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Reg. No.....805.....

Name.....Kalyan P.S.....

**B.C.A. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2017**

**Third Semester**

Complementary Course—ADVANCED STATISTICAL METHODS

(For the Programme B.C.A.)

[2013 Admission onwards]

Time : Three Hours

Maximum Marks : 80

**Part A (Short Answer Questions)**

*Answer all questions.*

*Each question carries 1 mark.*

1. Define a binomial distribution.
2. If  $X \sim B\left(8, \frac{1}{8}\right)$ , find  $P(X = 0)$  and  $P(X = 8)$ .
3. Give the formula for moment generating function of a Poisson random variable.
4. Define standard error.
5. Define a student 't' random variable.
6. State the sampling distribution of sample variance of a sample of size 'n' taken from a normal population.
7. How do you compare two estimators based on their efficiency ?
8. Give the formula for  $(1 - \alpha)$  100 % confidence interval for a population proportion.
9. Define Type I error.
10. Define 'p' value of a test statistic.

(10 × 1 = 10)

**Part B (Brief Answer Questions)**

*Answer any eight questions.*

*Each question carries 2 marks.*

11. Obtain the sampling distribution of the mean of samples from a population.
12. State and prove the additive property of Chi-square.
13. Show that if  $X \sim F_{(n_1, n_2)}$ ,  $\frac{1}{X} \sim F_{(n_2, n_1)}$ .
14. State any two properties of maximum likelihood estimators.
15. Distinguish between simple and composite hypothesis.

**Turn over**



- ✓ 16. What do you mean by most powerful test? How do you obtain such a test?
17. The mean weight of a sample of 100 students is 50 kg. with S.D. = 3 kg. Is it reasonable to accept the claim that the mean weight of all students is 51 kgs.
18. Write down the statistic and its sampling distribution in the case of a paired 't' test.
- ✓ 19. Obtain a sufficient estimator of 'p' in B (n, p).
- ✓ 20. Obtain the moment estimator of  $\theta$  in  $f(x, \theta) = \theta e^{-\theta x}$ .
- ✓ 21. What are the MLE's of  $a$  and  $b$  in  $f(x, \theta) = \frac{1}{b-a}$ ,  $a < x < b$ .
22. Give two applications of Chi-square distribution.

(8 × 2 = 16)

### Part C (Descriptive or Short Essays)

*Answer any six questions.*

*Each question carries 4 marks.*

- ✓ 23. How does a binomial distribution arise in practice?
24. Derive the recurrence relation connecting central moments of a Poisson distribution.
25. Derive the mode of Poisson distribution.
26. X is a normal variate with mean 20 and S.D. 5. Find the probability that (i)  $15 \leq X \leq 28$ ; (ii)  $X \geq 25$ ; (iii)  $|X - 20| > 7$ .
27. Write down the inter-relations among standard normal, Chi-square, 't' and F distributions.
28. In a sample of 20 persons from a town it was seen that 4 are suffering from T.B. Find a 95 % confidence interval for the preparation of T.B. patients in the town.
29. Obtain the most powerful test to test  $H_0: \theta = \theta_0$  against  $H_1: \theta = \theta_1$  where  $\theta$  is the parameters of the distribution.
- ✓ 30. Explain paired 't' test with an example.
31. Explain Chi-square test of goodness of fit.

(6 × 4 = 24)

### Part D (Essays)

*Answer any two questions.*

*Each question carries 15 marks.*

32. Explain the large sample test of equality of means of two populations, clearly mentioning the critical regimes.
33. Derive  $(1 - \alpha)$  100 % confidence interval for the difference of two population proportions.
34. Define sufficiency of estimators. Obtain sufficient estimators of  $\mu$  and  $\sigma^2$  in  $N(\mu, \sigma^2)$ .
35. Explain (a) the method of maximum likelihood and (b) the method of moments.

(2 × 15 = 30)