

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2024
(Fourth Semester)

Branch – STATISTICS

STATISTICAL INFERENCE - I

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (5 x 1 = 5)

- 1 The process of making inferences about the population based on sample data is known as
(i) Descriptive statistics (ii) Inferential statistics
(iii) Population statistics (iv) Sample statistics
- 2 When an estimator has a smaller variance than any other estimator of same parameter, it is known as _____.
(i) Efficient Estimator (ii) Sufficient Estimator
(iii) Unbiased (iv) Consistent Estimator
- 3 The Maximum Likelihood estimate is not always
(i) Efficient (ii) Unbiased
(iii) Sufficient (iv) Consistent
- 4 A 95% confidence interval for the mean of the population is such that
(i) It contains 95% of the values in the population
(ii) There is a 95% chance that it contains all the values in the population
(iii) There is a 95% chance that it contains mean of the population
(iv) There is a 95% chance that it contains SD of the population
- 5 Chi-square goodness of fit is a
(i) parametric test (ii) large sample test
(iii) non-parametric test (iv) sequential test

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 3 = 15)

- 6 a Describe T^2 is a biased estimator for θ^2 , if T is an unbiased estimator for θ .
OR
b Examine the invariance property of the consistent estimator.
- 7 a Let $x_1, x_2, \dots, x_n$ be a random sample from a uniform population on $[0, \theta]$. Find a sufficient estimator for θ .
OR
b Let $x_1, x_2, \dots, x_n$ be a random sample from $N(\mu, \sigma^2)$ population. Find sufficient estimators for μ and σ^2 .
- 8 a Compute the moment estimator of Exponential distribution.
OR
b Let $x_1, x_2, \dots, x_n$ denote random sample of size n from a uniform population with pdf: $f(x, \theta) = 1; \theta - \frac{1}{2} \leq x \leq \theta + \frac{1}{2}, -\infty < \theta < \infty$. Compute the MLE for θ .

Cont...

- 9 a Test the Confidence interval for the mean of the normal population.
OR
b Test for the confidence interval for the variance of the normal population.
- 10 a Explain the median test.
OR
b Write a short note on the chi-square test of goodness of fit of a random sample to a hypothetical distribution.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a If $x_1, x_2, \dots, x_n$ are random observations on a Bernoulli variate X taking value 1 with probability p and the value 0 with probability $1 - p$, show that $\frac{\sum x_i}{n} \left(1 - \frac{\sum x_i}{n}\right)$ is a consistent estimator of $p(1 - p)$.
OR
b State and prove Cramer-Rao inequality.
- 12 a A random sample $(x_1, x_2, x_3, x_4, x_5)$ of size 5 is drawn from a normal population with an unknown mean μ . Consider the following estimators to estimate μ : (i) $t_1 = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5}$ (ii) $t_2 = \frac{x_1 + x_2}{2} + x_3$ (iii) $t_3 = \frac{2x_1 + x_2 + \lambda x_3}{3}$ Where λ is such that t_3 is an unbiased estimator of μ . Find λ . Are t_1 and t_2 unbiased? State giving reason, the estimator which is best among t_1, t_2 and t_3 .
OR
b Summarize the state and proof of Rao Blackwell theorem.
- 13 a Write the concept of the Maximum Likelihood estimator and its properties..
OR
b In random sampling from normal population $N(\mu, \sigma^2)$, find the MLE for (a) μ when σ^2 is known (b) σ^2 when μ is known.
- 14 a Test for the confidence interval for the difference of means of the normal population.
OR
b Test for the confidence interval for the ratio of variance.
- 15 a Describe the Mann-Whitney-Wilcoxon U-test.
OR
b The following figures show the distribution of digits in numbers chosen at random from a telephone directory.

Digits	0	1	2	3	4	5	6	7	8	9	Total
Frequency	1026	1107	997	966	1075	933	1107	972	964	853	10000

Test whether the digits may be taken to occur equally frequently in the directory.

z-z-z

END