Non-parametric methods:
The Sign Test in SPSS

In this document we introduce nonparametric tests. Especially we focus on the 'Sign test' that can be used as an alternative to matched pairs t-test.

Consider 'Schizophrenia' example where volume of left hippocampus region in brain was measured for 15 pairs of twins. One twin was affected by schizophrenia while other was not.
We have to input these data manually since there is no data file for this example. So open a new file in SPSS and click on 'Variable View' button, here we introduce two variables:

Next in the 'Data View' section we enter the observations:

The goal is test if the means of these two variables ('Unaffect' and 'Affected') are the same or not, equivalently whether the difference between two means is zero or not. Since this is a matched pair example, we go to **Analyze > Compare Means > Paired-Sample T Test**
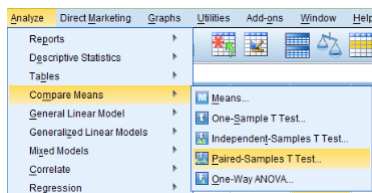
Now using arrow move 'Unaffect' to first column and 'Affected' to second (we use only pair 1):
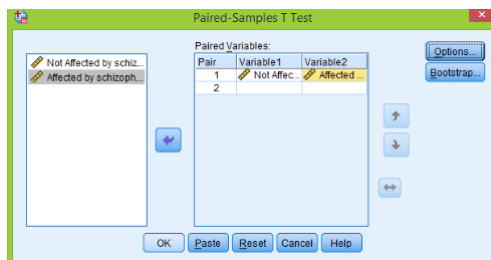
Click **OK** and the following table is produced:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Not Affected by schizophrenia	1.7587	15	.24242	.06259
	Affected by schizophrenia	1.5600	15	.30126	.07778

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Not Affected by schizophrenia & Affected by schizophrenia	15	.635	.011

Paired Samples Test

|		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Not Affected by schizophrenia - Affected by schizophrenia	.19867	.23829	.06153	.06670	.33063	3.229	14	.006

The two sided p-value is 0.006 and therefore we reject null hypothesis and conclude that means are not the same. However we should not use paired t-test without checking some conditions. In order to use t-test, the pairs have to be independent and distribution of differences approximately normal. We assume that the first condition is satisfied by design but to check second condition we have to analyze the differences. Let's first compute variable of differences by going to **Transform > Compute Variable**, call new variable 'Diff' and enter a simple expression:

Target Variable: Diff = Numeric Expression: Unaffect - Affected
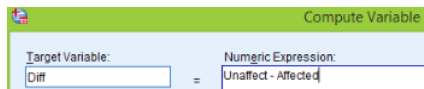
Click **OK**, the new column is computed:

| Unaffect	Affected	Diff
1.94	1.27	.67
1.44	1.63	-.19
1.56	1.47	.09
1.58	1.39	.19
2.06	1.93	.13
1.66	1.26	.40
1.75	1.71	.04
1.77	1.67	.10
1.78	1.28	.50
1.92	1.85	.07
1.25	1.02	.23
1.93	1.34	.59
2.04	2.02	.02
1.62	1.59	.03
2.08	1.97	.11

Once we have variable of differences we can easily make a boxplot of this variable (**Graph > Chart Builder > Boxplot**):
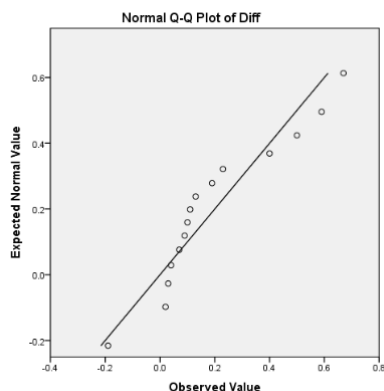
GGraph
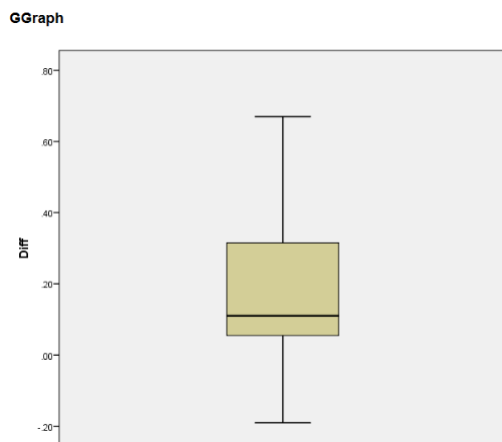
We observe that the boxplot is skewed to the right. Also we can check normality using quantile-quantile plot. Go to **Analyze > Descriptive Statistics > Q-Q Plots**
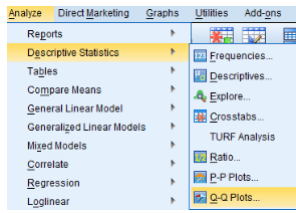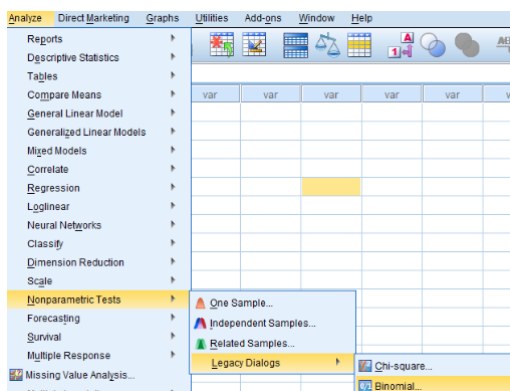
Move 'Diff' to the 'Variables' section:
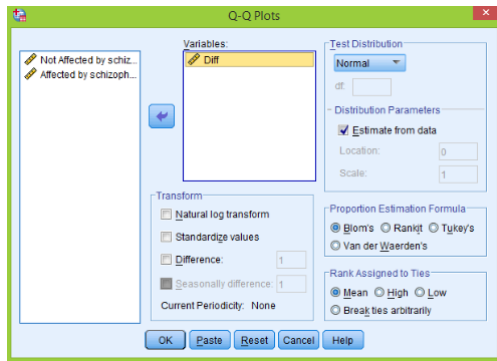
Click **OK** and two plots are created, we need only the first one:

We see that points depart from the straight line and therefor we cannot assume that the distribution of differences is nearly normal and therefore t-test may not be appropriate.

We can however compare these two groups using the sign test (exact binomial) rather than t test. To use sign test we do not have to assume normally of differences. For the sign test we only need to know number of positive and negative differences, the magnitudes of differences are not used at all. There is a built-in function in SPSS for the sign test, go to **Analyze > Nonparametric Tests > Legacy Dialogs > Binomial**:

Move 'Diff' to 'Test Variable List' section, also in 'Define Dichotomy' option select 'Cut point' and enter 0, since we need number of positive and negative differences:
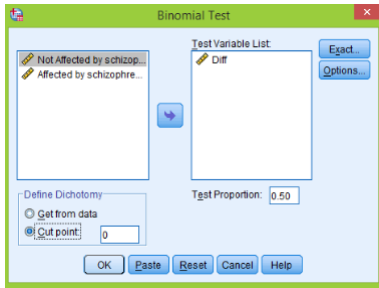
To finish click **OK**, here are the results:

NPar Tests

Binomial Test

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Diff	Group 1	<= 0	1	.07	.50	.001
	Group 2	> 0	14	.93		
	Total		15	1.00		

We see that we have 14 positive and 1 negative differences. The two sided p-value for this test is 0.001, we reject null hypothesis and conclude that two groups have different means.