**Statistics for Psychology - PSYCH-UH 1004Q)**

**Homework 5**

(The homework assignments will never require you to use R unless the problem explicitly says “use this R code”. For other problems, can use R if you find it useful, they should be completed easily by hand.)

1. a. For a two-sample experiment, *n1* = 14 and *n2* = 9. How many degrees of freedom would be associated with the equal variances (pooled-variance) *t*-test? (1 point)

b. What are the two-tailed critical *t-*values if alpha = .05? (1 point)

c. What are the two-tailed critical *t-*values if alpha = .01? (1 point)

2. The two samples in a psychology experiment both have the same variance, *s2* = 135. What is the pooled variance? (Note: It doesn’t matter how large the groups are or even whether they are the same size.) (1 point)

3. A psychologist is studying the concentration of a certain enzyme in saliva as a possible indicator of chronic anxiety level. The researcher does not know which direction to expect the enzyme to differ between high-anxiety and low-anxiety participants. A sample of 12 participants reporting high anxiety yields a mean enzyme concentration of 3.2 with *s* = 0.7. For comparison purposes, a sample of 20 participants reporting low levels of anxiety is measured and yields a mean enzyme concentration of 2.3, with *s* = 0.4.

You will perform an independent samples *t*-test with alpha = .05, two-tailed, to determine whether the two populations sampled differ with respect to their mean saliva concentration of this enzyme.

1. First, state the null hypothesis in English words. (1 point)
2. Second, state the null hypothesis in mathematical terms (i.e., using the symbol μ with appropriate subscripts to represent the relevant population means as we do in the book and in the slides). (1 point)
3. Show us the formula for the statistical test. (1 point)
4. Show us the formula for pooled variance. (1 point)
5. Calculate the pooled variance. (1 point)
6. Plug the required values into the *t*-test formula, and calculate the *t* statistic. (4 points)
7. Show us the formula for degrees of freedom: (1 point)
8. Plug the correct values into the formula and calculate the degrees of freedom: (1 point)
9. What are the critical *t* values for the df, an alpha of .05, and a two-tailed hypothesis? (1 point)
10. Make a decision, do you reject the null hypothesis or fail to reject the null hypothesis? (1 point)
11. Based on your decision above, what type of error (Type I or Type II) might you be making? (1 point)

5. a. What is the Type II error rate (β) when power is .65? (1 point)

b. What is the Type II error rate (β) when power is .96? (1 point)

c. What is the power when the Type II error rate (β) is .12? (1 point)

d. What is the power when the Type II error rate (β) .45? (1 point)

6. a. If the mean verbal SAT score is 510 for women and 490 for men and σ=100, what is *d*? (2 points)

b. State the formula to calculate *d*. (1 point)

c. Plug in the values and calculate d. (1 point)

7. a. A researcher wants to use the students in his psychology class to assess how fast they are at solving a puzzle when provided with a helpful strategy. The students are divided in two groups: the same puzzle will be presented to both groups, but only one group will be given the strategy for solving the puzzle. The researcher expects the effect size to be approximately a Cohen’s d of 0.9. Calculate the sample size that will lead to a power of 0.8 at α = .05 (one-tailed) for a target effect size of Cohen’s *d* of 0.9. Use the R command power.t.test() to answer. (5 points)

b. Eventually, the researcher finds out that someone else has already run the same study with sample size of 15 per group. They reported a Cohen's *d* of 0.6 at alpha = 0.05 (one-tailed). How much power did the study have? Use the R command power.t.test() to answer this. (5 points)

c. Did the study discussed in (b) have good statistical power based on Cohen’s recommendations? (1 point)

d. Given that we now know the effect size is a Cohen’s *d* of 0.6, what size samples should the researcher run to have good statistical power? Use the R command power.t.test() to answer. (5 points)