Lab – 4: (One-Sample T test)

A company manufactures a metal ring for industrial engines that usually weight about 50 ounces. A random sample of 50 of these metal rings produced the following weights (in ounces) 51 53 56 50 44 47 53 53 42 57

46 55 41 44 52 56 50 57 44 46

41 52 69 53 57 51 54 63 42 47

47 52 53 46 36 58 51 38 49 50

62 39 44 55 43 52 43 42 57 49

Test the null hypothesis that population mean weight of ring is 50 ounces against not. Take $\alpha = 0.05$.

SOLUTION:

Descriptive Statistics

N	Mean	StDev	SE Mean	95% CI for μ
50	49.620	6.577	0.930	(47.751, 51.489)

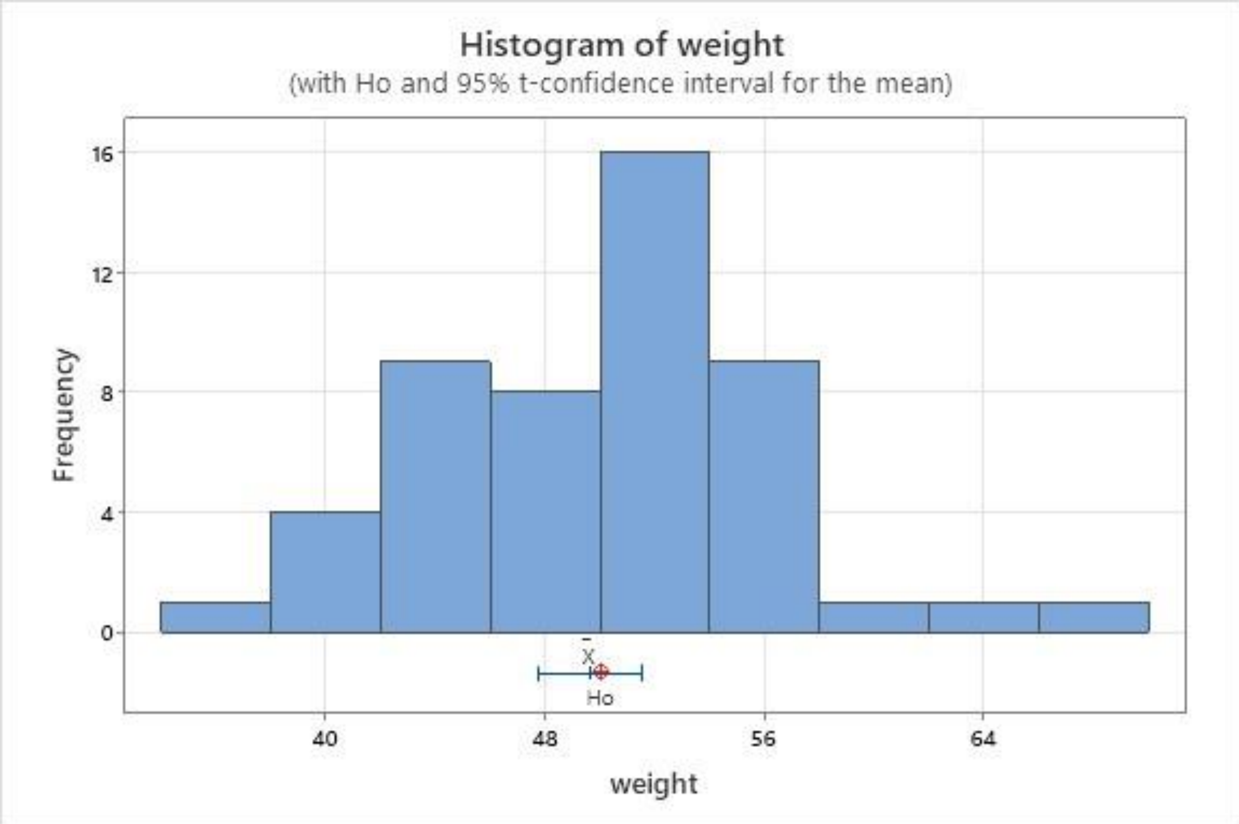
μ: population mean of weight

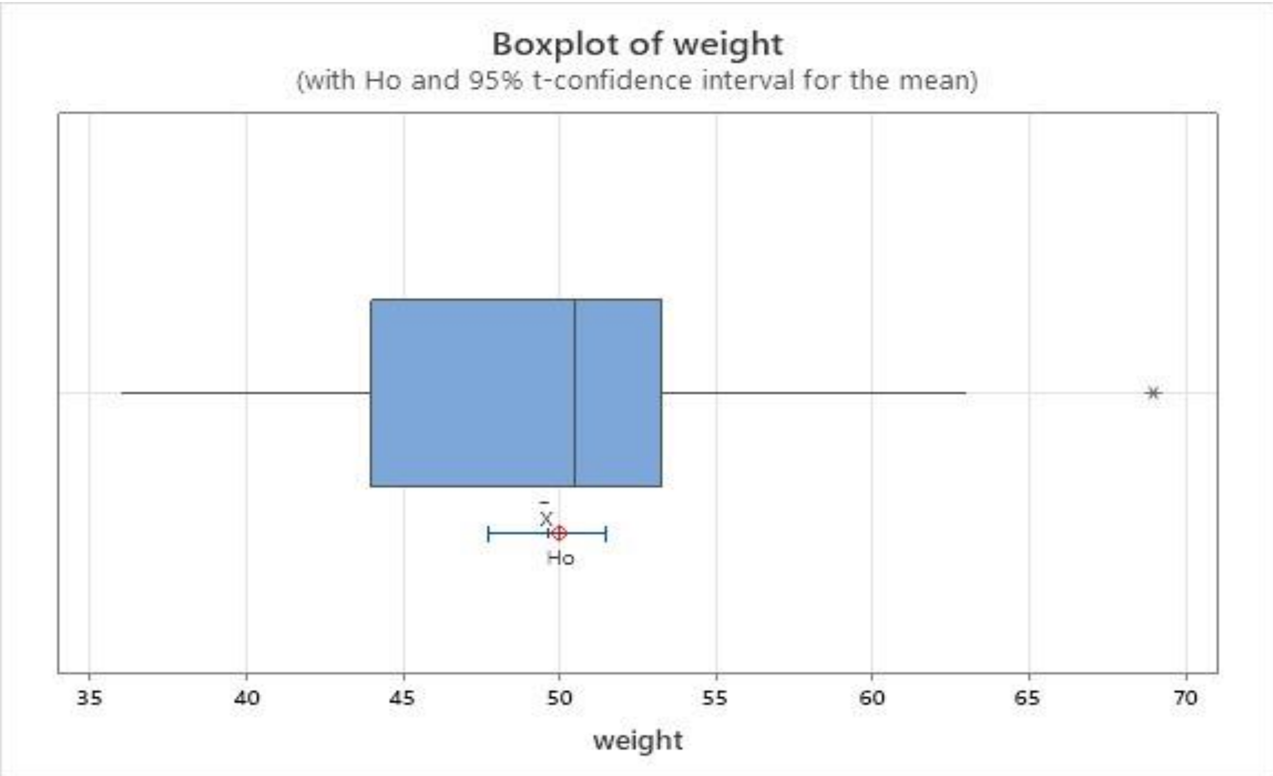
Test

Null hypothesis H_0: $\mu = 50$

Alternative hypothesis H_1: $\mu \neq 50$

T-Value	P-Value
-0.41	0.685


Histogram of weight
(with Ho and 95% t-confidence interval for the mean)
Frequency
16
12
8
4
0
X̄
Ho
40
48
56
64
weight


Boxplot of weight
(with Ho and 95% t-confidence interval for the mean)
X̄
Ho
35
40
45
50
55
60
65
70
weight

Conclusion

The graph of box and whisker plot and histogram shows that the data is left skewed i.e. not normally distributed. Hence, t - test for mean is not valid test for population mean because it violates the fundamental assumptions that the data is normally distributed. The alternative test could be Wilcoxon signed rank test or sign test.

Further p-value = 0.685 > α – value = 0.05, we accept the null hypothesis that the mean weight of metal ring is 50 ounces. The 95% confidence interval for population mean (μ) is 47.75 ounces to 51.49 ounces.

Lab - 5 :(Two-Sample T-Test and CI: New Machine, Old Machine) 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:

Method

μ_1 = Mean of New Machine μ_2

= Mean of Old Machine

Difference = μ_1- μ_2

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

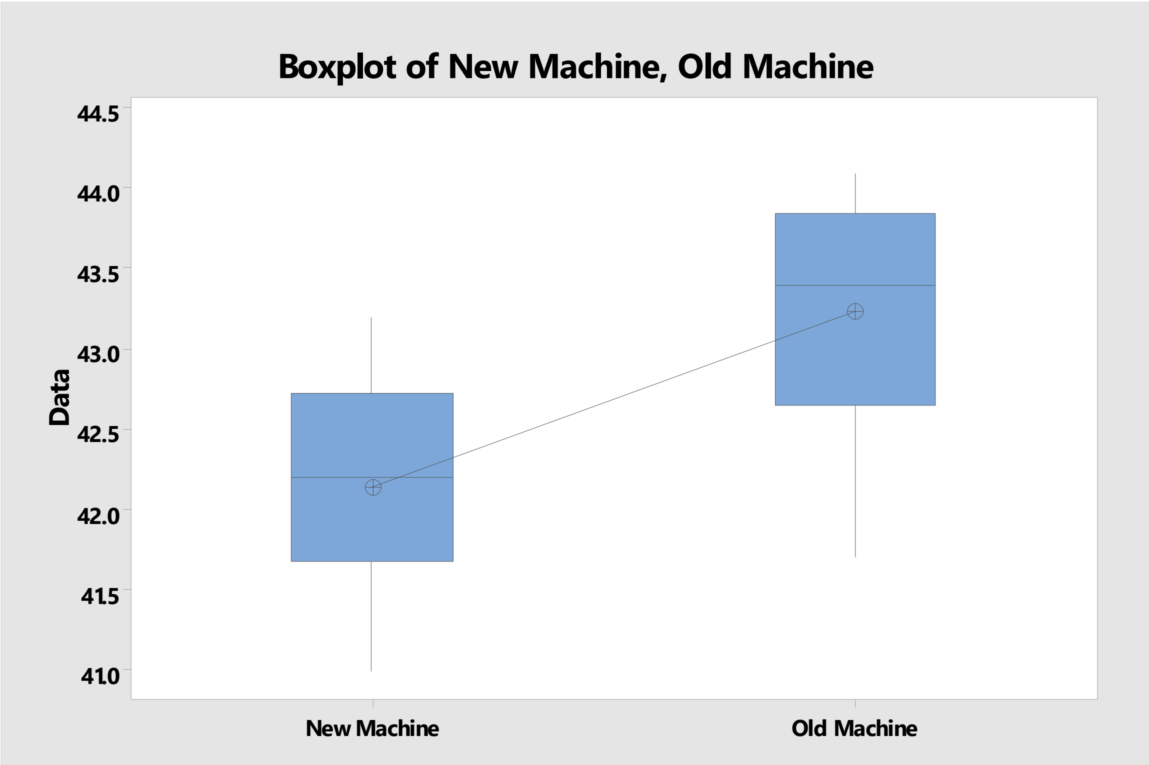
Difference	Pooled StDev	95% Upper Bound for Difference
-1.090	0.717	-0.534

Test

Null hypothesis H_0: $\mu_1 - \mu_2 = 0$

Alternative hypothesis H_1: $\mu_1 - \mu_2 < 0$

T-Value	DF	P-Value
-3.40	18	0.002



Conclusion

The box plot clearly shows that the new machine has significantly lower meaning than that of the 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 for both machines is the same. Hence the two machines are the 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 the average packaging of a new machine (42.14) and that of a new machine (43.23), the new machine packs significantly faster than the old machine. hence new machine is superior to old machine .