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
13		

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*).

	Compute Variable						
Transform Analyze Graphs Utilities Add-ons	Target Variable:	Numeric Expression: before - after_plus_null					
Compute Variable	Type & Label				after_plus_null	before	D
Count Values within Cases	(After plus null value) [		Function group:		188	186	-2
Recode into Same Variables	Before [before]		All Arithmetic	2	2 177	171	-6
Recode into Different Variables			CDF & Noncentral CDF Conversion		3 176	177	1
Automatic Recode			Date Arithmetic	4	1 169	168	-1
Visual Binning			Date Extraction	≥ 5	5 196	191	-5
Rank Cases			Functions and Special Variab	les: E	i 172	172	0
				7	165	177	12
Date and Time Wizard				8	3 190	191	1
Peolece Missing Values				9	9 165	170	5
Random Number Generators				10	) 180	171	-9
	If (optional case selection	condition)		11	181	188	7
Run Pending Transforms Ctrl+G	ОК	Paste Reset Ca	ancel Help	12	2 172	187	15
180.0 171				4.5			

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  $\rightarrow$  Nonparametric Tests  $\rightarrow$  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*).

Analyze Graphs Utilities	Add-ons Window Help		
Reports Descriptive Statistics Tables Compare Means General Linear Model Generalized Linear Models Mixed Models	r var var	Two-Related-Samples Tests	×
Correlate Regression Loglinear Classify Data Reduction Scale		After plus null value [a     After plus null value [a     Before [before]	OK Paste Reset Cancel
Nonparametric Tests Time Series Survival	Chi-Square Binomial Runs	- Current Selections	Help
<ul> <li>Multiple Response</li> <li>Missing Value Analysis</li> <li>Quality Control</li> </ul>	1-Sample K-S     2 Independent Samples     K Independent Samples	Variable 1: ✓ Wilcoxon Sign McNemar Variable 2:	
ROC Curve	2 Related Samples K Related Samples	Options	j

6. Your output should look like this.



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

<u>Step 0</u> :	<b>Check Assumptions</b> The boxplot appears roughly symmetric, so the symmetry assumption appears to be met.									
<u>Step 1</u> :	Hypotheses $H_0: \mu_{Before} = \mu_{After}$ $H_0: \mu_{Before} - \mu_{After} = 0$ $H_0: \mu_D = 0$ $H_a: \mu_{Before} > \mu_{After}$ or $H_a: \mu_{Before} - \mu_{After} > 0$ or $H_a: \mu_D > 0$									
<u>Step 2</u> :	<b>Note:</b> $D = Before - (After + 0)$ (If there is a weight reduction, $D > 0$ .) <b>Significance Level</b> $\alpha = 0.05$									
<u>Step 3</u> : <u>Step 4</u> :	Rejection Region Reject the null hypothesis if <i>p</i> -value ≤ 0.05. Test Statistic									
	Ranks									
	No       Mefan Rank       Sum of Banks         Before - (After Negative Ranks       54       5.5000       27.5000         plus null value)       Positive Ranks       64       6.4167       38.5000         Total       12       12       12       24.01         a. Before < (After plus null value)       .6240       .6240       .6240         b. Before > (After plus null value)       .       .       .       .         c. Before = (After plus null value)       .       .       .       .         b. Before = (After plus null value)       .       .       .       .									

*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.