# *Wilcoxon Signed-Rank Test in SPSS*   STAT 314

In 12 test runs a brand of harvesting machine operated for 10.1, 12.2, 12.4, 12.4, 9.4, 11.2, 14.8, 12.6, 10.1, 9.2, 11.0, and 12.5 hours on a tank of gasoline. Use the Wilcoxon Signed-Rank Test to determine if the machine lives up to the manufacturer's claim of an average of 12.5 hours on a tank of gasoline. Use $\alpha = 0.05$. [Actually, $n = 11$ since one of the values will be omitted because it equals the null value of 12.5 hours

1. Enter the null-hypothesized value into one variable and enter the data values into another variable *(see upper-left figure, below)*. If you want your differences to be "hours – 12.5", then you must put the "12.5" values in the first column and the "hours" values in the second column. Be sure to enter the null-hypothesized value in each row/case of data. Next you need to check the symmetric distribution assumption by checking a boxplot of the data. Select "Boxplot…" under the "Legacy Dialogs" section of the "Graphs" menu *(see upper-right figure, below)*. Select "Simple" and "Summaries for groups of cases" before clicking "Define" *(see lower-left figure, below)*. The variable to be graphed should be Hours of Operation, and the category axis should be based upon the Null Hypothesis Value *(see lower-right figure, below)*.
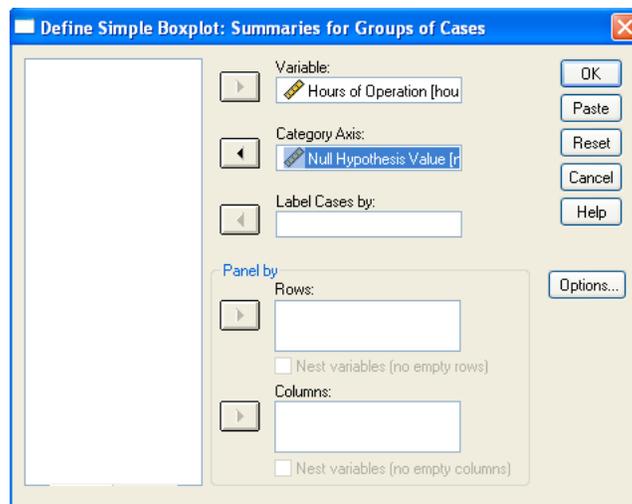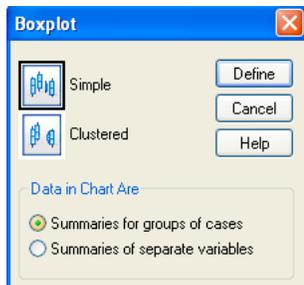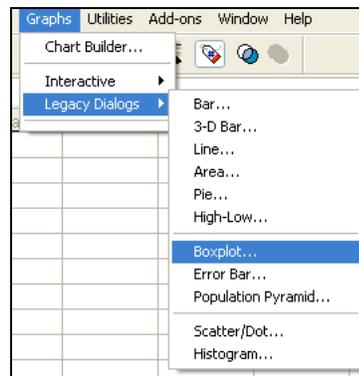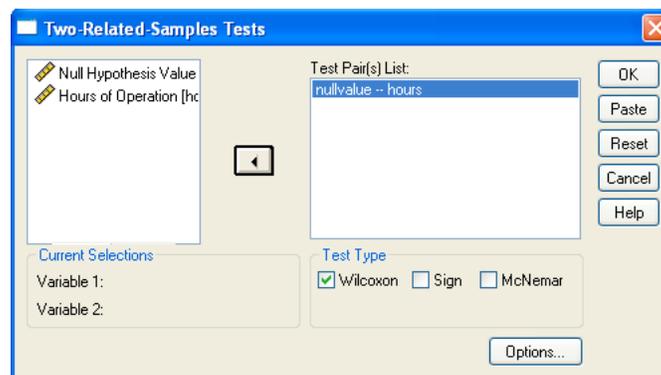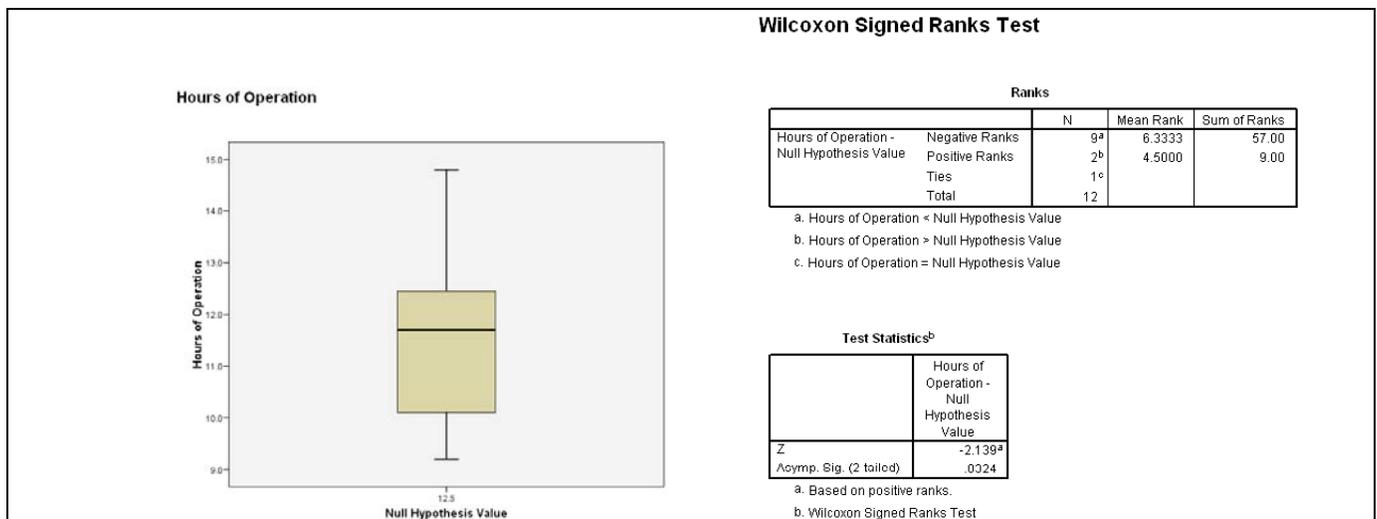
2. Select Analyze → Nonparametric Tests → 2 Related Samples … *(see figure, below)*.
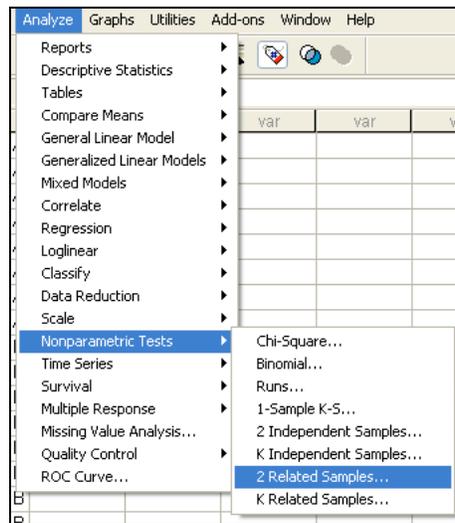
3. Select "Null Hypothesis Value" and "Hours of Operation" together, then click the arrow button to enter them into the Test Pair(s) List. Select "Wilcoxon" as the Test Type and then click "OK" *(see the figure, below)*.

4. Your output should look like this.

Wilcoxon Signed Ranks Test

Hours of Operation

Ranks

		N	Mean Rank	Sum of Ranks
Hours of Operation - Null Hypothesis Value	Negative Ranks	9[a]	6.3333	57.00
	Positive Ranks	2[b]	4.5000	9.00
	Ties	1[c]		
	Total	12		

a. Hours of Operation < Null Hypothesis Value

b. Hours of Operation > Null Hypothesis Value

c. Hours of Operation = Null Hypothesis Value

Test Statistics[b]

	Hours of Operation - Null Hypothesis Value
Z	-2.139[a]
Asymp. Sig. (2 tailed)	.0024

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

5. You should use the output information in the following manner to answer the question.

Step 0: **Check Assumptions**
The boxplot appears roughly symmetric, so the symmetry assumption appears to be met.

Step 1: **Hypotheses**
H_0: $\mu = 12.5 \ hours$

H_a: $\mu \neq 12.5 \ hours$

Step 2: **Significance Level**
$\alpha = 0.05$

Step 3: **Rejection Region**
Reject the null hypothesis if p-value ≤ 0.05.

Step 4: **Test Statistic**

Ranks

		N	Mean Rank	Sum of Ranks
Hours of Operation - Null Hypothesis Value	Negative Ranks	9[a]	6.3333	57.00
	Positive Ranks	2[b]	4.5000	9.00
	Ties	1[c]		
	Total	12		

a. Hours of Operation < Null Hypothesis Value
b. Hours of Operation > Null Hypothesis Value
c. Hours of Operation = Null Hypothesis Value

Test Statistics[b]

	Hours of Operation - Null Hypothesis Value
Z	-2.139[a]
Asymp. Sig. (2 tailed)	.0324

a. Based on positive ranks
b. Wilcoxon Signed Ranks Test

$S\text{-}RS$ = (sum of positive ranks) – (sum of negative ranks) = 9 – 57 = -48
p-value = Asymp. Sig. (2-tailed) = 0.0324
[If the test were one-tailed, the p-value would be $\frac{1}{2}$(Asymp. Sig. (2-tailed)).]

Step 5: **Decision**
Since p-value = 0.032 $\leq$ 0.05, we reject the null hypothesis.

Step 6: **State conclusion in words**
At the $\alpha = 0.05$ level of significance, there exists enough evidence to conclude that the manufacturer's claim of an average of 12.5 hours on a tank of gasoline is incorrect.