**Lab 5: t-test for difference of means**

In a packing plant, a machine packs carton with jars. It is supposed that a new machine will pack faster on the average than the machine currently used. To test that hypothesis, the times it takes each machine to pack ten cartons are recorded. The results in seconds, are shown in the following table.

New machine

42.1, 41.3, 42.4, 43.2, 41.8,

41.0, 41.8, 42.8, 42.3, 42.7

Old machine

42.7, 43.8, 42.5, 43.1, 44.0,

43.6, 43.3, 43.5, 41.7, 44.1

Do the data provide sufficient evidence to conclude that, on the average, the new machine packs faster? Perform the required hypothesis test at the 5% level of significance.

Solution:

Let x1 and x2 be the

**Method**

|  |
| --- |
| μ₁: mean of New Machine |
| µ₂: mean of Old Machine |
| Difference: μ₁ - µ₂ |

*Equal variances are assumed for this analysis.*

**Descriptive Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample | N | Mean | StDev | SE Mean |
| New Machine | 10 | 42.140 | 0.683 | 0.22 |
| Old Machine | 10 | 43.230 | 0.750 | 0.24 |

**Estimation for Difference**

|  |  |  |
| --- | --- | --- |
| Difference | Pooled StDev | 95% Upper Bound for Difference |
| -1.090 | 0.717 | -0.534 |

**Test**

|  |  |
| --- | --- |
| Null hypothesis | H₀: μ₁ - µ₂ = 0 |
| Alternative hypothesis | H₁: μ₁ - µ₂ < 0 |

|  |  |  |
| --- | --- | --- |
| T-Value | DF | P-Value |
| -3.40 | 18 | 0.002 |



**Conclusion:**

The boxplot clearly shows that the new machine has significantly lower mean that of old machine. the shape of the new machine is symmetrical while the shape of the old machine is slightly left skewed. but the variation of packing time both machine is almost same. Hence two machines are same in terms of process standard deviation but they are different in terms of average processing time.

Since p- value <<α -value =0.05, we strongly reject the null hypothesis that the average packaging time is same and hence conclude that packaging time is significant difference. Comparing average packing of new machine (42.14) and that of new machine (43.23), the new machine is packaging significantly faster than the old machine. hence new machine is superior to old machine.