Practical No. 9 : Friedman test

A winery wanted to find out whether people preferred red, white or rosé wines. They invited 12 people to taste one red, one white and one rose' wine with the order of tasting chosen at random and a suitable interval between tastings. Each person was asked to evaluate each wine with the scores tabulated in the table.

Subject	1	2	3	4	5	6	7	8	9	10	11	12
White	10	8	7	9	7	4	5	6	5	10	4	7
Red	7	5	8	6	5	7	9	6	4	6	7	3
Rose	8	5	6	4	7	5	3	7	6	4	4	3

Enter this data in Minitab and generate the following reports:

Questions :

a) Test the hypothesis that there is no significant difference between the three types of wines.
b) Find the average rating of each type of wine. Which type of wine is more popular?

Solution :

Step 1 : Type your data into the data pane of a worksheet. Make sure you put your data into columns. Use column header for "Rater", "Rating" and "Wine Type". Type the "Rater" data into column C1, "Rating" data into column C2 and "Wine Type" data into column C3-T.

Step 2 : To perform Friedman test, under the drop-down menu "STAT, choose "Nonparametrics" then "Friedman…". A "Friedman" dialogue box will appear. Set the "Response:" as "C1 Rater", "Treatment:" as "C3 Wine Type" and "Blocks:" as "C2 Rater" from the table on the left. Click "OK".

Step 3 : For the descriptive statistics for rater, under the drop-down menu "Stat", choose "Basic Statistics" then "Display Descriptive Statistics…". A "Display Descriptive Statistics" dialogue box will appear. In the "Variables:" box, choose "C2 Rating" and in the "By variable (optional):" box, choose "C1 Rater" from the table on the left. Click the "Statistics…" option. A "Display Descriptive Statistics: Statistics" dialogue box will appear. Check the "Mean", "Standard deviation", "Minimum", "Maximum", "Range", "First quartile", "Median" and "Third quartile" checkboxes. Click "OK". Click "OK" again.

Step 4 : For the descriptive statistics for wine type, under the drop-down menu "Stat", choose "Basic Statistics" then "Display Descriptive Statistics…". A "Display Descriptive Statistics" dialogue box will appear. In the "Variables:" box, choose "C2 Rating" and in the "By variable (optional):" box, choose "C3 Wine Type" from the table on the left. Click the "Statistics…" option. A "Display Descriptive Statistics: Statistics" dialogue box will appear. Check the "Mean", "Standard deviation", "Minimum", "Maximum", "First quartile", "Median" and "Third quartile" checkboxes. Click "OK".

Step 5 : Click the “Graphs…” option. Click “OK”. Check the “Boxplot of data” option. Click “OK”. Click “OK” again. The following boxplot will be generated.

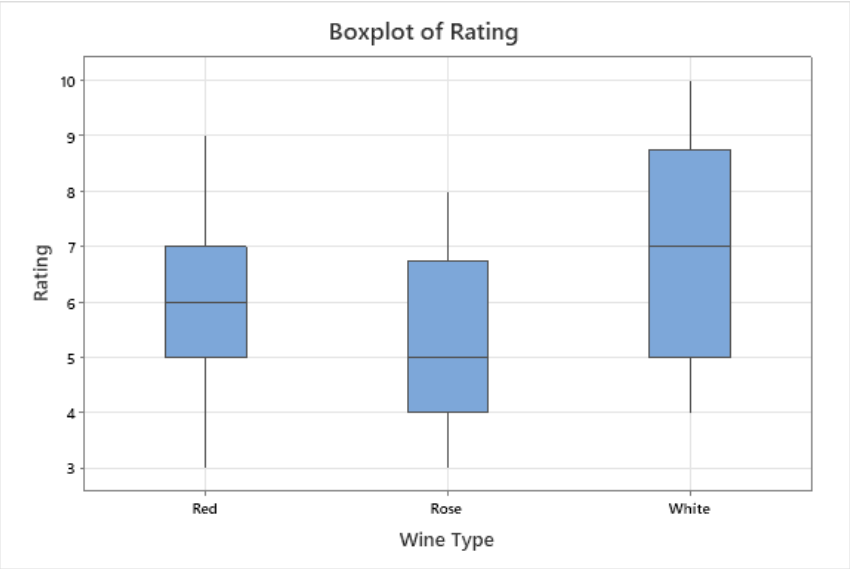

Fig 1 : Boxplot of Rating

Interpretation :

From the boxplot, it is seen that the distribution of test scores for red wine is symmetrical, while the distribution for rosé wine is right-skewed. The distribution for white wine is approximately symmetrical. In terms of variability, rosé wine has the least variation in scores, white wine has the most, and red wine falls in between.

Descriptive Statistics :

Variable	Rater	Mean	StDev	Minimum	Q1	Median	Q3	Maximum	Range
Rating	1	8.333	1.528	7.000	7.000	8.000	10.000	10.000	3.000
	2	6.00	1.73	5.00	5.00	5.00	8.00	8.00	3.00
	3	7.000	1.000	6.000	6.000	7.000	8.000	8.000	2.000
	4	6.33	2.52	4.00	4.00	6.00	9.00	9.00	5.00
	5	6.333	1.155	5.000	5.000	7.000	7.000	7.000	2.000
	6	5.333	1.528	4.000	4.000	5.000	7.000	7.000	3.000
	7	5.67	3.06	3.00	3.00	5.00	9.00	9.00	6.00
	8	6.333	0.577	6.000	6.000	6.000	7.000	7.000	1.000
	9	5.000	1.000	4.000	4.000	5.000	6.000	6.000	2.000
	10	6.67	3.06	4.00	4.00	6.00	10.00	10.00	6.00
	11	5.00	1.73	4.00	4.00	4.00	7.00	7.00	3.00
	12	4.33	2.31	3.00	3.00	3.00	7.00	7.00	4.00

Variable	Wine Type	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Rating	Red	6.083	1.676	3.000	5.000	6.000	7.000	9.000
	Rose	5.167	1.642	3.000	4.000	5.000	6.750	8.000
	White	6.833	2.125	4.000	5.000	7.000	8.750	10.000

Interpretation :

The average rating across all wine types is identical, indicating that all wine types are equally popular among raters. Furthermore, there is no significant statistical difference in the median ratings of the three wine types, suggesting comparable levels of preference among consumers. This conclusion is supported by the median scores, which are 6.91 for white wine, 5.75 for red wine, and 5.08 for rose wine.

Method :

Treatment = Wine Type

Block = Rater

Descriptive Statistics :

Wine Type	N	Median	Sum of Ranks
Red	12	5.75000	23.5
Rose	12	5.08333	21.0
White	12	6.91667	27.5
Overall	36	5.91667	

Hypothesis :

Null hypothesis	H_o: All treatment effects are zero
Alternative hypothesis	H_1: Not all treatment effects are zero

Test :

Method	DF	Chi-Square	P-Value
Not adjusted for ties	2	1.79	0.408
Adjusted for ties	2	2.00	0.368

Conclusion :

Since p-value (0.386) of the test is less than significance probability (0.05), we do not reject the null hypothesis at 5 % level of significance.

Worksheet :

↓	C1	C2	C3-T	C4
	Rater	Rating	Wine Type	
1	1	10	White	
2	2	8	White	
3	3	7	White	
4	4	9	White	
5	5	7	White	
6	6	4	White	
7	7	5	White	
8	8	6	White	
9	9	5	White	
10	10	10	White	
11	11	4	White	
12	12	7	White	
13	1	7	Red	
14	2	5	Red	
15	3	8	Red	
16	4	6	Red	
17	5	5	Red	
18	6	7	Red	
19	7	9	Red	
20	8	6	Red	
21	9	4	Red	
22	10	6	Red	
23	11	7	Red	
24	12	3	Red	
25	1	8	Rose	
26	2	5	Rose	
27	3	6	Rose	
28	4	4	Rose	
29	5	7	Rose	
30	6	5	Rose	
31	7	3	Rose	
32	8	7	Rose	
33	9	6	Rose	
34	10	4	Rose	
35	11	4	Rose	
36	12	3	Rose	