Lab no. 7(Wilcoxon sign rank test)

1.The performance score of students before and after training is given below:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| before | 44 | 48 | 70 | 65 | 35 | 55 | 48 | 52 | 65 |
| after | 43 | 52 | 73 | 62 | 39 | 54 | 56 | 53 | 67 |

At 5% level of significance test whether training is beneficial or not.

Hypothesis

Null hypothesis: Md1=Md2 i.e. training isn’t beneficial

Alternative hypothesis: Md2>Md2 i.e. training is beneficial.

Level of significance

Alpha= 5%

Test statistics:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ranks | | | | |
|  | | N | Mean Rank | Sum of Ranks |
| after - before | Negative Ranks | 3a | 3.17 | 9.50 |
| Positive Ranks | 6b | 5.92 | 35.50 |
| Ties | 0c |  |  |
| Total | 9 |  |  |
| a. after < before | | | | |
| b. after > before | | | | |
| c. after = before | | | | |

|  |  |
| --- | --- |
| Test Statisticsa | |
|  | after - before |
| Z | -1.548b |
| Asymp. Sig. (2-tailed) | .122 |
| a. Wilcoxon Signed Ranks Test | |
| b. Based on negative ranks. | |

Since, pval>alpha so we accept H0

Hence we conclude that training isn’t beneficial.

2. The following dataset represents the score of 7 students in two attempts.

|  |  |
| --- | --- |
| Before | After |
| 4 | 8 |
| 6 | 5 |
| 7 | 9 |
| 11 | 12 |
| 15 | 18 |
| 19 | 17 |
| 5 | 10 |

Use Wilcoxon sign rank test to test whether there is significant difference between score of students in two attempts.

Solution:

Hypothesis

H0:Md1=Md2 i.e. there is no significance difference between score of students in 2 attempts.

H1: Md1≠ Md2 i.e. there is significance difference between score of students in 2 attempts.

Level of significance

Alpha= 5%

Critical value:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ranks | | | | |
|  | | N | Mean Rank | Sum of Ranks |
| after - before | Negative Ranks | 2a | 2.50 | 5.00 |
| Positive Ranks | 5b | 4.60 | 23.00 |
| Ties | 0c |  |  |
| Total | 7 |  |  |
| a. after < before | | | | |
| b. after > before | | | | |
| c. after = before | | | | |

|  |  |
| --- | --- |
| Test Statisticsa | |
|  | after - before |
| Z | -1.527b |
| Asymp. Sig. (2-tailed) | .127 |
| a. Wilcoxon Signed Ranks Test | |
| b. Based on negative ranks. | |
| Since Pval>alpha so we accept H0.  Hence we conclude that there is no significance difference between score of students in two attempts. | |

Lab no. 8 (Mann Whitney U test):

1. The following dataset represent the age of male and female employee of certain company.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Age of male | 36 | 48 | 25 | 33 | 22 | 40 | 35 |
| Age of female | 20 | 28 | 35 | 42 | 46 | 25 | 29 |

At 5% level of significant test whether there is significance difference between age of male and female employee. Use man Whitney U test.

Solution:

Hypothesis:

H0:Md1=Md2 i.e. there is no significant difference between age of male and female.

H1: Md1≠ Md2 i.e. there is significant difference between age of male and female.

Level of significance

Alpha= 5%

Test statistics:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ranks | | | | |
|  | group | N | Mean Rank | Sum of Ranks |
| age | male | 7 | 8.00 | 56.00 |
| female | 7 | 7.00 | 49.00 |
| Total | 14 |  |  |

|  |  |
| --- | --- |
| Test Statisticsa | |
|  | age |
| Mann-Whitney U | 21.000 |
| Wilcoxon W | 49.000 |
| Z | -.448 |
| Asymp. Sig. (2-tailed) | .654 |
| Exact Sig. [2\*(1-tailed Sig.)] | .710b |
| a. Grouping Variable: group | |
| b. Not corrected for ties. | |

Since, Pval >alpha so we accept H0.

Hence we conclude that there is no significant difference between age of male and female employee.

2. The following datasets represents the problem solving time of two groups of students.

|  |  |
| --- | --- |
| Group I | Group II |
| 12 | 16 |
| 20 | 10 |
| 16 | 18 |
| 22 | 24 |
| 30 | 19 |
| 11 | 21 |
| 39 | 40 |

At 5% level of significance, test whether the problem solving time of two group of student is similar. Use Mann- Whitney U test.

Solution:

Hypothesis

H0:Md1=Md2 i.e. the problem solving time is similar

H1: Md1≠Md2 i.e. the problem solving time isn’t similar.

Level of significance

Alpha= 5%

Test statistics:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ranks | | | | |
|  | group | N | Mean Rank | Sum of Ranks |
| time | group I | 7 | 7.50 | 52.50 |
| group II | 7 | 7.50 | 52.50 |
| Total | 14 |  |  |

|  |  |
| --- | --- |
| Test Statisticsa | |
|  | time |
| Mann-Whitney U | 24.500 |
| Wilcoxon W | 52.500 |
| Z | .000 |
| Asymp. Sig. (2-tailed) | 1.000 |
| Exact Sig. [2\*(1-tailed Sig.)] | 1.000b |
| a. Grouping Variable: group | |
| b. Not corrected for ties. | |

Here Pval>alpha so we accept H0

Hence we conclude that the problem solving time is similar.