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D4BST2101 (Pages 2)

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

FOURTH SEMESTER UG DEGREE EXAMINATION, APRIL 2023

(Regular / Improvement / Supplementary)

STATISTICS: Complementary Course for Mathematics and C.S

GSTA4C04T: STATISTICAL INFERENCE AND QUALITY CONTROL

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries 2 marks. (Ceiling 20 Marks)

1. Define sufficiency of an estimator.
2. Give the likelihood function corresponding to a random sample of size n from $P(\lambda)$.
3. Suppose X follows an exponential distribution with mean $\frac{1}{\theta}$. Obtain the moment estimator for θ.
4. Give the confidence interval for the mean of a normal population when σ is unknown and n is large.
5. Distinguish between critical region and acceptance region.
6. Define small sample tests. Name any two small sample tests.
7. What is meant by mean sum of squares?
8. Which are the various sum of squares in one way ANOVA? Give their corresponding degrees of freedom.
9. What is meant by Yate's correction?
10. Give the test statistic for χ^2 test for independence of attributes applying Yate's correction.
11. Define non-parametric test.
12. Write down the control limits for $\bar{X}$ chart.

SECTION B: Answer the following questions. Each carries 5 marks. (Ceiling 30 Marks)

13. Obtain the sufficient statistic for θ if $X_1, X_2, \ldots, X_n$ is a random sample from a distribution with probability density function $f(x,\theta) = \begin{cases} \frac{1}{\theta}x^{\frac{1-\theta}{\theta}} & ; \ 0 \le \theta \le 1 \\ 0 & ; \ \text{otherwise} \end{cases}$.
14. Estimate λ by the method of maximum likelihood for a $P(\lambda)$ distribution.

(PTO)

15. Let $X_1, X_2, \ldots, X_n$ be a random sample of size 9 from $N(\mu, \sigma^2)$. Obtain the 97% C.I. for μ if $\bar{X} = 3.2$ and $\sigma^2 = 2$.

16. Given a binomial distribution, it is desired to test $H_0 : p = \frac{1}{2}$ against $H_1 : p = \frac{1}{3}$ by agreeing to accept the null if the number of success in 4 trials is less than or equal to 2 and reject otherwise. Find power and β.

17. The random samples of sizes 8 and 11 drawn from two normal populations are characterized as follows.

Sample size	Sum of obs.	Sum of squares of obs.
8	9.6	61.52
11	16.5	73.26

Examine whether the two samples came from populations having the same variance.

18. For a given set of data the observed and expected frequencies are as shown below.
Observed frequencies 30 31 42 40 57
Expected frequencies 38 45 36 36 45
Test at 1% level of significance that there is no significant difference between them.

19. Define c chart. Explain the procedure for its construction.

SECTION C: Answer any 1 question. Each carries 10 marks.

20. A random sample of 400 teaching departments, students of the university it was found that 300 students failed in the examination. In another random sample of 500 students of the affiliated colleges the number of failures in the same examination was found to be 300. Find out whether the proportion of failures in the university teaching department is significantly greater than that of the proportion of failures in the two samples combined. $\alpha = 0.05$.

21. The following are the values of mean $\bar{X}$ and range R for 20 subgroups of 5 readings each taken from an inspection.

$\bar{X}$:	1.85	1.81	1.75	1.76	1.83	1.76	1.71	1.80	1.77	1.79
R:	0.28	0.14	0.23	0.35	0.26	0.25	0.21	0.08	0.19	0.39
$\bar{X}$:	1.82	1.68	1.69	1.81	1.78	1.57	1.72	1.74	1.55	1.57
R:	0.36	0.10	0.23	0.29	0.22	0.05	0.23	0.23	0.32	0.47

Draw the $\bar{X}$ and R charts. ($A_2 = 0.577$, $D_3 = 0$, $D_4 = 2.155$)

(1 x 10 = 10 Marks)