LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

FOURTH SEMESTER – **APRIL 2023**

18/17/16UST4AL01 – MATHEMATICAL STATISTICS

Date: 04-05-2023   Dept. No.   Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

SECTION - A

Answer all the questions.   (10 X 2 = 20)

1. Define unbiased estimator.
2. Write any two properties of ML estimators.
3. Define confidence interval
4. Define Efficient Estimator.
5. Write short notes on simple and composite hypotheses.
6. Define two-tailed tests.
7. What are the applications of t-distribution in tests of significance?
8. Give the test statistic for testing the difference between two population variances.
9. State the principles of least squares.
10. When we can use sampling methods?

SECTION- B

Answer any five questions.   (5 X 8 = 40)

11. a) Show that the sample mean is an unbiased estimator of the population mean.
    b) Define sufficiency and state Factorization Theorem

12. Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on The basis of a sample of size 'n'

13. State and prove Rao-Blackwell theorem.

14. Find $100(1- \alpha)$ % confidence intervals for the parameter μ when σ^2 is unknown in the normal distribution.

15. Describe the steps involved in the testing of statistical hypothesis.

16. Let p be the probability that a coin will fall head in a single toss in order to test H_0:

    $p = \frac{1}{2}$ against H_1: $p = \frac{3}{4}$ the coin is tossed 5 times and H_0 is rejected if more than 3 heads

    are obtained. Find the probability of type I Error and power of the test.

17. Below are given the gain in weights (in kgs) of pigs fed on two diets A and B

Diet A	25	32	30	34	24	14	32	24	30	31	35	25		
Diet B	44	34	22	10	47	31	40	30	32	35	18	21	35	29	22

    Test if the two diets differ significantly regarding their effect on weight increase.

18. Explain in detail various Sampling Methods.

SECTION- C

Answer any two questions.   (2 X 20 = 40)

19. i) Describe the procedure of Maximum Likelihood Estimation.   (10)

  ii) In random sampling from normal population N (μ, σ^2) , find the maximum likelihood
      estimators (MLE) for i) μ when σ^2 is known ii) σ^2 is unknown   (10)

20. i)   State and prove Cramer-Rao Inequality   (10)

  ii) Obtain the Most powerful test for testing H: $\mu = \mu_0$ against K: $\mu = \mu_1$ using a
      random sample of n observations from N(μ, σ^2),σ^2 is known at level α.   (10)

21. i) State and prove Neyman – Pearson Lemma.   (12)

  ii) The table below shows the data obtained during small pox outbreak.

	Attacked	Not Attacked
Vaccinated	31	469
Not Vaccinated	185	1315

   Test the effectiveness of vaccination in preventing the attack from smallpox. Test at 5
   % Level of significance.   (8)

22. A test was given to 5 students taken at random from the 5th class of 3 schools in 9 towns.
   The individual scores are

		Scores				
		A	B	C	D	E
Schools	School I	9	7	6	5	8
	School II	7	4	5	4	5
	School III	6	5	6	7	6

 Carry out the analysis of variance and draw the conclusion.

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