**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 :**

1. Test the hypothesis that there is no significant difference between the three types of wines.
2. 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.

A diagram of a box plot

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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 | H₀: All treatment effects are zero |
| Alternative hypothesis | H₁: 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 :**

**A screenshot of a computer

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