Kruskal-Wallis Test

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- Direct generalisation of Wilcoxon Rank sum test to the case in which we have three or more independent groups.
- Nonparametric analogue of One way analysis of variance

Example 1

- You randomly split up a class of 90 students into three groups of 30. Each group uses a different studying technique for one month to prepare for an exam. At the end of the month, all of the students take the same exam. You want to know whether or not the studying technique has an impact on exam scores.

EXAMPLE 2

- You want to know whether or not sunlight impacts the growth of a certain plant, so you plant groups of seeds in four different locations that experience either high sunlight, medium sunlight, low sunlight or no sunlight. After one month you measure the height of each group of plants

EXAMPLE 3

- A researcher wants to know whether or not three drugs have different effects on knee pain, so he recruits 30 individuals who all experience similar knee pain and randomly splits them up into three groups to receive either Drug 1, Drug 2, or Drug 3. After one month of taking the drug, the researcher asks each individual to rate their knee pain on a scale of 1 to 100, with 100 indicating the most severe pain

EXAMPLE 3

- The researcher wants to know whether or not the three drugs have different effects on knee pain, so he conducts a Kruskal-Wallis Test using a .05 significance level to determine if there is a statistically significant difference between the median knee pain ratings across these three groups.

EXAMPLE 4

- In Psychotherapy centre, counsellors use pranayama technique to improve the lung capacity of their clients before giving them any therapeutic exercises. The coordinator may like to test whether the pranayama given for 15 minutes, 20 minutes or 25 minutes durations are equally effective in enhancing the lung capacity

STEPS FOR TESTING NULL HYPOTHESIS

- Pool the scores of all groups and allot them ranks. Give lowest score the rank 1 and highest score the rank n. In case of tie, allot each score the average rank

STEPS FOR TESTING NULL HYPOTHESIS

- Add the ranks of all the scores in each group and denote it by R_i.

STEPS FOR TESTING NULL HYPOTHESIS

- Compute H Statistic

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(n+1)$$

- k=The number of group
- n=total number of scores in all groups
- R_i=The total of ranks of all scores in the i^{th} group.
- n_i=The number of scores in i^{th} group

STEPS FOR TESTING NULL HYPOTHESIS

- The statistic H can be treated as Chisquare if the number of subjects in each group is more than 5.
- If the value of H is greater than or equal to the tabulated value of Chisquare with $(k-1)$ d.f., then reject the null hypothesis.

Problem 1

In an educational experiment, three different methods of teaching were used for one month in three different groups of subjects to compare their effectiveness in learning a course. The marks of the students so obtained in the three treatment groups are shown in table given below.

Sl No.	Audio-Visual(AV)	Blackboard(BB)	Selflearning(SL)
1	23	40	29
2	34	41	22
3	31	37	34
4	41	35	28
5	29	38	39
6	25	42	37
7	22	34	31
8	32	38	29

Test the hypothesis of no difference in the performance of the students under these three teaching methods at 5% level

PROBLEM 2

Theproduction volume of units assembled by 3 different operators during 9 shifts are given below. Check whether there is significant difference between the production volumes of units assembled by the 3 operators using Kruskal-Walli's test at $\alpha = 0.05$.

Shift no.	1	2	3	4	5	6	7	8	9
Operator1	29	34	34	20	32	45	42	24	35
Operator2	30	21	23	25	44	37	34	19	38
Operator3	26	36	41	48	27	39	28	46	15