

Psychology 310
Lab 7
T-Tests on Means

For this lab, you can use either syntax or the pull-down menus, though if you use the menus, you need to *Paste* what you do into a syntax window. Menus and syntax can accomplish many of the same tasks, but there are actually quite a few tasks that can only be done using syntax (though not in this lab). Syntax is also useful in that it can be saved and the analyses readily repeated or modified at some later date.

KEY INFO: For the following analyses, use 2-tailed tests and $\alpha = .05$. *SPSS* gives an actual significance value in the output (“Sig.”). This is often referred to as a “*p*-value” and is the “conditional probability that a relationship as strong as the one observed in the data would be present, if the null hypothesis were true.” On *SPSS* output, there are no critical values of the test statistics displayed so you will decide to retain or reject the null hypothesis using the *p*-values.

If $p \leq \alpha$, then you decide to reject.

If $p > \alpha$, then you decide to retain.

NOTE: The examples in this lab are taken directly from the handout, Cases.pdf. You can use this handout to check your work.

Open the data file, “Lab7.sav”.

1. One Sample

You are interested in testing the hypothesis that the average height of women at Vanderbilt is 65 inches. This is a hypothesis of the form

$$H_0 : \mu = a$$

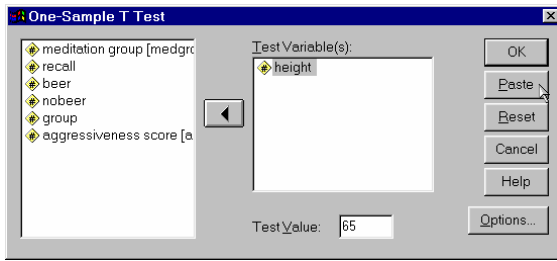
where $a = 65$.

You obtain a sample of size 25, and find $\bar{X} = 65.9$ inches with $s = 2.16$.

The data for this sample are in the variable, “height”.

Menu

Select *Analyze* → *Compare Means* → *One-Sample T Test*. In the window that opens, transfer the variable, “height”, to the *Test Variable(s)* box and change the value in the *Test Value* box to 65 (the value of the constant, a , in your null hypothesis). Then click *OK*.



Your Output should look like this:

One-Sample Test

	Test Value = 65					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper	
HEIGHT	2.083	24	.048	.9000	.0084	1.7916	

Confidence Interval: SPSS gives you a 95% confidence interval [CIN(.95)], but it is around the difference between your hypothesized and actual means, *not* around \bar{x} .

NOTE: You may need to COMPUTE the upper and lower limits of the confidence interval separately. The formula is

$$\bar{X}_0 \pm t_{crit}^* \frac{s}{\sqrt{n}}$$

where, in this case, $t_{crit}^* = 2.064$.

Decision: Looking at your output, what decision will you make regarding the null hypothesis in this situation? What will you base this decision on? (HINT: One way is to look at the *p*-value.) Please type your answer into the output window.

2. Two Independent Samples

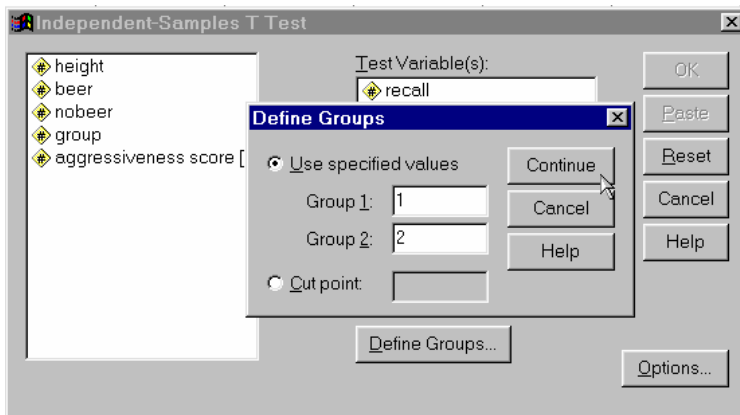
Transcendental Meditation and Memory. Transcendental Meditation (TM) is a meditation technique that was publicized widely in the 1970's. Many benefits were claimed by its adherents, and improved memory was one of them. To test the hypothesis that TM improves memory, we conduct a two group experiment, in which one group receives TM training, the other group a similar type of training (which we'll call OM for "other meditation"). OM is claimed by the skeptical to be equivalent to TM, but TM adherents claim that it is clearly an inferior meditation technique. Ten subjects are randomly selected for each group. All subjects receive training, followed by a standard memory recall task.

The data for this experiment are contained in the variables, *medgroup* and *recall*. Note how the data are laid out. For tests on independent samples, one variable needs to identify which group each particular subject belongs to and one needs to contain the his

or her scores on the dependent variable. In this case, subjects assigned to the TM group receive a label of “1” in *medgroup* and subjects in the OM group receive a label of “2”.

Menu

Select *Analyze* → *Compare Means* → *Independent-Samples T Test*. In the window that opens, transfer the variable, “recall”, to the *Test Variable(s)* box and the variable, “medgroup”, to the *Grouping Variable* box. Next, click on *Define Groups* and in the new box that opens up, enter a “1” next to *Group 1* and a “2” next to *Group 2*. This simply tells SPSS how we have coded the two groups we wish to compare. Click *Continue* followed by *OK*.



NOTE: For the purposes of this lab, assume equal variances for this analysis and the analysis in section 4 (though look closely at the results of both sections and note if and where they diverge).

Confidence Interval: The confidence interval provided in the output is the one you want (and the same as the one in the handout) so you don’t need to compute it on your own.

Decision: Again, looking at your output, what decision will you make regarding the null hypothesis in this situation? What will you base this decision on?

3. Two Dependent Samples

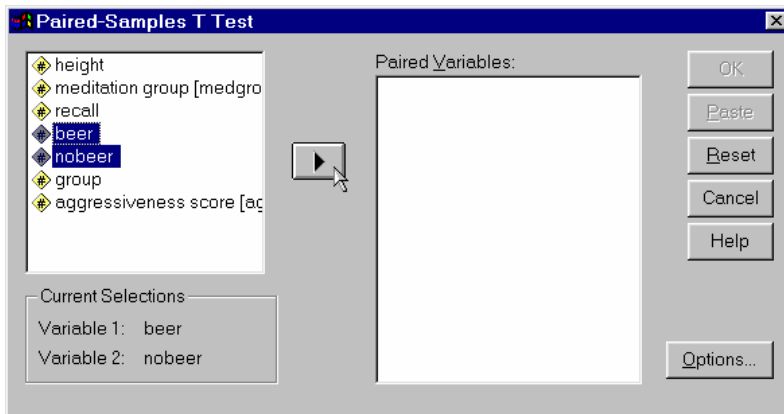
Suppose you have a hypothesis that, because of the interesting metabolic characteristics of statistics students, consumption of beer has absolutely no effect on their cognitive capacities. You decide to test this hypothesis by having each of 10 randomly selected students play games of “Night-Mission Pinball” either sober, or immediately after consuming 3 beers. (To control for practice effects, order is counterbalanced.)

The data for this experiment are contained in the variables, *beer* and *nobeer*. **Again note how the data are laid out.** For tests on dependent samples, there is no “marker” variable

like *medgroup*. Instead, each variable contains the scores on one of the dependent variables.

Menu

Select *Analyze* → *Compare Means* → *Paired-Samples T Test*. In the window that opens, click on the variable, *beer*, and then *nobeer*. When both are highlighted, click the box with the right arrow to transfer them to the *Paired Variables* box. Then click *OK*.



Bonus Question (for a feeling of mastery, but not marks): Using the data from these two dependent samples, how would you use SPSS to do the one-sample test that corresponds to this test?

Confidence Interval: Again the confidence interval provided in the output is the one you want.

Decision: Same questions as above.

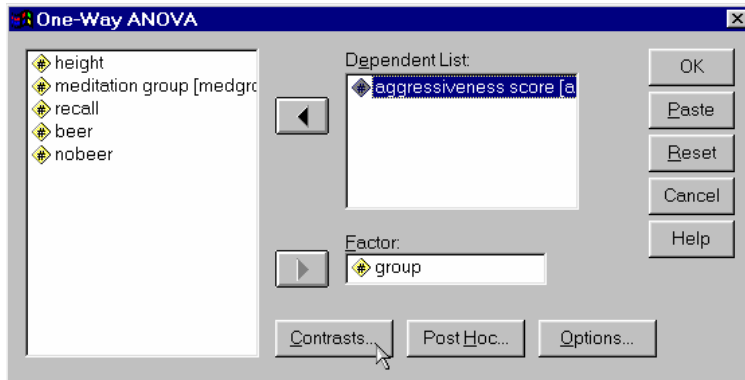
4. K Independent Samples

Suppose you wished to compare a control group with the average of 3 experimental groups. An example might occur in the following context. 3 groups of subjects view 3 *different* violent movies, while a 4th group views a “Control” (non-violent) movie. You want to test the hypothesis that the average of the 3 “Experimental” group means does not differ from the “Control” group mean on a measure of “aggressiveness” taken just after the viewing of the movie.

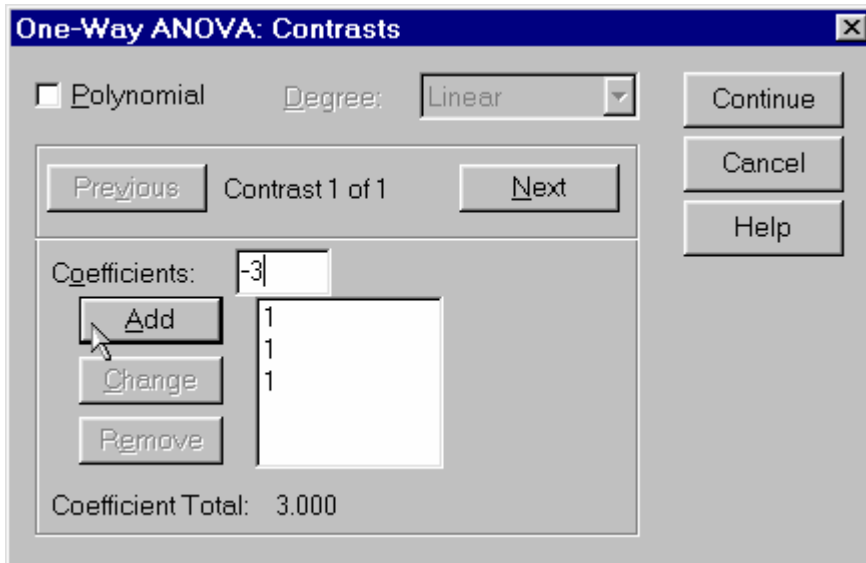
The data for this experiment are contained in the variables, *group* and *aggress*. Note that the data are laid out in the same manner as in the 2 independent samples case with one variable containing group membership information and the other containing the scores on the dependent variable. In this case, subjects assigned to the experimental groups receive labels of “1”, “2”, or “3” and subjects in the control group receive a label of “4”.

Menu

The T-Test on a linear combination (also known as a “contrast” in the following analysis) of the means of K independent samples is accessed in a somewhat different way from the other tests you’ve seen to this point. You have to look in the realm of the one-way ANOVA to find it. Select *Analyze* → *Compare Means* → *One-Way ANOVA*. In the window that opens, transfer the variable, “aggress”, to the *Dependent List* box and the variable, “group”, to the *Factor* box.



Next, click on *Contrasts* and enter the linear weight (also known as a “contrast coefficient”) for each group into the box next to *Coefficients*. Do this by entering the linear weight for the first group (i.e., 1) and then clicking *Add* before entering the weight for the second group (i.e., 1). Click *Add* again and repeat this procedure for the last two groups (whose weights are 1 and –3, respectively).



Click *Continue* followed by *OK*.

NOTE: The output resulting from running this analysis should be in the form of three tables. Ignore the first one, entitled “ANOVA”, for now. We will get to that in the next lab. Look briefly at the second table, entitled “Contrast Coefficients”, to confirm that you entered the linear weights correctly. The third table is where the action is for the purposes of this lab. It provides you with the test on the linear combination / contrast that you’ve just run and most of the information you require to calculate the confidence interval.

Confidence Interval: Unfortunately, *SPSS* can’t seem give us the confidence interval we want for this test. So using either syntax or the menus, calculate a confidence interval around κ . NOTE: You may need to COMPUTE the upper and lower limits of the confidence interval separately. The formula is

$$\kappa \pm t_{crit}^* \sqrt{\hat{\sigma}_K^2}$$

where t_{crit}^* is 1.9921 and the rest of the information is in the third table. (HINT: κ and $\sqrt{\hat{\sigma}_K^2}$ appear in the table as their alter egos, “Value of Contrast” and “Std. Error”, respectively.)

Decision: Same questions as above.

HAND IN: Your output and data files.