E 6127 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017

Fourth Semester

Complementary Course—Statistics—STATISTICAL INFERENCE

(Common for B.Sc. Mathematics, Physics and B.Sc. Computer Applications)

[2013 Admission onwards]

Time : Three Hours Maximum : 80 Marks

Part A (Short Answer Questions)

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

1. What do you mean by point estimation ?
2. What is meant by confidence interval ?
3. Define null hypothesis.
4. Define critical region.
5. Define consistency of estimators.
6. Give a situation where moment estimator coincides with maximum likelihood estimator.
7. What is meant by a likelihood function ?
8. Give the test statistic for testing independence in a 2×2 contingency table.
9. Give an example of an estimator which is unbiased and not consistent for a parameter.
10. Define Type II error.

$(10 \times 1 = 10)$

Part B

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

11. A random sample (X_1, X_2, X_3) is drawn from $N(\mu, \sigma^2)$. Let $t = \frac{2X_1 + X_2 + \lambda X_3}{3}$ be unbiased for μ. Obtain the value of λ.
12. State a set of sufficient conditions for the consistency of an estimator.
13. Explain the method of minimum variance.
14. Given $n = 10$, $S^2 = 5$, obtain 95 % C.I. for σ^2 of $N(\mu, \sigma^2)$.

Turn over

15. Let (X_1, X_2, X_3) be a random sample from a population with mean μ and σ^2. Let T_1 and T_2 be the estimators used to estimate μ where $T_1 = \frac{X_1 + X_2 + X_3}{3}$ and $T_2 = \frac{X_1 + 2X_2 + 3X_3}{6}$. Find which estimator is more efficient.
16. State the assumptions involved in a *t*-test.
17. What is meant by one-way classification ?
18. State Neyman-Pearson lemma.
19. Estimate the parameter *p* of the geometric distribution by the method of moments.
20. What is the test statistic for testing the equality of two population means in two large samples with unequal variances ?
21. Write down the Chi-square statistic for testing independence in a 2×2 contingency table.
22. What is meant by Yate's correction ?

$(8 \times 2 = 16)$

Part C

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

23. Let $(X_1, X_2, \ldots X_{n_1})$ and $(Y_1, Y_2, \ldots Y_{n_2})$ be random samples obtained from two normal populations $N(\mu_1, \sigma_1^2)$ and $N(\mu_2, \sigma_2^2)$. Explain how you will test $H_0 : \sigma_1^2 = \sigma_2^2$ against $H_1 : \sigma_1^2 > \sigma_2^2$.
24. Find the M.L.E. of $N(\mu, \sigma^2)$ where σ^2 is known.
25. Explain the method of minimum variance.
26. Show that in random sampling from $f(x, \theta) = \frac{1}{\theta} e^{x/\theta}, 0 < x < \infty$, and 0 otherwise, the sample mean is M.V.U.E. for θ with variance $= \theta^2/n$.
27. State Cramer-Rao inequality and mention its uses.
28. If $X \geq 2$ in the C.R. for testing $H_0 : \theta = 2$ against $H_1 : \theta = 1$, on the basis of a single observation from a population with pdf $f(x, \theta) = \theta e^{-\theta x}, 0 < x < \infty$, obtain the level of significance and power of the test.
29. Define sufficiency of estimators. Given an example of an estimator which is (i) consistent and sufficient ; (ii) consistent but not sufficient.
30. The following are two sets of observations from two normal populations. Test the equalty of their means :

X :	15	16	18	20	22	
Y :	24	10	16	17	18	19

31. Explain a paired '*t*' test.

$(6 \times 4 = 24)$

Part D

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

32. (a) Explain Chi-square test of goodness of fit.

(b) Derive a most powerful test for testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$ based on a random sample from Poisson distribution with mean λ.

33. (a) Given a random sample of size n from $f(x, \theta) = e^{-(x-\theta)}$, $x > \theta, \theta \in R$. Obtain MLE of θ.

(b) Give an example of a MLE which is biased. Justify.

34. (a) The following are the diameters in m.m. of 10 tubes. Test whether the mean diameter is 2.1 mm:

2,12, 2.13, 2.00, 2.09, 2.08, 2.10, 2.07, 2.11, 2.12, 2.08.

(b) The following table was obtained from an experiment to see whether an advanced training programme is effective or not :

	No. of candidates who took the course	Do not take
Score below 50	16	18
Between 50–70	14	10
Above 70	23	16

Test whether the training programme is effective in improving the score.

35. (a) Explain how you test the significance of an observed corrrelation coefficient ? Is a correlation coefficient 0.45 observed in a sample of 58 observations significant.

(b) Explain how you carry out the test of equality of two correlation coefficients.

$(2 \times 15 = 30)$