TB254708D

Reg. No :..............................

Name :..................................

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2018, 2019, 2020, 2021, 2022 ADMISSIONS SUPPLEMENTARY

SEMESTER IV - COMPLEMENTARY COURSE (FOR MATHS & PHYSICS)

ST4C01B18 - Statistical Inference

Time : 3 Hours **Maximum Marks : 80**

Part A

I. Answer any Ten questions. Each question carries 2 marks **(10x2=20)**

1. Distinguish between parameter and statistic
2. Define t statistics. Give an example.
3. State Cramer Rao inequality.
4. Based on a set of sample values 1, 5, 3, 4, 7 obtain a moment estimate of the parameter of Poisson distribution.
5. Compare the efficiency of $T_1 = (x_1+x_2+x_3+x_4)/4$ and $T_2 = (x_1+x_2+x_3+x_4+x_5)/5$ in estimating the parameter of a Poisson distribution.
6. Explain efficiency of an estimate.
7. Explain the two types of errors in testing of hypothesis.
8. What is meant by the best critical region in testing of hypothesis?
9. Define simple and composite hypothesis with one example each.
10. What is the reason for keeping the significance level at a lower level in testing of hypotheses?
11. Explain the procedure for testing equality of proportions of two populations.
12. Write down the criteria for calculating degrees of freedom in goodness of fit.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. A random sample of size 12 is taken from a normal population $N(\mu, 3)$. Find the probability that variance of the sample lies between 3.4 and 14.8
14. Find the mean and variance of chi square distribution.
15. Obtain the Cramer- Rao lower bound for the variance of any unbiased estimator of μ in $N(\mu,\sigma)$.
16. Examine whether there exists a Minimum Variance Unbiased Estimator for the Poisson parameter λ.
17. Examine whether sample variance is an unbiased estimate of the population variance for a normal population. If not suggest an unbiased estimate for the population variance.
18. If $x \geq 1$ is the critical region for testing $\theta = 2$ against $\theta = 1$ on the basis of a single observation from a population with p.d.f. $f(x) = \theta e^{-\theta x}$, $0 \leq x < \infty$. Obtain type I and type II errors.
19. Obtain the most powerful test for testing $H_0: \theta = 1/4$ against $H_1: \theta = 1/2$ based on a sample of size 2 say x_1 and x_2, if the p.d.f. in the population is $f(x) = \theta(1-\theta)^x$; $x = 1, 2, 3, ..$
20. A sample of 600 persons in normal area had 28 persons suffering from TB where in a sample of 400 persons in slum area, 96 persons had TB. Do the data support the argument that TB in slum area is more than that of normal area?
21. Explain paired t – test.

Part C

III. Answer any Two questions. Each question carries 15 marks **(2x15=30)**

22. Derive the distribution of t = $\frac{\bar{x}_1-\bar{x}_2-(\mu_1-\mu_2)}{\sqrt{\frac{n_1s_1^2+n_2s_2^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$, where $\bar{x}_1$ and $\bar{x}_2$ are the means, s_1^2 and s_2^2 are the variances of random samples of sizes n_1 and n_2 from two Normal populations with the same but unknown variance σ^2.

23. (a) Explain the method of constructing the confidence interval for the standard deviation of a normal population. (b) If 1.5, 2.3, 1.4, 3.6, 2.5 are the observed values of a random sample of size5 from a normal population N(2, σ) construct 90% confidence interval for σ2.

24. Obtain the best critical region for the population f(x,θ) =θ e-θx , x ≥ 0 of size ∝ for testing H_0: $\theta=\theta_0$ against H_1 : $\theta = \theta_1$

25. (a) Derive the expression of χ^2 -test of independence in a 2×2 contingency table. (b) From the following data test whether the colour of the son's eye is associated with that of the father.

Father's eye colour	Son's eye colour	
	Light	Not light
Light	471	151
Not light	414	230