Exam 2 Practice Questions
Psych 3101

Vocabulary

Rather than choosing some practice terms at random, I suggest you go through all the terms in the vocabulary lists. The real exam will ask for definitions of 4-5 terms taken from these lists.

Conceptual questions

1. For each of the following experiments, indicate which type of t-test and directionality (one- or two-tailed) would be most appropriate.

A researcher predicts that having pets visit hospital patients will improve medical outcomes. Each patient is randomly assigned to spend time with a therapy dog or not.
t: _____   tails: _____

A new species of slug is discovered. Scientists use a mathematical model based on previous species to predict the new species will have a lifespan of seven months. A set of the new slugs are observed from birth until they die, to test whether the model's prediction is correct.
t: _____   tails: _____

Cognitive dissonance theory predicts that people will adapt their beliefs to match their behavior even if the behavior was not their choice. Subjects in an experiment are assigned to write an essay advocating torture of small animals, and their attitudes toward squirrels are measured both before and after writing, to test whether those attitudes become more negative.
t: _____   tails: _____

2. What does the Central Limit Theorem say about the *shape* of the distribution of sample means?
_____

Under what condition(s) does this apply?
_____

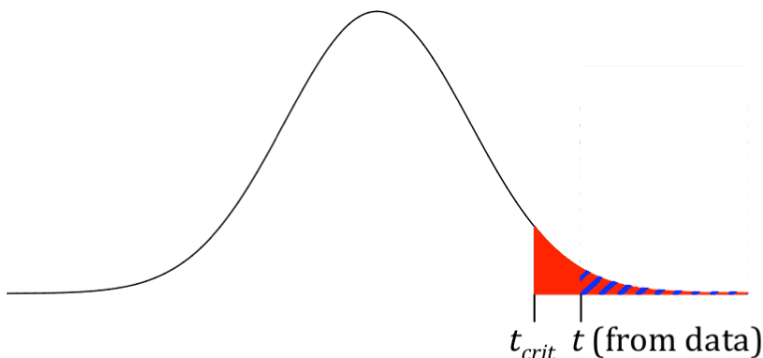3. Describe two things you can do to reduce the width of a confidence interval.
_____

_____

4. The figure below shows a t distribution being used for a one-tailed hypothesis test.
What is the red shaded area (including the striped area) equal to?   _____
What it the blue (striped) area equal to?   _____

t_{crit} t (from data)

Math questions

You don't need to show your work, but I will give partial credit for partial answers.

Note: This practice test doesn't include a t table, but the real exam might. See Homework 7.

1. Compute a single-sample t statistic for [11, 7, 3, 11, 2, 13, 5, 3].

2. Compute Cohen's d for the independent samples [7, 10, 6, 4, 8] and [6, 3, 5, 8].

3. Compute a 95% confidence interval for the mean difference score for the paired samples [96, 107, 84, 91, 88] and [91, 105, 88, 95, 84]. The critical t-value in this case is 2.78.

4. What is the degrees of freedom for Question 3? _____
What is $p(t_{df} > t_{crit})$? _____

R questions

1. For each of the following R functions, write an example command that uses the function, then explain what that command does and give an example of when you would use it.

Rather than choosing a few functions at random, I suggest you make sure you can answer this question for all the commands in the short list of R functions for this exam (see the Study Guide). The real exam will ask you to do this for 3-4 functions. An example answer is below.

Function: `pt()`
Command: `pt(2.1,7,lower.tail=FALSE)`
Computes: probability of a result greater than 2.1, according to a t distribution with 7 degrees of freedom
When: doing a one-tailed t-test

2. What kind of t-test is performed by the following command?
`> t.test(X-Y, mu=0)`

3. What function would you use to create random numbers so that all numbers between 0 and 1 have an equal chance of being selected?

4. What is being by estimated by the following command?
`> for(i in 1:10000) x[i] = var(runif(5))`

Answers

1. independent-samples, one-tailed; single-sample, two-tailed; paired-samples, one-tailed

2. It's approximately Normal, if the sample size is large enough ($n \geq 30$).

3. increase the sample size, reduce the confidence level

4. red = α; blue = p-value

Math

1.

$M = (11+7+3+11+2+13+5+3)/8 = 55/8 = 6.875$

$$s = \sqrt{\frac{\sum(X-M)^2}{n-1}}$$

$$= \sqrt{\frac{(11-6.875)^2+(7-6.875)^2+(3-6.875)^2+(11-6.875)^2+(2-6.875)^2+(13-6.875)^2+(5-6.875)^2+(3-6.875)^2}{7}}$$

$$= \sqrt{\frac{128.875}{7}} = \sqrt{18.41} = 4.29$$

$$t = \frac{M}{s/\sqrt{n}} = \frac{6.875}{4.29/2.83} = \underline{4.53}$$

2.

$$M_A = \frac{7+10+6+4+8}{5} = \frac{35}{5} = 7$$

$$M_B = \frac{6+3+5+8}{4} = \frac{22}{4} = 5.5$$

$$MSE = \frac{\sum_A(X-M_A)^2 + \sum_B(X-M_B)^2}{n_A+n_B-2}$$

$$= \frac{(7-7)^2+(10-7)^2+(6-7)^2+(4-7)^2+(8-7)^2+(6-5.5)^2+(3-5.5)^2+(5-5.5)^2+(8-5.5)^2}{5+4-2}$$

$$= \frac{33}{7} = 4.71$$

$$d = \frac{M_A-M_B}{\sqrt{MSE}} = \frac{7-5.5}{\sqrt{4.71}} = \underline{.69}$$

3.

$$X = [96 - 91, \ 107 - 105, \ 84 - 88, \ 91 - 95, \ 88 - 84] = [5, \ 2, \ -4, \ -4, \ 4]$$

$$M_A = \frac{5 + 2 - 4 - 4 + 4}{5} = \frac{3}{5} = .6$$

$$
\begin{aligned}
s &= \sqrt{\frac{\sum (X - M)^2}{n-1}} \\
&= \sqrt{\frac{(5-.6)^2 + (2-.6)^2 + (-4-.6)^2 + (-4-.6)^2 + (4-.6)^2}{4}} \\
&= \sqrt{\frac{75.2}{4}} = \sqrt{18.8} = 4.34
\end{aligned}
$$

$$\sigma_M = \frac{s}{\sqrt{n}} = \frac{4.34}{\sqrt{5}} = 1.94$$

$$
\begin{aligned}
CI &= [M - t_{crit} \cdot \sigma_M, \ M + t_{crit} \cdot \sigma_M] \\
&= [.6 - 2.78 \cdot 1.94, \ .6 + 2.78 \cdot 1.94] \\
&= [-4.79, \ 5.99]
\end{aligned}
$$

4.

$df = n - 1 = \underline{4}$

$\alpha = 1 - confidence = 1 - .95 = .05$

$p(t_{df} > t_{crit}) = \alpha/2 = .05/2 = \underline{.025}$

R

2. paired-samples t-test

3. runif()

4. distribution of sample variances (from 10000 samples of size 5 from a population with a Standard Uniform distribution)