LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

FIFTH SEMESTER – **APRIL 2024**

UST 5504 – TESTING OF HYPOTHESES

Date: 22-04-2024 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Define the following**	
a)	Simple and composite hypothesis.	
b)	Critical region.	
c)	Parameter space.	
d)	Critical value.	
e)	Non-parametric test.	
2.	**MCQ - Choose the correct option**	
a)	Type I error is i) True positive ii) False positive iii) True negative iv) False negative	
b)	Which of the following distributions does not belong to one parameter exponential families of distributions i) Normal ii) Exponential iii) Cauchy iv) Binomial	
c)	Likelihood function under H_0 is obtained by substituting the i) Unbiased estimator under subspace ii) Unbiased estimator under parameter space iii) Maximum Likelihood Estimator under subspace iv) Maximum Likelihood Estimator under parameter space	
d)	The number of degrees of freedom associated with the t-test, when the data are gathered from a matched pairs experiment with 8 pairs is: i) 8 ii) 16 iii) 7 iv) 14	
e)	Comparing the times-to-failure of radar transponders made by firms A, B, and C based on an airline's sample experience with the three types of instruments one may use i) Kolmogorov-Smirnov test ii) Kruskal-Wallis test iii) Wilcoxon Rank-Sum test iv) Spearman Rank Correlation test	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Match the following**	
a)	SPRT - Population variance not known	
b)	Small sample test - Varying sample size	
c)	Size of the test - Composite	
d)	H0: $\mu \leq 0, \sigma^2 = 0$ - 1-β Maximum	

e)	Most powerful test - Producers risk
4.	**True or False**
a)	In statistical testing of the hypothesis, the rejection region is reduced in size when the level of significance alpha is reduced?
b)	For $\theta_2 > \theta_1$ if $f(x, \theta_1)/f(x,\theta_2)$ is increasing function then it is called, Increasing MLR
c)	Under certain conditions LRT tests are Unbiased
d)	t-test is useful to test the significance of observed sample correlation coefficient
e)	When using the sign test, if two scores are tied, then we discard them
	SECTION B - K3 (CO2)
Answer any TWO of the following	**(2 x 10 = 20)**
5.	State and prove Neyman-Pearson Lemma
6.	Construct the UMPCR for testing the scale parameter of an exponential distribution based on a random sample of size n drawn from $f(x, \theta) = \theta e^{-\theta x}$; $x \geq 0$, $\theta > 0$ for the hypothesis $H_0: \theta = \theta_0$ Vs $H_1: \theta > \theta_0$
7.	Describe the steps involved in testing statistical hypothesis
8.	Explain Kolmogorov-Smirnov test for fitting of distributions.
	SECTION C – K4 (CO3)
Answer any TWO of the following	**(2 x 10 = 20)**
9.	Consider an observation X follows $f(x) = 1/\theta$, $0<x<\theta$ and $H_0: \theta = 1$ against $H_1: \theta = 2$ based on the critical regions $W_1 = \{1 \leq x \leq 1.5\}$. Obtain the size and power of the test, also find β.
10.	Test whether the binomial distribution is member of one parameter exponential family.
11.	Obtain OC and ASN function of SPRT.
12.	Two catalysts are being analysed to determine how they affect the mean yield of a chemical process. A test is run in the pilot plant and the results are given. Catalyst 1 : 91.50 94.18 92.18 95.39 91.79 89.07 94.72 89.21 Catalyst 2 : 89.19 90.95 90.46 93.21 97.19 97.04 91.07 92.75 Is there any difference between the mean yields?
	SECTION D – K5 (CO4)
Answer any ONE of the following	**(1 x 20 = 20)**
13.	i) Construct the Most Powerful Critical Region for testing $H_0: \theta = \theta_0$ Vs $H_1: \theta = \theta_1$ based on a random sample of size n drawn from $N(\theta, \sigma^2)$ where σ^2 is known. Also find the power of the test. (15) ii) Discuss the merits and demerits of non-parametric test. (5)
14.	Construct LR test for mean of a normal distribution when variance is not known.
	SECTION E – K6 (CO5)
Answer any ONE of the following	**(1 x 20 = 20)**
15.	i) Discuss Median test (8) ii) The following are the amounts of money (in dollars) spent by 16 persons at an amusement park: 20.15, 19.85, 23.75, 18.63, 21.09, 25.63, 16.65, 19.27, 18.80, 21.45, 20.29, 19.51, 23.80, 20.00, 17.48, 19.11 assuming that sample is randomly drawn from a symmetrical population. Test the hypothesis that the average amount spent by a person at the park is less than 19.00 dollars using Wilcoxson sign rank test. (12)
16.	i) Discuss the test procedure to test equality of two variances ii) Elaborate when a distribution is said to be a member of one parameter exponential family and test whether $N(0, \sigma^2)$ possess MLR property. (8 + 12)