E 6649 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2019

Fourth Semester

Complementary Course—STATISTICAL INFERENCE

[Common for B.Sc. Mathematics, Physics and B.Sc. Computer Applications]

(2013—2016 Admissions)

Time : Three Hours Maximum Marks : 80

Part A (Short Answer Questions)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. What is an estimator ?
2. Define the term sufficiency.
3. Given an example of a consistent estimator which is not unbiased.
4. Write a note on minimum variance method of estimation.
5. Write the expression for 95% confidence interval for the variance of a normal distribution.
6. Define simple and composite hypothesis.
7. What is power of test ?
8. Define critical region.
9. What are the assumptions of F test ?
10. Give two uses of X^2 test.

$(10 \times 1 = 10)$

Part B (Brief Answer Questions)

Answer any **eight** *questions.*
Each question carries 2 *marks.*

11. If $X \to P(\lambda)$ Find an unbiased estimator of $e^{-\lambda}$.
12. Explain the concept of confidence interval.
13. State Fisher Neymann factorization for theorem.

Turn over

14. What are the regularity conditions for Crammer Rao inequality ?

15. Construct the 98% confidence interval for the proportion of success of population.

16. Explain the procedure for testing a statistical hypothesis.

17. Define Null and Alternative hypothesis.

18. Define (i) Type I error (ii) Type II error.

19. What is the Neymann Pearson approach to testing a statistical hypothesis.

20. What is a test statistic ?

21. In what way ANOVA is different from t-test ?

22. What is a contingency table ?

$(8 \times 2 = 16)$

Part C (Descriptive/Short Essay Type Questions)

Answer any **six** *questions.*
Each question carries 4 *marks.*

23. If T is an unbiased estimator of θ, show that T^2 and $\sqrt{T}$ are biased estimators of θ^2 and $\sqrt{\theta}$ respectively.

24. X_1, X_2, X_3 are three independent observations from a population with mean μ and variance σ^2. If $t_1 = x_1 + x_2 - x_3$ and $t_2 = 2x_1 + 3x_2 - 4x_3$ are two estimators of μ. Compare their efficiencies.

25. Find the MLE of Poisson parameters of Poisson distribution.

26. For the rectangular distribution over and interval $(a, b), a < b$, find the MLE of a and b.

27. Two random samples of sizes 10 and 12 from normal populations having the same variance gave $\bar{x}_1 = 20, s_1^2 = 25, \bar{x}_2 = 24, s_2^2 = 36$. Find 90% confidence limits for $\mu_1 - \mu_2$.

28. The hypothesis $H_0 : \theta = 2$ is accepted against $H_1 : \theta = 5$ if $x \leq 3$, when x has an exponential distribution with mean θ. Find the size of the test and power of the test.

29. A sample of 900 members is found to have a mean of 3.4 cm and standard deviation 2.61. Could it be reasonably regarded as a sample from a large population whose mean is 3.25 cm.

30. Theory predicts that the proportion of beans in the four groups A,B,C and D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans the numbers in the 4 groups were 882, 313, 287 and 118. Does the experimental result support the theory.

31. To test the efficiency of sleeping pills, a drug company uses a sample of insomniacs. The time in minutes until falling asleep is observed for each of them. Few days later, the same persons are given a sleeping pill and the time until falling asleep is measured again. The measurements are given below :

Persons	A	B	C	D	E
No pill (x_i)	65	35	80	40	50
With pill (y_i)	45	15	61	31	20

Test whether the sleeping pills are effective

(6 × 4 = 24)

Part D (Long Essays)

Answer any **two** *questions.*
Each question carries 15 *marks.*

32. Obtain the best critical region for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu > \mu_0$ in $N(\mu, \sigma^2)$ using a random sample of size n. Also find the power function.

33. Distinguish between size and power of a test. A continuous random variable $X \sim U(0, \theta)$. It is desired to test the hypothesis $H_0 : \theta = 1$ against $H_1 : \theta = 2$, using a single observation x. The CR is taken as $X \leq 0.85$. Evaluate the size and power of the test.

34. Test whether the two samples come from populations having the same variance citing the assumptions involved :

Sample A	:	17	27	18	25	27	29	27	23	17
Sample B	:	16	16	20	16	20	17	15	21	

35. The following figures relate to production in kilogram of three varieties A, B and C of wheat. Shown in 12 plots :

A	14	16	18		
B	14	13	15	22	
C	18	16	16	19	20

Using ANOVA, test whether there is any significant difference in the production of three varieties.

(2 × 15 = 30)