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1B5N25093 (Pages : 2) Reg. No:.............................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2025

BST5B05 - Mathematical Methods in Statistics

(2022 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A

Each question carries 2 marks.

1. State the completeness property of R.
2. Give an example of a set which is bounded below but not bounded above.
3. State Bernoulli inequality.
4. Define absolute value of a real number.
5. State nested interval property.
6. Show that $\lim\limits_{x\to\infty} \frac{Sin\, x}{x} = 0$.
7. Define limit of a Sequence.
8. Show that the series $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \cdots$is not convergent.
9. State the necessary condition for the convergence of an infinite series.
10. State Mean Value Theorem.
11. What is the relationship between continuity and differentiability of a function?
12. Show that a function which is uniformly continuous on an interval I is continuous on that interval.
13. Define Norm of a partition.
14. Define Upper Sum and Lower sum of a function f corresponding to the partition P.
15. For $f(x) = x,\ x \in [0,3]$ and let $P = \{0,1,2,3\}$ be the partition of $[0,3]$. Find the value of $U(P, f)$?

Maximum Marks = 25

PART B

Each question carries 5 marks.

16. State and prove density theorem
17. Show every bounded sequence of real numbers has a convergent subsequence.
18. Find $\lim_{x\to 0} \frac{x-sinx}{x^3}$
19. State and prove Monotone Convergence Theorem.
20. Examine the validity of the hypothesis and the conclusion of Rolle's Theorem for the following function: $f(x) = x^3 - 4x$ on $[-2,2]$.
21. Evaluate $lim_{x\to 0} \frac{e^{\frac{1}{x}}}{e^{\frac{1}{x}}+1}$
22. State and prove Second fundamental theorem on integral calculus.
23. If f is bounded and integrable on $[a, b]$ and k is a number such that $|f(x)| \leq k$ for all $x \in [a, b]$, then prove that $| \int_a^b f\, dx | \leq k|b - a|$.

Maximum Marks = 35

PART C

Each question carries 10 marks (Answer any TWO Questions)

24. State and prove the principle of Mathematical Induction.
25. A positive term series $\sum \frac{1}{n^p}$ is convergent if and only if $p > 1$.
26. a) Show that a function which is continuous on a closed interval is also uniformly continuous on that interval.

    b)Examine the uniform continuity of the function $f(x) = sinx^2$ on $[0, \infty)$.
27. a) Show that $(3x + 1)$ is integrable on $[1,2]$ and $\int_1^2 (3x + 1)dx = \frac{11}{2}$.

b) Show that if a function f is monotonic on $[a, b]$, then it is integrable on $[a, b]$.

(2 x 10 =20)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2025

BST5B06 - Sample Surveys

(2022 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A

Each question carries 2marks.

1. Why the pre-testing/pilot testing of a questionnaire is important?
2. Define the terms finite population and infinite population.
3. List two types of questions used in a questionnaire.
4. Explain probability sampling.
5. Give two differences between primary and secondary data in terms of cost and purpose.
6. What is census method?
7. Write a short note on Cohort study.
8. What is sampling frame
9. Define circular systematic sampling
10. Explain non-sampling error
11. Define two stage sampling
12. Write the unbiased estimator of population total and its variance in stratified random sampling.
13. Show that the sample mean is an unbiased estimator of population mean if samples are taken by SRS without replacement.
14. Explain stratified sampling.
15. Explain 'precision of an estimate'?

Maximum Marks = 25

PART B

Each question carries 5 marks

16. Explain the merits and de-merits of the sampling method over census method
17. What are the properties of a good questionnaire
18. Test the efficiency of the sample mean- of simple random sampling (SRS) with and without replacement.

19. Find an unbiased estimate of the population total and hence find its variance in SRSWOR
20. Explain non-probability sampling. Mention any three non-probability sampling method.
21. Explain the advantages of stratified sampling over simple random sampling.
22. Define systematic sampling. 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 cluster sampling. Also find its variance.

Maximum Marks = 35

PART C

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

24. Describe in detail the principal steps in a sample survey.
25. Show that $V\left(\bar{y}_{st}\right)_{opt} \leq V\left(\bar{y}_{st}\right)_{prop} \leq V\left(\bar{y}\right)_{SRS}$ (Here opt: optimal, prop: proportional, srs: simple random sampling)
26. Show that $var\left(y'_{sys}\right) = \frac{N-1}{Nn}(1+(n-1)\rho)S^2$ where ρ is the intra class correlation between the units of the same systematic sample.
27. Define cluster sampling and equal cluster sampling. Derive mean and variance of equal cluster sampling.

2 × 10 = 20 Marks

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2025

BST5B07 - Linear Regression Analysis

(2022 Admission onwards)

Time: 2 ½ hours Max. Marks : 80

PART A

Each question carries 2 marks.

1. Define regressor and response.
2. State the assumptions of the simple linear regression model.
3. Write the formula for the least square estimate of slope coefficient.
4. Define coefficient of determination.
5. What is PRESS statistic?
6. List any two residual plots used in model adequacy checking.
7. What are standardized residuals?
8. Write the null and alternative hypothesis for testing overall regression in multiple linear regression.
9. Explain the role of error term in a regression model.
10. Define R-student.
11. Write one application of polynomial regression.
12. Define logit function
13. How do you interpret the regression coefficient of a binary logistic regression model when the linear predictor has only one predictor?
14. Define piecewise polynomial.
15. Define residuals. Mention one significance of using scaled residuals.

(Maximum Mark = 25)

PART B

Each question carries 5 marks

16. Derive the least square estimate of the intercept in a simple linear regression model.
17. The data on rainfall (in cm) and crop yield (in quintals) for 8 seasons are given below:

Rainfall	12	8	15	10	18	20	16	22
Yield	30	24	36	28	40	45	38	50

Fit a simple linear regression model with crop yield as the response variable and rainfall as the regressor, and interpret the slope.

18. Explain the use of ANOVA in multiple linear regression.
19. Describe the method of maximum likelihood estimation for regression parameters.
20. Explain the difference between R^2 and adjusted R^2.
21. Define and explain polynomial regression model in two variables.
22. Discuss the assumptions of logistic regression.
23. Explain studentized residuals in linear regression analysis. Also explain the difference between studentized residuals and PRESS residuals.

(Maximum Mark = 35)

PART C

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

24. Derive the least square estimators of regression coefficients in multiple linear regression and state their properties.
25. Explain model adequacy checking with suitable residual plots.
26. *a*) Consider the simple linear regression model $y = \beta_0 + \beta_1 x + \varepsilon$. Under the usual assumptions of regression, derive (*i*) $\mathrm{Cov}(\hat{\beta}_0, \hat{\beta}_1)$ and (*ii*) $\mathrm{Cov}(\bar{y}, \hat{\beta}_1)$.

    b) Explain the *t* test for testing the significance of regression coefficients in a simple linear regression.
27. Discuss the estimation and interpretation of parameters in logistic regression model.

(2 × 10 = 20 Marks)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Statistics Degree Examination, November 2025

(Open Course)

BST5D03 - Basic Statistics

(2022 Admission onwards)

Time: 2 hours Max. Marks : 60

(Use of Calculator is permitted)

Part A

Each question carries 2 marks

1. Define census and sample survey.
2. What is probability sampling.
3. Distinguish between sampling and non-sampling errors.
4. Name any four measures of central tendency.
5. Define geometric mean and harmonic mean.
6. Give formulas of mean deviation and quartile deviation of n observations.
7. Briefly explain scatter plot of a bivariate data.
8. Explain the principle of least squares.
9. Define sample space and sample points.
10. Describe frequency 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 and disadvantages of sampling?
14. Establish the relationship between Arithmetic mean, Geometric mean and Harmonic mean if all observations are not equal.
15. The mean weight of 25 students is 68.4. It was later found that the weight of one student was misread as 60 instead of 90. Calculate the correct average.
16. Explain the absolute measures of dispersion.
17. Prove that correlation coefficient lies between -1 and +1.
18. State and prove addition theorem of probability of two events.
19. Explain pairwise 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 more consistent.

    A: 22 5 81 97 62 1 16 11 88

    B: 74 36 4 82 14 71 101 0 77

21. Explain different definitions of probability with examples.

(1 X 10 = 10)