

**Assignment 19: t Test for Two Independent Groups**  
**Psych 6250**  
**Spring, 2010**

1. The t test for two independent groups is an appropriate tool to use to analyze your data when you want to determine whether (select all that apply)
  - a. two populations have different variances
  - b. two populations have different means
  - c. three or more populations have different means
  
2. If two populations have identical means (select one)
  - a. the two sample means will also be identical
  - b. the two sample means will probably differ at least a little due to random sample error
  
3. The null and alternative hypotheses are always about:
  - a. samples
  - b. populations
  
4. In an experiment to determine whether or not a person is talking on a cell phone affects the number of driving errors they make, what is the independent variable?
  - a. The number of driving errors they make.
  - b. Whether or not they are talking on a cell phone.
  - c. The effect of talking on a phone on driving errors.
  
5. In an experiment to determine whether or not a person is talking on a cell phone affects the number of driving errors they make, what is the dependent variable?
  - a. The number of driving errors they make.
  - b. Whether or not they are talking on a cell phone.
  - c. The effect of talking on a phone on driving errors.
  
6. In a study to determine whether the temperature of the planet is affected by the amount of CO<sub>2</sub> released into the atmosphere, what is the independent variable:
  - a. Amount of CO<sub>2</sub> released.
  - b. Temperatures on the planet.
  
7. In a study to determine whether the temperature of the planet is affected by the amount of CO<sub>2</sub> released into the atmosphere, what is the dependent variable:
  - a. Amount of CO<sub>2</sub> released.
  - b. Temperatures on the planet.

**Story Problem:** A researcher is interested in whether the upper reaches of a (long) river differ from the lower reaches in terms of the number of alligators found along the banks. He randomly samples 40 one-mile stretches of river in the upper area and 40 one-mile stretches in the lower area. The number of alligators found in each one-mile stretch is recorded. The data are given below:

Group 1--Upper Area:  $M=14.28$     est.  $\sigma^2=15.49$      $N=40$   
Group 2--Lower Area:  $M=15.78$     est.  $\sigma^2=18.28$      $N=40$

8. Which of the following would be appropriate ways of writing the null hypothesis? (select all that apply)

- a.  $\mu_{\text{upper}} = \mu_{\text{lower}}$
- b.  $\mu_1 \neq \mu_2$
- c.  $M_1 = M_2$
- d.  $\mu_1 = \mu_2$

9. Which of the following would be appropriate ways of writing the alternative hypothesis? (select all that apply)

- a.  $\mu_{\text{upper}} \neq \mu_{\text{lower}}$
- b.  $\mu_1 > \mu_2$
- c.  $\mu_1 \neq \mu_2$
- d.  $M_1 \neq M_2$

10. If the null hypothesis in this experiment is true, then the expected (mean) value of  $(M_1 - M_2)$  will equal \_\_\_\_\_ (numeric answer)

11. What is the independent variable of this experiment?

- a. upper vs. lower river
- b. number of alligators

12. What is the dependent variable of this experiment?

- a. upper vs. lower river
- b. number of alligators

13. Compute the pooled estimate of the variance of the populations.  $\text{est.}\sigma^2 =$  \_\_\_\_\_

14. Estimate the standard error of the difference between  $M_1$  and  $M_2$ .

$\text{est.}\sigma_{(M_1 - M_2)} =$  \_\_\_\_\_

15. Compute the difference between  $M_1$  and  $M_2$ . \_\_\_\_\_

16. Compute the value of  $t$ .  $t =$  \_\_\_\_\_

17. Compute the degrees of freedom.  $df =$  \_\_\_\_\_

18. State the  $p$  value (use the  $t$  Distribution Tool):  $p =$  \_\_\_\_\_

19. State your decision regarding  $H_0$ :

- a. I reject  $H_0$
- b. I accept  $H_0$
- c. I do not reject  $H_0$

20. The difference between the sample means (upper and lower river) was...

- a. not statistically significant.
- b. statistically significant.

21. Which of the following is correct

- a. I can conclude that the population means were different.

- b. I can not determine whether or not the population means were different.
- c. I can conclude that the population means were the same.

22. Given your decision about  $H_0$ , if you happen to be incorrect what type of error would that be:

- a. type 1 error
- b. type 2 error

**Story Problem:** The goal of this experiment is to examine whether how deeply students 'process' a word influences how well they remember it. Group 1 (the rhyming group) is given a list of words to read, and for each word they have to say whether the word rhymes with the word 'gate'. Group 2 (the semantic group) is given the same list, and for each word they have to say whether it is a noun or verb. The subjects are then asked to recall as many of the words from the list as they can, the number of words they correctly recall is recorded.

The idea behind these tasks is that determining whether a word rhymes with another word does not take very deep processing of the word, the subject only has to know what the word sounds like, but determining whether a word is a noun or a verb involves accessing what the word means and how it is used in a sentence, which involves a deeper processing of the word which may affect how well the word is remembered.

23. Which of the following would be the appropriate way(s) of writing the null hypothesis?

- a.  $M_1 \neq M_2$
- b.  $\mu_1 \neq \mu_2$
- c.  $M_1 = M_2$
- d.  $\mu_1 = \mu_2$

24. Which of the following would be the appropriate way(s) of writing the alternative hypothesis?

- a.  $M_1 \neq M_2$
- b.  $\mu_1 \neq \mu_2$
- c.  $M_1 = M_2$
- d.  $\mu_1 = \mu_2$

25. If the null hypothesis is true, then the expected (mean) value of  $(M_1 - M_2)$  will equal \_\_\_\_\_

26. What is the *dependent* variable of this experiment?

- a. rhyming task versus semantic task
- b. number of words remembered

27. What is the *independent* variable of this experiment?

- a. rhyming task versus semantic task
- b. number of words remembered

The data are available in the file 'Depth.sav'. Notice how the data are set up. Each subject has two scores, one is their score on the independent variable ('Group') and the

other is their score on the dependent variable ('Y'). Analyze the data using SPSS, go to the Analyze>>Compare Means>>Independent Samples t Test. The 'Grouping Variable' is (gasp) 'Group', while the 'Testing Variable' is the dependent variable. After you designate the grouping variable you will need to let SPSS know that the two groups you are interested in are those with scores of '1' and '2' in the grouping variable (this option is in SPSS so that if you have several groups you can indicate the two you want to analyze with the t test). When viewing the output attend to 'equal variances assumed', we will cover equal variances not assumed in a later lecture.

28, 29, 30. Fill in the missing parts of the results:  $t(\text{_____}) = \text{_____}$ ,  $p = \text{_____}$ .  
(don't round)

31. State your decision regarding  $H_0$ :

- a. I reject  $H_0$
- b. I accept  $H_0$
- c. I do not reject  $H_0$

32. The difference between the sample means (rhyming and semantic) was...

- a. not statistically significant.
- b. statistically significant.

33. Which of the following is correct

- a. I can conclude that the population means were different.
- b. I can not determine whether or not the population means were different.
- c. I can conclude that the population means were the same.

34. Given your decision about  $H_0$ , if you happen to be incorrect what type of error would that be:

- a. type 1 error
- b. type 2 error

35. If you reject  $H_0$ , can you conclude that it was the type of task (rhyming versus semantic) that affected the number of words remembered?

- a. Yes, that is what rejecting  $H_0$  means.
- b. That depends upon whether or not there were any confounding variables.

36. In the samples, the semantic group had a greater mean than the rhyming group. What p value would you use to determine whether you can conclude that the mean of the population doing the semantic task would also be greater than the mean of the population doing the rhyming task? \_\_\_\_\_ (numeric answer...don't round)

37. Considering both p values, which of the following can you conclude: (select all that apply)

- a. We cannot conclude that the population means differ.
- b. We can conclude that the population means differ.
- c. We can conclude that the mean of the population doing the semantic task is greater than the mean of the population doing the rhyming task.