Semester : 4 Subject : Statistics for AIDS Academic Year: 2023-2024

FRIEDMAN TEST :

* Friedman Test is a non-parametric test for more than two treatment groups. Basically it is used in place of the two way ANOVA test when you don't know the distribution of the data.

* Nonparametric means test doesn't assume your data comes from a particular distribution (like the normal distribution).

* When more than two treatments groups as paired data are available, Friedman Test is conducted

$$FM = \left(\frac{12}{(n \times k \times (k+1)}\right) \times \Sigma R^2 - [3 \times n \times (k+1)]$$

n = No. of subjects

k = the No. of Treatments.

$\Sigma R^2 = R_1^2 + R_2^2 + R_3^2 \ldots$ (Squared Sum of Total Ranks).

Degree of freedom = No. of Treatment - 1

$V = k - 1$.

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Example :-

In order to the following data represents the number of units of tablet production (in thousands) per day by five different technicians by using three different type of machines.

Technicians	Machine X	Machine Y	Machine Z
A	54	48	57
B	56	50	62
C	44	46	54
D	53	48	56
E	48	52	59

Conduct a Friedman test with the given data and judge whether there is any difference among the machines ($\chi^2_{0.05,2} = 5.99$).

Solution :

H_0 = There is no difference among machines.

H_a = There is difference between machines.

$H_0 : X = Y = Z$

$H_a : X \neq Y \neq Z$.

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Technicians	Machine X	Machine Y	Machine Z	R_1	R_2	R_3
A	54	48	57	2	1	3
B	56	50	62	2	1	3
C	44	46	54	1	2	3
D	58	48	56	2	1	3
E	48	52	59	1	2	3
	R_1			8	7	15
	R_1^2			64	49	225

$$FM = \left(\frac{12}{(n \times k \times (k+1)}\right) \times \Sigma R^2 - [3 \times n \times (k+1)]$$

$n = 5, k = 3, \Sigma R^2 = 64 + 49 + 225 = 338$

$$FM = \left(\frac{12}{5 \times 3 \times (3+1)}\right) \times 338 - [3 \times 5 \times (3+1)]$$

$$FM = \left(\frac{12}{60}\right) \times 338 - [15 \times 4]$$

$FM = 0.2 \times 338 - 60$

$FM = 67.6 - 60 = \boxed{7.6}$

Degree of freedom $r = k - 1 = 3 - 1 = 2$

$\chi^2_{0.05,2} = 5.99$.

$FM_{cal} = 7.6 > \chi^2_{0.05,2} = 5.99$.

H_0 is rejected. There is difference between the 3 machines.

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Example : 2

Consider that 3 different treatments A, B, C are given to 5 different subjects (S_1, S_2, S_3, S_4, S_5). Calculate, using Friedman Test at 0.05 significant value and find is there any difference between the 3 treatments ($\chi^2_{0.05,2} = 5.99$).

Solution:

H_0 = There is no difference in Treatment.

H_a = There is difference between machines.

H_0 = ~~X=Y=Z~~. $A = B = C$

H_a = ~~X≠Y≠Z~~ . ~~X≠Y=~~ $A \neq B \neq C$.

Subjects	Treatment A	Treatment B	Treatment C	R_A	R_B	R_C.
S_1	3	4	6	1	2	3
S_2	0	3	2	1	3	2
S_3	2	1	4	2	1	3
S_4	0	1	3	1	2	3.
S_5	0	1	4	1	2	3.
		R		6	10	14
		R^2		36	100	196.

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$$FM = \left(\frac{12}{(n \times k \times (k+1)}\right) \times \Sigma R^2 - [3 \times n \times (k+1)]$$

$n=5, k=3, \Sigma R^2 = 36+100+196 = 332$

$$FM = \left(\frac{12}{5 \times 3 \times (4)}\right) \times 332 - [3 \times 5 \times (4)]$$

$$= 66.4 - 60$$

$$\boxed{FM = 6.4}$$

Degree of Freedom $= k-1 = 3-1 = 2$

$$\chi^2_{0.05,2} = 5.99$$

$$FM_{cal} = 6.4 > \chi^2_{0.05,2} = 5.99$$

H_0 is rejected There is difference between the 3. Treatments