

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



M.Sc. DEGREE EXAMINATION – STATISTICS

THIRD SEMESTER – APRIL 2023

PST 3602 – NON-PARAMETRIC METHODS

Date: 08-05-2023

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

PART - A

Answer ALL the questions

(10 x 2 = 20)

1. Distinguish between parametric test and nonparametric test.
2. What is the difference between interval scale and ratio scale?
3. State the assumptions for Wilcoxon matched – pair signed rank test.
4. When do we use Mann Whitney – U test for large sample case?
5. Write the formula for McNemar's test statistic.
6. When do you recommend Kruskal Wallis test?
7. Give the formula for Kendall's rank correlation coefficient.
8. What is coefficient of concordance?
9. When do you use Cochran's Q test?
10. What is the nonparametric equivalent test of regression?

PART - B

Answer any FIVE questions

(5 x 8 = 40)

11. A physician states that the median number of times he sees each of his patients during the year is six. In order to evaluate the validity of this statement, he randomly selects twelve of his patients and determines the number of office visits each of them made during the past year. He obtains the following values for the twelve patients in his sample: 10, 8, 5, 4, 7, 0, 10, 9, 3, 8, 12, 11. Do the data support his contention that the median number of times he sees a patient is six?
12. A sample of 36 tools produced by a machine shows the following sequence of good (G) and bad (B) tools:
G G G B G G G G B B B G G G G G B B G G G G G G G G B B G G G G G
Test whether the machine has produced good (G) and bad (B) tools in random order at 5% level of significance. ($Z_{0.05} = 1.96$)
13. An experiment is conducted to determine whether the coin is biased or not. The coin was flipped 200 times resulting in 96 heads and 104 tails. Does the result indicate that the coin is biased? Verify.
($Z_{0.05} = 1.96$)
14. In order to assess the efficacy of a new antidepressant drug, twelve clinically depressed patients are randomly assigned to one of the two groups. Six patients are assigned to Group 1, which is administered the antidepressant drug for a period of six months. The other Six patients are assigned to Group 2, which is administered by a placebo during the same six-month period. Assume that prior to introducing the experimental treatments; the experimenter confirmed that the level of depression in the two groups was equal. After six months elapse all the subjects are rated by a psychiatrist (who is blind with respect to a subject's experimental condition) on their level of depression. The psychiatrist's depression ratings for the Six subjects in each group are given below: (the higher the rating, the more depressed a subject):
Group 1: 14, 3, 1, 2, 0, 4; Group 2: 14, 13, 7, 9, 3, 2.
Apply Mann Whitney U – test and test whether the antidepressant drug is effective or not?

15. The following are the marks in Statistics of B.Com. students taken randomly from two section A and B:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Section A	2	2	4	6	3	3	4	8	7	5
Section B	1	1	2	5	7	3	3	2	6	6

Apply Kolmogorov-Smirnov test to examine that the distribution of marks in section A and section B is same at 1% level of significance.

16. Explain general Procedure for The Siegel–Tukey Test for Equal Variability.

17. The following are the final examination of marks of three groups of students who were taught computer by three different methods.

First method: 90 92 93 95 80 83

Second method: 95 60 72 72 75 76 74

Third method : 63 61 68 70 60

Use H- test at the 5% level of significance to test the null hypothesis that the three methods are equally effective.

18. Four members of a track team are ranked by the head coach with respect to their ability on six track and field events. For each event, the coach assigns a rank of 1 to the athlete who is best at the event and a rank of 4 to the athlete who is worst at the event. The following Table summarizes the data for the study. Use Kendall’s Coefficient of Concordance test and test whether there is any significant association between the rank-orders assigned to the athletes on the six events?

Event	Athlete			
	1	2	3	4
Sprint	3	2	1	4
1500 meters	3	2	1	4
Pole vault	3	2	1	4
Long jump	4	2	1	3
Shot put	3	2	1	4
400 meters	4	1	2	3

PART - C

Answer any TWO questions

(2 x 20 = 40)

19. a) Write the advantages and disadvantages of non parametric test?

b) The results of an intelligence test administered to 10 students are evaluated with respect to goodness-of-fit for a normal distribution with the following parameters: $\mu = 60$ and $\sigma = 20$. The IQ scores of the 10 students are noted below:

42, 58, 40, 50, 61, 65, 65, 73, 70, 72.

Do the data conform to normal distribution with the specified parameters?

(8+

12)

20. a) A researcher wants to determine whether or not a group of subjects who are given a low dose of a stimulant drug exhibit more variability with respect to the number of errors they make on a test of eye-hand coordination than a group of subjects who are given a placebo. There are $n_1 = 12$ subjects in the group administered the drug and $n_2 = 17$

subjects in the placebo group. The scores of the $N = 29$ subjects are listed below.

Group 1: 8, 5, 4, 3, 2, 9, 6, 1, 14, 18, 8, 8

Group 2: 7, 7, 7, 8, 9, 7, 8, 9, 8, 8, 7, 10, 11, 12, 7, 9, 5

Is there a significant difference between the degrees of variability within each of the groups?

b) A market researcher asks 12 male subjects whether or not they would purchase an automobile manufactured by three different companies. Specifically, subjects are asked whether they would purchase a car manufactured by the following automobile manufacturers: Chenesco, Howasaki and Gemini (1 indicate that the subject purchase the product and 0 indicate that the subject not purchase the product)

Subject	1	2	3	4	5	6	7	8	9	10	11	12
Chenesco	1	0	1	0	0	0	0	0	1	1	0	0
Howasaki	1	1	1	1	1	1	0	1	1	0	0	0
Gemini	0	0	1	0	0	1	0	0	0	1	0	1

Use Cochran Q test, at 1% level of significance, Can the market researcher conclude that there are differences with respect to car preference based on the responses of subjects?

(12 + 8)

21. a)The table given below shows reaction time (in second) data from 6 Objects (treatments) each of which was tested under three conditions I, II and III:

Condition \ Object	Object					
	A	B	C	D	E	F
I	356	590	665	450	540	500
II	401	564	567	560	570	525
III	455	570	650	575	560	550

Apply the Friedman test to test whether the reaction time of each object is the same or not at the 5% level of significance.

b) A medical researcher is interested to compare the accuracy of a low cost new procedure in determining brain tumor versus a standard high cost procedure. The medical researcher selects 150 patients with complaints at random and made them to undergo both the procedures. The results are as follows:

		New procedure	
		positive	negative
Standard procedure	Positive	33	41
	Negative	29	47

Determine the effectiveness of the new procedure with respect to the standard procedure? (12 + 8)

22. Compute the estimate of the population regression slope coefficient by Theil's test. Subsequently, compute the estimator of the intercept coefficient for the following data

Y	180	128	290	235	252	123
X	360	222	562	423	412	80

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