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

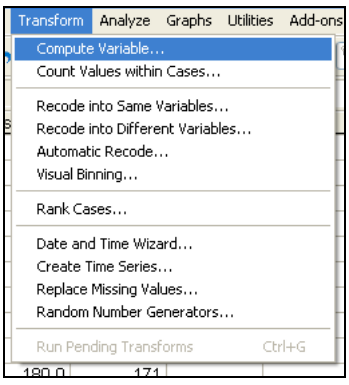
Twelve adult males were put on a liquid diet in a weight-reducing plan. Weights were recorded before and after the diet. The data are shown in the table below. Use the Wilcoxon Signed-Rank Test to ascertain if the plan was successful. Use $\alpha = 0.05$.

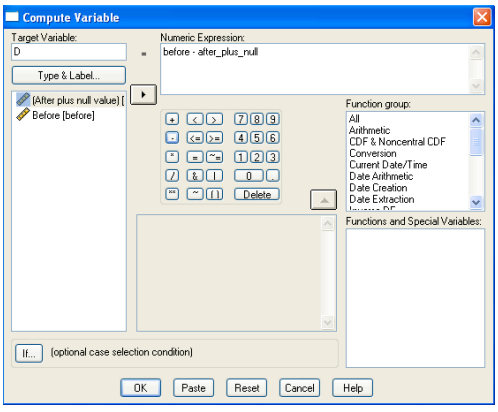
	Subject											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Before	186	171	177	168	191	172	177	191	170	171	188	187
After	188	177	176	169	196	172	165	190	165	180	181	172

1. Enter the "After plus null value" data values into one variable (add the null value, zero, to each of the "After" values) and the "Before" data values into another variable *(see left figure, below)*. If you want your differences to be "Before – After – null value", then you must put the "after plus null value" values in the first column and the "before" values in the second column. Note that the row/case numbers correspond to the subject numbers, as in the table above.

	after_plus_null	before
1	188	186
2	177	171
3	176	177
4	169	168
5	196	191
6	172	172
7	165	177
8	190	191
9	165	170
10	180	171
11	181	188
12	172	187

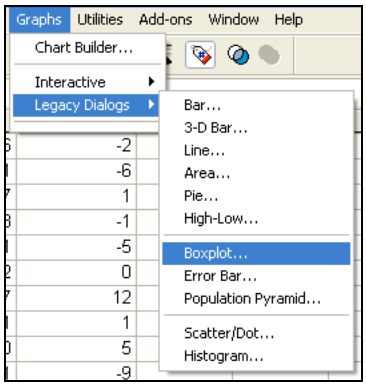
2. Next you need to create the differences, D, so that you can check the symmetric distribution assumption by checking a boxplot of the differences. Select "Compute Variable…" under the "Transform" menu *(see right figure, below)*. Name the target variable "D" with numeric expression "before – after_plus_null" before clicking "OK" *(see middle figure, below)*. The results of the computations will appear in the Data Window *(see right figure, below)*.

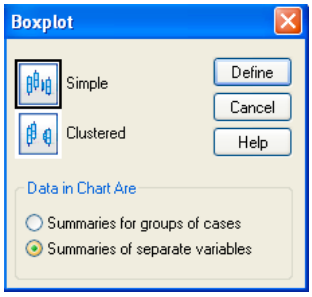


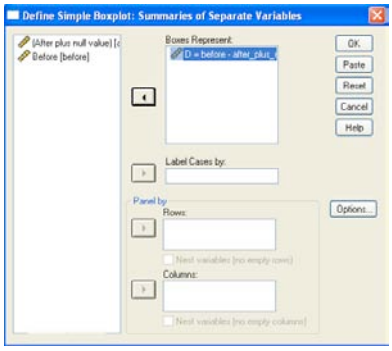


	after_plus_null	before	D
1	188	186	-2
2	177	171	-6
3	176	177	1
4	169	168	-1
5	196	191	-5
6	172	172	0
7	165	177	12
8	190	191	1
9	165	170	5
10	180	171	-9
11	181	188	7
12	172	187	15

3. Next you can check the symmetric distribution assumption by checking a boxplot of the differences. Select "Boxplot…" under the "Legacy Dialogs" section of the "Graphs" menu *(see right figure, below)*. Select "Simple" and "Summaries of separate variables" before clicking "Define" *(see middle figure, below)*. The variable to be graphed should be "D" *(see right figure, below)*.

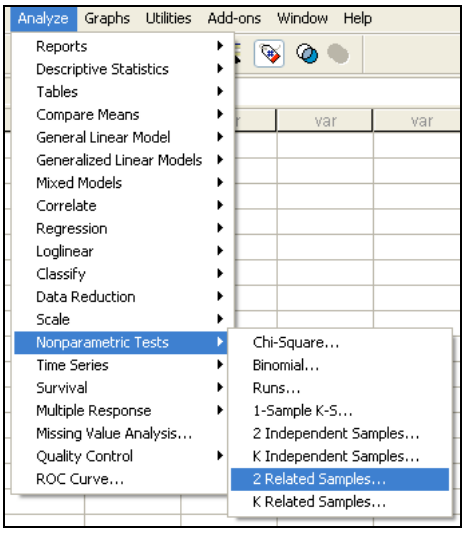


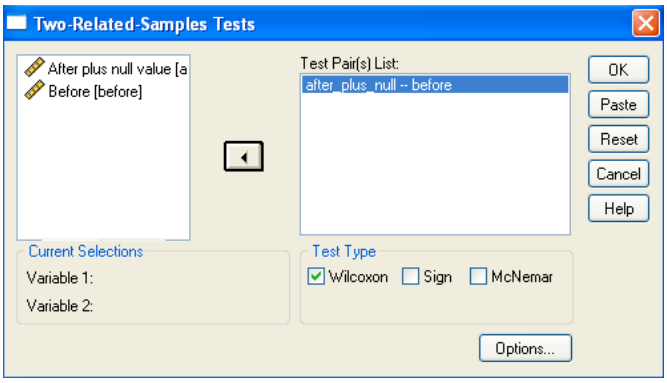




4. Select Analyze → Nonparametric Tests → 2 Related Samples … *(see left figure, above)*.

5. Select "After plus null value" and "Before" 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 right figure, below)*.





6. Your output should look like this.

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
Before - (After plus null value)	Negative Ranks	5[a]	5.5000	27.5000
	Positive Ranks	6[b]	6.4167	38.5000
	Ties	1[c]		
	Total	12		

a. Before < (After plus null value)
b. Before > (After plus null value)
c. Before = (After plus null value)

Test Statistics[b]

	Before - (After plus null value)
Z	-.4902[a]
Asymp. Sig. (2-tailed)	.6240

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

7. 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: $\mu_{Before} = \mu_{After}$ or H_0: $\mu_{Before} - \mu_{After} = 0$ or $H_0 : \mu_D = 0$

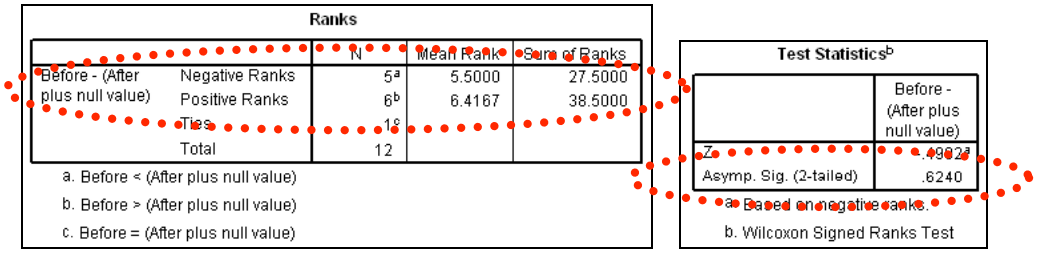
H_a: $\mu_{Before} > \mu_{After}$ H_a: $\mu_{Before} - \mu_{After} > 0$ $H_a : \mu_D > 0$

Note: *D* = *Before* – (*After* + 0) (If there is a weight reduction, D > 0.)

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

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

Step 4: **Test Statistic**



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

S-RS = (sum of positive ranks) – (sum of negative ranks) = 38.50 – 27.50 = 11
p-value = $\frac{1}{2}$Asymp. Sig. (2-tailed) = $\frac{1}{2}$(0.6240) = 0.3120
[If the test were two-tailed, the *p*-value would be Asymp. Sig. (2-tailed).]

Step 5: **Decision**
Since *p*-value = 0.312 > 0.05, we fail to reject the null hypothesis.

Step 6: **State conclusion in words**
At the level $\alpha = 0.05$ of significance, there is not enough evidence to conclude that the plan was successful.