of the simple linear regression coefficient.
3. Write the degrees of freedom corresponding to the sum of squares due to error and due to regression.
4. How do you interpret coefficient of determination?
5. List the properties of the maximum likelihood estimators of simple linear regression parameters.
6. Write the confidence interval for the multiple linear regression coefficients.
7. Define adjusted R^2 .
8. Write the maximum likelihood estimates of the parameters of a multiple linear regression model.
9. Define standardized residual. Write its mean and variance.
10. Define R-Student.
11. Derive the variance of studentized residual.
12. Define PRESS statistic. Write its significance.
13. Write the cubic spline function with 5 knots.
14. Write the mean and variance of the maximum likelihood estimates of the logistic regression coefficients.
15. Define logit function.

Maximum Mark = 25

PART B

Each question carries 5 marks

16. Derive the confidence interval for the parameters in a simple linear regression model.
17. Discuss the estimation of variance of the response variable in a simple linear regression model.
18. Describe the ANOVA test for testing the significance of multiple linear regression coefficients.
19. Prove that the hat matrix $\mathbf{H} = \mathbf{X}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'$ is symmetric and idempotent.
20. Describe multiple linear regression model. Write the assumptions associated with multiple linear regression.
21. Explain about PRESS residuals. Derive its variance.
22. Explain polynomial regression models and list some of its applied areas.
23. Discuss about piece wise polynomial fitting.

Maximum Mark = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. A Statistics Professor at a College is interested to study the influence of hours spent studying on total marks earned in a course. Data collected on 10 students who took the course are given below. Fit a simple linear regression model for the following data and estimate the mark of a student who has spent 98 hours for studying.

Hours Spent Studying	45	30	90	60	105	65	90	80	55	75
Total Points Earned	40	35	75	65	90	50	90	80	45	65

25. Explain the least square estimation of multiple linear regression coefficients.
26. Discuss the importance of residual plots in model adequacy checking of linear regression models.
27. Describe the logistic regression with binary response variable.

(2 × 10 = 20 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2021

BST5B06 – Sample Surveys

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks: 80

PART A**Each question carries 2marks.**

1. What is sampling frame ?
2. What the term 'population' implies?
3. Explain non probability sampling.
4. Define Systematic sampling.
5. What is census method?
6. Explain primary data.
7. Define Quota Sampling.
8. What is sampling fraction ?
9. Explain non sampling error.
10. Define two stage sampling.
11. Write the unbiased estimator of population total and its variance.
12. Show that the sample mean is an unbiased estimator of population mean if samples are by SRS without replacement.
13. Explain stratified sampling.
14. Is sample proportion, p an unbiased estimate of the population proportion. Explain
15. Explain 'precision of an estimate'?

Maximum Mark = 25**PART B****Each question carries 5 marks**

16. What are the properties of a good questionnaire ?
17. The sample mean- of simple random sampling (SRS) with and without replacement is considered. Which one is more efficient ? Establish the same.
18. Find an unbiased estimate of the population total and hence find its variance in SRSWOR.

19. What are the advantages of sampling over census?
20. What is probability sampling? Explain any three probability sampling methods.
21. Explain the advantages of stratified sampling.
22. Explain precision of an estimate? Show that mean of a systematic sample is more precise than mean of simple random sample.
23. Obtain an unbiased estimator of population mean in systematic sampling and find its variance.

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. Obtain an unbiased estimator for population proportion and find its variance - in SRSWOR of attributes.
26. Show That $V(\bar{y})_{\text{STRAT}} \leq V(\bar{y})_{\text{SYS}} \leq V(\bar{y})_{\text{SRS}}$
27. Find the sample size in each stratum under optimal allocation with fixed sample size.
Also find the variance of the estimate of population mean in two stage cluster sampling.

(2 × 10 = 20 Marks)

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Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2021

(Open Course)

BST5D03 – Basic Statistics

(2019 Admission onwards)

Time: 2 hours

Max. Marks: 60

Section-A

Each question carries two marks

1. Define Census. Write any two of its advantages.
2. Distinguish between sampling and non sampling errors.
3. Define simple random sampling.
4. When the distribution is symmetrical, what is the relation between mean, median and mode ?
5. The measure of deviation of the data from the central tendency is called.....
6. Obtain the mode of 3, 1, 12, 8, 9, 4, 15, 7, 11, 1, 8, 18, 8, 9.
7. Find the arithmetic mean of the numbers 1, 2, 3, ... , n.
8. Define Scatterplot.
9. What is meant by curve fitting ?
10. State the addition theorem of probability for 2 events and 3 events.
11. Define statistical regularity.
12. State the axiomatic definition of probability.

Maximum Marks = 20

Section-B
Each question carries five marks

13. What are the advantages of using sampling over census ?

14. Find the median for the following frequency data.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No.of. students	4	8	11	15	12	6	3

15. Explain the absolute measures of dispersion.

16. Find the Karl Pearson coefficient of correlation for the following data:

X	-3	-2	-1	0	1	2	3
Y	9	4	1	0	1	4	9

17. Explain the principle of least squares for fitting a straight line.

18. What are the limitations of classical definition of probability and frequency definition of probability ?

19. A bag contains 3 red 6 white and 7 blue ball. What is the probability that two balls drawn are white and blue.

Maximum Marks = 30

Section-C
Answer any one question. Each question carries ten marks

20. Find the mean and standard deviation for the following table:

X	1	2	3	4	5	6	7	8	9
F	8	10	11	16	20	25	15	9	6

21. Explain i) conditional probability ii) multiplication theorem of probability and iii) independence of three events.

(1 x 10 = 10 marks)