

## How to run a Paired t test in SPSS

In this example, we want to test the claim that the typical number of cacti per square km in Tucson, AZ in the year 2001 is less than the typical number of cacti per square km in Tucson, AZ in the year 1970 (the number of cacti are measured on the same plots in the two years). The differences in the number of cacti will be calculated as  $\#cacti_{2001} - \#cacti_{1970}$ . Here are the hypotheses:

$$H_a: \mu_d < 0$$

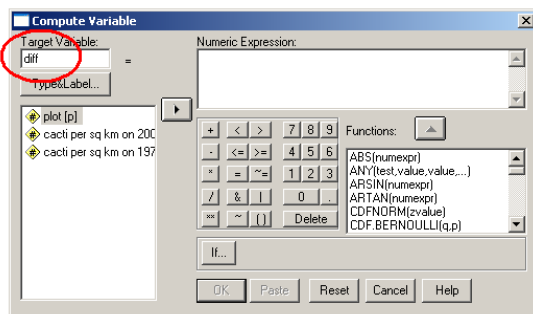
$$H_o: \mu_d \geq 0$$

where  $\mu_d$  = the mean difference in the number of cacti on all plots in Tucson, calculated as  $\#cacti_{2001} - \#cacti_{1970}$

The data set is called '**cactus**' and can be found on the class website.


1) **First, you need to calculate the differences to get the plots necessary for checking conditions.** To do this, in SPSS go to Transform→Compute



2) Enter the name of your difference variable, (in this case it's "diff") in the "target variable" box.

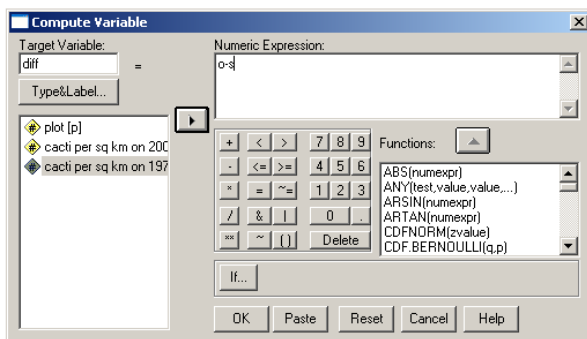


3) Enter in the formula for the difference in the "Numerical Expression" box. In this example, we want the formula to be

$$\text{difference variable} = \#cacti_{2001} - \#cacti_{1970}$$


You can move variables into the "Numeric expression" box by highlighting them and clicking the right arrow button, . You can get the minus sign in the expression by typing it on your keyboard or clicking the minus button in the window. In this example,

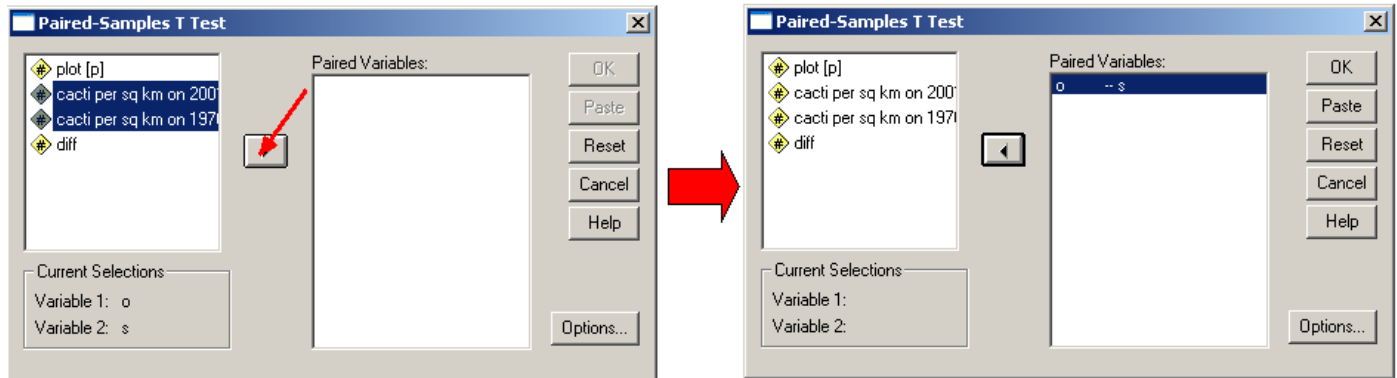
- the variable *cacti per sq km in 2001* is highlighted and moved to the numeric expression box by clicking the right arrow button, .
- then the minus sign is typed on the keyboard,
- then the variable *cacti per sq km in 1970* is highlighted and moved into the numeric expression box by clicking the right arrow button, .
- Once this is done, you see "o - s" in the "Numeric Expression" box.



4) Click OK, and you see the new variable, diff, in the SPSS data view. Now you can construct a histogram, NQ pot, and box plot of this new variable, diff, to see if a paired t test is appropriate

5) To run the paired t test, in SPSS, go to Analyze→Compare means→Paired samples T test...

6) Click the both variables, then click the right arrow button, , to move it to the Paired Variable(s) list. It should give the numeric expression for how SPSS will calculate the differences for the test. Note: there is no way to tell SPSS how you would like the differences calculated. For example, no matter what you do, it is calculating these differences as  $\#cacti_{2001} - \#cacti_{1970}$  (it should say "o - s").



7) Click "OK"

8) Your output should look like this:

## T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	cacti per sq km on 2001	680.6000	15	153.53120	39.64158
	cacti per sq km on 1970	683.3333	15	153.36868	39.59962

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	cacti per sq km on 2001 & cacti per sq km on 1970	15	1.000	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	cacti per sq km on 2001 - cacti per sq km on 1970	-2.7333	2.96327	.76511	-4.3743	-1.0923	-3.572	14	.003

p-value for test of

$$H_a: \mu_d \neq 0$$

$$H_o: \mu_d = 0$$

To get the p-value for  $H_a: \mu_d < 0$   $H_o: \mu_d \geq 0$ , we need to divide this p-value by 2 (since the sample mean difference is  $-2.7333$  and this supports  $H_a$ ). Therefore, the p-value is  $0.003/2 = 0.0015$ .

**Note!** If we were testing  $H_a: \mu_d > 0$   $H_o: \mu_d \leq 0$  the correct p-value would be  $1 - 0.003/2 = 0.9985$  since in this case, the sample mean difference would support  $H_o$ .