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 θ in $f(x, \theta) = \theta e^{-\theta x}$.

21. What are the MLE's of a and b in $f(x, \theta) = \dfrac{1}{b-a}, a < x < b$.

22. Give two applications of Chi-square distribution.

$(8 \times 2 = 16)$

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 θ is the parameters of the distribution.

30. Explain paired 't' test with an example.

31. Explain Chi-square test of goodness of fit.

$(6 \times 4 = 24)$

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 μ and σ^2 in $N(\mu, \sigma^2)$.

35. Explain (a) the method of maximum likelihood and (b) the method of moments.

$(2 \times 15 = 30)$