

Spss Lab 7: T-tests Section 1

In this lab, we will be using everything we have learned in our text and applying that information to understand t-tests for parametric and nonparametric data.

THERE WILL BE TWO SECTIONS FOR THIS LAB, EACH CONTAINING TASKS TO COMPLETE. SEE ME WHEN YOU FINISHE ONE SECTION TO RECEIVE THE NEXT SECTION.

Task 1: Your Data

Go to our course webpage (<http://laura.goadrich.com/stats/lab.html>). Under the lab section you will find SpiderRM.sav and SpiderBG.sav

The data is arranged as if the same participants were used in each condition (so each participant was exposed to a picture of a spider and their anxiety was measured, and at some other time the same participants were exposed to the real spider and their anxiety was measured again).

Each row in the data editor represents a different participant's data.

1. **Download** SpiderRM.sav (RM is for repeated measures) and SpiderBG.sav (BG is for between group) to your computer to use for the assignment.
2. **Create** a Word file Lab7.doc to put your solutions to the tasks below. Put your name at the top of the file.

Task 2: Dependent t-test

Constructing a dependent t-test is very straightforward in SPSS. Using SpiderRM.sav, access the main dialogue box by

1. Going to Analyze -> Compare Means -> Paired-Samples T Test...
2. Select the **two** variables from the list (at the same time, so they are both highlighted in blue) and move them to the box labeled *Paired Variables* using the arrow.

At this point, if you want to carry out several t-tests then you would select another pair of variables, transfer them to the variables list, and then select another pair and so on.

3. Click on the **Options...** button
4. In the new dialogue box, change the confidence interval to **99%**
5. Click **OK**
6. **Copy** your three charts from the Output window to your Word document.

Answer the following questions in your Word document:

- a. What is the risk of changing the confidence interval from 95% to 99%?
- b. Looking at the first table created, is the Paired Sample Statistics table showing you the results from independent-means or repeated-measures?

- c. Using the results from the same table, Paired Sample Statistics, describe the differences in the data created by the “picture of the spider” and the “real spider.”
- d. Looking at the last table created, is the Paired Sample Test table showing you the results from independent-means or repeated-means?
- e. Using the results from the same table, Paired Sample Test, describe the differences in the data created by the “picture of spider” and the “real spider.”
- f. Using what you have learned, on average, which participants experienced significantly greater anxiety? Justify your answer by discussing the t-score and the chosen alpha value.

Task 3: Independent t-test

Constructing a independent t-test is very straightforward in SPSS. Using SpiderBG.sav, access the main dialogue box by

1. Go to Analyze -> Compare Means -> Independent Samples T Test...
2. Once the dialog box is activated, select the dependent variable from the list (**anxiety**) and transfer it to the box labeled Test Variable(s) by using the arrow.
3. Next select the independent variable (**group**) and then transfer it to the box labeled *Grouping Variable*.
4. Click the button for Define Groups...
5. Enter 0 for the Group 1 (the picture group)
6. Enter 1 for the Group 2 (the real group)
7. Click Continue
8. Click OK
9. Copy your new tables to your Word document.

Answer the following question in your Word document:

- g. What differences do you notice in your Group Statistics table and your Paired Sample Statistics (the first table you copied for the lab) table?

The second table contains the main test statistics. One row is labeled *Equal variances assumed* while the other is labeled *Equal variances not assumed*. This has to do with the equal variance assumption; we only have to pay attention to the first row.

We want to compare the results in Sig.(2-tailed) column with the data in the t column (the t-value).

Answer the following question in your Word Document:

- h. What can you infer about the anxiety caused by the pictures and by real spiders?

Spss Lab 7: T-tests Section 2

Sometimes our data does not fit the normal curve (non-parametric data). In class you were given a handout about two tests that are alternatives to our independent t-test and handle nonparametric data.

Task 4: Your Data

For this section, you will need to create your data set with its associated values. The study results that you are entering are from a neurologist that carried out an experiment to investigate the depressant effects of certain recreational drugs. She tested 20 clubbers in all: 10 were given an Ecstasy tablet to take on Saturday night and 10 were allowed only to drink alcohol. Levels of depression were measured using the Beck Depression Inventory (BDI) the day after and midweek.

To create your SPSS data,

1. Open SPSS and create a new Data file.
2. Save the file as lab7.sav
3. Add your variables:

Name	Label
Drug	Type of Drug
sunbdi	Beck Depression Inventory (Sun)
wedbdi	Beck Depression Inventory (Wed)

4. And your associated values:

Drug	sunbdi	wedbdi
Ecstasy	15	28
Ecstasy	35	35
Ecstasy	16	35
Ecstasy	18	24
Ecstasy	19	39
Ecstasy	17	32
Ecstasy	27	27
Ecstasy	16	29
Ecstasy	13	36
Ecstasy	20	35
Alcohol	16	5
Alcohol	15	6
Alcohol	20	30
Alcohol	15	8
Alcohol	16	9
Alcohol	13	7
Alcohol	14	6
Alcohol	19	17
Alcohol	18	3
Alcohol	18	10

Task 5: Understanding simplified data

(To understand this section, you must read the packet I gave you covering the Wilcoxon and Mann-Whitney tests.)

Both of the tests you are about to do work very similarly. First imagine that there is no difference in depression levels between Ecstasy and Alcohol users. Suppose we were to rank the data ignoring the group to which a person belonged from lowest to highest (i.e. give the lowest score a rank of 1 and the next lowest a rank of 2 etc.).

Answer the following question in your word document:

- i. If you summed the ranks of both groups separately (given the above conditions), what number of high and low ranks would you expect in each group?
- j. What about the summed total of ranks in each group?

Now let's think about what would happen if there was a difference between the groups. Let's imagine that people in the Ecstasy group are more depressed than the people in the Alcohol group.

Answer the following question in your word document:

- k. If you summed the ranks of both groups separately (given the above conditions), what number of high and low ranks would you expect in each group?
- l. What about the summed total of ranks in each group?

The Mann-Whitney and Wilcoxon rank-sum tests both work on this principle. In fact, when the groups have unequal numbers of participants in them then the test statistic for Wilcoxon's rank-sum test is simply the sum of the ranks in the group that contains the fewer people; when the group sizes are equal it's the value of the smaller summed rank.

Task 6: Understanding our data

Let's apply this ranking idea to our data set and watch what happens. First we will need to add some more variables to lab7.sav

1. After sunbdi, add **sunRank** and **sunActualRank**.
2. Similarly after wedbdi, add **wedRank** and **wedActualRank**.
3. Sort the Wednesday scores in ascending order
4. Now assign ranks in **wedRank** from 1 (for the smallest value) to 20 (for the largest value)

Now we want to assign the actual ranks for the **wedbdi** values. This will not always match up with the **wedRank** values because when the scores occur more than once in the data set (e.g. in these data a score of 6 occurs twice and a score of 35 occurs three times). These *tied ranks* need to be given all the same

rank. So assign a rank that is the average of the potential ranks for those scores. For example, with the 6s, you would take $(3 + 4)/2=3.5$; so under **wedActualRank** for the **wedbdi** values of 6 and 6, you would type 3.5 and 3.5

5. Assign the appropriate values for **wedActualRank**

After you've ranked the data, add up all the ranks for the two groups.

Answer the following questions in your Word document:

- m. What is the sum of ranks for the Alcohol group?
- n. What is the sum of ranks for the Ecstasy group?

We take the lowest of these sums to be our test statistic.

Answer the following questions in your Word document:

- o. So, what is the test statistic for Wednesday?

Repeat the process above (steps 1-5) to calculate **sunRank** and **sunActualRank**.

In SPSS Data View, select all your data and copy it (Edit -> Copy). Go to your Word Document and paste the data into it (Edit -> paste). With the data still highlighted, create a table around it (Table -> Insert -> Table)

Answer the following questions in your Word document (about the Sunday group):

- p. What is the sum of ranks for the Alcohol group?
- q. What is the sum of ranks for the Ecstasy group?
- r. So, what is the test statistic for Sunday?

Task 7: Significance using the Wilcoxon rank-sum test

Now we need to determine whether this test statistic is significant. Given

n_1 is the sample size of group 1 (Alcohol) and

n_2 is the sample size of group 2 (Ecstasy)

Calculate the mean = $\frac{n_1(n_1 + n_2 + 1)}{2}$

And standard error = $\sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$

Answer the following questions in your Word document:

- s. What is the mean and standard error?
- t. Now use a z-score to convert the test statistic to a z-score for both Sunday and Wednesday.
- u. What is your critical value when $p < 0.05$ for a two-tailed test?

- v. Is there a significant difference between the groups on Wednesday and/or Sunday?

Task 8: Significance using the Mann-Whitney test

This test is basically the same to with Wilcoxon rank-sum test, but your significance formulas will be reduced to one.

Given

n_1 is the sample size of group 1 (Alcohol) and

n_2 is the sample size of group 2 (Ecstasy)

R_1 = the sum of ranks for Ecstasy data for the given day

R_2 = the sum of ranks for Alcohol data for the given day

Test statistic for the Alcohol data: $n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$

Test statistic for the Ecstasy data: $n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_2$

Answer the following questions in your Word document:

- w. What is the value for the test statistic for the Sunday Ecstasy data?
- x. What is the value for the test statistic for the Sunday Alcohol data?
- y. Using the Mann-Whitney U table (Appendix B.9A in your text), what is your critical value when $p < 0.05$ for a two-tailed test?
- z. Is there a significant difference between the Ecstasy and Alcohol groups on Sunday?
- aa. Repeat the above analysis (w through z) for Wednesday.

Task 9: Mann-Whitney U-test & Wilcoxon signed-ranks test

Now let's have SPSS do the work for us.

1. Open your lab7.sav
2. Click on Analyze -> Nonparametric Tests -> 2 Independent Samples...
3. Add **sunbdi** and **wedbdi** to the box labeled *Test Variable List* by highlighting the variable and clicking the arrow.
4. Select **drug** as the independent variable by highlighting it and clicking the appropriate arrow to move it to the box labeled *Grouping Variable*.
5. Click on the *Define Groups...* button

SPSS needs to know what numeric codes you assigned to your two groups. We coded the Ecstasy group as 1 (so put a 1 in *group 1*) and the Alcohol group as 2 (so put a 2 in *group 2*).

6. Click **Continue**
7. Under Test Type, you should have a **check mark** next to Mann-Whitney U
8. Click **OK**

Copy your two charts from your output window to your Word document.

Answer the following questions in your Word document:

- bb. Looking at the charts you copied, do your results from task 7 & 8 match (if not they should)?
- cc. How can you determine if there was a significant difference based on the charts alone?

Task 10: Wrap-up

Print out Lab7.doc and sign the honor code.

Turn in your electronic version of Lab7.doc via blackboard and the paper copy to Laura by the end of the lab session.