21U332S (Pages: 2) Name: ……………………….

Reg. No: …………………….

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(CUCBCSS-UG)

CC15U ST3 C03 - STATISTICAL INFERENCE

(Statistics-Complementary Course)

(2015 to 2018 Admissions – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

Section A

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

1. Distribution of a statistic is known as ....
2. Mean of a chi-square random variable with n degrees of freedom is ....
3. If a random variable X follows t distribution with 'n' degrees of freedom, then the distribution of X^2 is ....
4. …… is an example for consistent estimator, but not unbiased.
5. The test for independence of attributes is based upon .... distribution
6. If T_n is a consistent estimator of θ, then as 'n' tends to infinity $V(T_n)$ tends to ....
7. If $t \sim t_{(n)}$, the all odd central moment of t distribution is ....
8. Critical region is the region of ....
9. Type II error is Reject H_0 when ....
10. The test $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0$ for large sample is based on .... distribution.

(10 × 1 = 10 Marks)

Section B

Answer ***all*** questions. Each question carries 2 marks.

11. Define standard error.
12. Define unbiasedness.
13. Define likelihood function.
14. Explain point estimation.
15. What are the properties of MLE?
16. Define power of a test.
17. What is the test statistic used for the test $H_0: \sigma = \sigma_0$ against $H_1: \sigma > \sigma_0$?

(7 × 2 = 14 Marks)

Section C

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

18. State and prove the reproductive property of Chi-square distribution.
19. Explain the properties of students' t-distribution.

20. Show that sample mean is an unbiased estimate of the population mean.
21. Explain the method of constructing 95% confidence interval for the population mean, when the samples are taken from a normal population with known standard deviation.
22. If $X \geq 1$ is the critical region for testing $\theta = 2$ against the alternative $\theta = 1$ on the basis of a single observation from the population with p.d.f $f(x) = \theta e^{-\theta x}, 0 < x < \infty$. Obtain probability of type II error.

($3 \times 4 = 12$ Marks)

Section D

Answer any ***four*** questions. Each question carries 6 marks.

23. Define F-distribution. If F follows $F(n_1, n_2)$, find the distribution of $\frac{1}{F}$.
24. Derive the mode of chi-square distribution.
25. X_1, X_2, X_3 are three independent observations taken from a population with mean μ and variance σ^2. If $t_1 = X_1 + X_2 - X_3$ and $t_2 = 2X_1 + 3X_2 - 4X_3$. Compare the efficiencies of t_1 and t_2.
26. A random sample of 1000 workers from factory A shows that the mean wages were Rs 47 per week with a standard deviation of Rs 23. Another random sample of 1500 workers from factory B gives a mean wage of Rs 49 per week with a standard deviation of Rs 30. Is there any significant difference between their mean level of wages?
27. Explain paired *t* test.
28. Explain chi-square test for independence of attributes.

($4 \times 6 = 24$ Marks)

Section E

Answer any ***two*** questions. Each question carries 10 marks.

29. Derive the distribution of chi-square statistic.
30. Find the M.L.E of p for a binomial population with p.d.f $f(x) = (NC_x)p^x(1-p)^{N-x}$ where N is known.
31. (a) State and prove the necessary conditions for a consistent estimator.
    (b) Prove that sample mean is an unbiased and consistent estimator of population mean while sample variance is a biased but consistent estimator of population variance, when samples taken from a normal population.
32. (i) Explain the Chi square test for goodness of fit.
    (ii) Samples of sizes 10 and 18 taken from two normal populations gave $s_1 = 14, s_2 = 20$. Test the hypothesis that the samples have come from populations with the same variance.

($2 \times 10 = 20$ Marks)

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