TM253154Q

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, OCTOBER 2025

2024 ADMISSIONS REGULAR

SEMESTER III - CORE COURSE Applied Statistics and Data Analytics

ST3C11TM - Testing of Hypotheses

Time : 3 Hours

Maximum Weight : 30

Part A

I. Answer any Eight questions. Each question carries 1 weight (8x1=8)

1. Distinguish between randomized and non-randomized test. Give example.
2. Define Power function and power curve.
3. Explain simple and composite hypothesis with suitable examples.
4. Distinguish between UMP and LMP test.
5. State Neyman structure test. Prove that every Neyman structure test of level α leads to a similar region test of size α.
6. Define stopping boundaries in SPRT.
7. Outline the constraints and drawbacks associated with the Sequential Probability Ratio Test (SPRT).
8. How does violating the assumptions of parametric tests impact their accuracy?
9. When would you choose the Wilcoxon rank-sum test (Mann-Whitney U test) instead of the Kruskal-Wallis test?
10. Describe the Friedman test. When is it appropriate to use this test instead of repeated measures ANOVA for non-parametric data?

Part B

II. Answer any Six questions. Each question carries 2 weight (6x2=12)

11. If X follows hypergeometric distribution, with pdf, , Find a UMP size α test to test against $H_1 : M > M_0$.
12. Check whether the binomial distribution possesses MLR property.
13. (a) Write a short note on Multiparameter exponential family.
    (b) Give the UMPU test for testing or against for multiparameter exponential family.
14. Consider the problem of testing $H_0 : \sigma^2 \geq \sigma_0^2$ against using a random sample of n observations from $N(\mu, \sigma^2)$, μ is unknown. Find the UMAU confidence set at level $1 - \alpha$.
15. Derive Wald's fundamental identity.
16. Derive the formula for the Operating Characteristic (O.C.) function of a Sequential Probability Ratio Test (SPRT). Explain the practical applications of the O.C. function, and provide a qualitative depiction of the O.C. curve.
17. Compare and contrast the Wilcoxon rank-sum test (Mann-Whitney U test) and the Wilcoxon signed-rank test. Discuss their respective applications, assumptions, null hypotheses, and interpretation of results. Provide practical scenarios for both tests.
18. Describe the ANOVA (Analysis of Variance) test in detail. Explain the situations in which it is used and how it compares to the Kruskal-Wallis test, a non-parametric alternative for analyzing variance.

Part C

III. Answer any Two questions. Each question carries 5 weight (2x5=10)

19. Let be a random sample from the poisson distribution with parameter . Consider against . Find the MP size α test of H_0 against H_1.

20. Obtain the level α likelihood ratio test for testing $H_0 : \mu \leq \mu_0$ against $H_1 : \mu > \mu_0$ based on a sample of n observations from where σ^2 is known.

21. Let $X_1, X_2, X_3, \ldots\ldots\ldots, X_n$ be the sample at the n^{th} stage. If $Z = (\log f(x; \theta_1)) / (\log f(x; \theta_0))$ and $S_n = \sum_{i=1}^{n} Z_i$. Show that $E(n) = E(S_n) / E(z)$; $E(Z) \neq 0$ and $E(n) = V(S_n)/V(Z)$; $E(Z) = 0$.

22. (a) Explain the Friedman Test, its relevance in non-parametric analysis, and when to use it. (b) Compare and contrast the Friedman Test with the repeated-measures ANOVA. (c) Describe the Kruskal-Wallis test and its primary purpose in statistical analysis.