Name:________________________

PSY 216
Assignment 9 Answers

1. The __*estimated standard error (s_M)*__________________________ is used as an estimate of the real standard error σ_M when the value of σ is unknown. It is computed from the sample variance or sample standard deviation and provides an estimate of the standard distance between a sample mean M and the population mean μ.

2. The __*t statistic*________________ is used to test hypotheses about an unknown population mean μ when the value of σ is unknown. The formula for this statistic has the same structure as the z-score formula, except that the statistic uses the estimated standard error in the denominator.

3. __*Degrees of freedom*__________________________________ describe the number of scores in a sample that are independent and free to vary.

4. A(n) __*t distribution*__________________________________ is the complete set of t values computed for every possible random sample for a specific sample size (*n*) or a specific degrees of freedom (*df*). This distribution approximates the shape of a normal distribution.

5. Problem 14 from the text

The librarian at the local elementary school claims that, on average, the books in the library are more than 20 years old. To test this claim, a student takes a sample of n = 30 books and records the publication date for each. The sample produces an average age of M = 23.8 years with a variance of $s^2 = 67.5$. Use this sample to conduct a one-tailed test with $\alpha = .01$ to determine whether the average age of the library books is significantly greater than 20 years ($\mu > 20$).

Step 1: Hypotheses and α level
$H_0: \mu \leq 20$
$H_1: \mu > 20$
$\alpha = 0.01$

Step 2: Critical region
$\alpha = .01$
One-tailed
df = n – 1 = 30 – 1 = 29
$t_{critical} = 2.462$

Step 3: Calculate $t_{observed}$
$s_M = \sqrt{(s^2 / n)} = \sqrt{(67.5 / 30)} = 1.5$
$t = (M - \mu) / s_M$
$t = (23.8 - 20) / 1.5$

$t = 2.533$

Step 4: Decide

The observed t (2.533) is in the tail cut off by the critical t (2.462), therefore we reject H_0. It is likely that the books are older than 20 years of age on average.

6. Problem 18 from the text

Other research examining the effects of preschool childcare has found that children who spent time in day care, especially high-quality day care, perform better on math and language tests than children who stay home with their mothers (Broberg, Wessels, Lamb, & Hwang, 1997). Typical results, for example, show that a sample of n = 25 children who attended day care before starting school had an average score of M = 87 with SS = 1536 on a standardized math test for which the population mean is μ = 81. Is this sample sufficient to conclude that the children with a history of preschool day care are significantly different from the general population? Use a two-tailed test with α = .01.

Step 1: Hypotheses and α

H_0: $\mu = 81$

H_1: $\mu \neq 81$

$\alpha = 0.01$

Step 2: Critical region

$\alpha = 0.01$

Two-tailed

$df = n - 1 = 25 - 1 = 24$

$t_{critical} = 2.797$

Step 3: Calculate $t_{observerd}$

$s^2 = SS / (n - 1) = 1536 / (25 - 1) = 64$

$s = \sqrt{s^2} = \sqrt{64} = 8$

$s_M = \sqrt{(s^2 / n)} = \sqrt{(64 / 25)} = 1.6$

$t = (M - \mu) / s_M$

$t = (87 - 81) / 1.6$

$t = 3.75$

Step 4: Decide

The observed t (3.75) is in one of the tails cut off by the critical t (2.797), therefore we reject H_0. It is likely that attending preschool changes math performance.

b. Compute Cohen's *d* to measure the size of the preschool effect.

estimated $d = (M - \mu) / s = (87 - 81) / 8 = 0.75$

c. Write a sentence showing how the outcome of the hypothesis test and the measure of effect size would appear in a research report.

Infants who attended preschool scored an average of *M* = 87 on a standardized math test with *SD* = 8.00. Statistical analysis indicates that the score is significantly different than the population mean of 80, $t(24) = 3.75$, $p \leq .05$, Cohen's $d = 0.75$.

7. Use SPSS with the class data set to answer the following question: Do students expect to earn at least a B- (more than 248 points) in a statistics class? Give H_0, H_1 and α. Sketch a t distribution and indicate the critical region(s) on the distribution and the critical t value(s). Is this a one-tailed or two-tailed test? From the SPSS output, report the following:

Statistic	**Value**
$\bar{X}$	270.36
df	10
t	4.124
p	.002 (two-tailed)

What is the estimated value of Cohen's *d*? Is this a small, medium, or large effect?

Step 1: Hypothesis and α

H_0: $\mu \leq 248$

H_1: $\mu > 248$

$\alpha = .05$

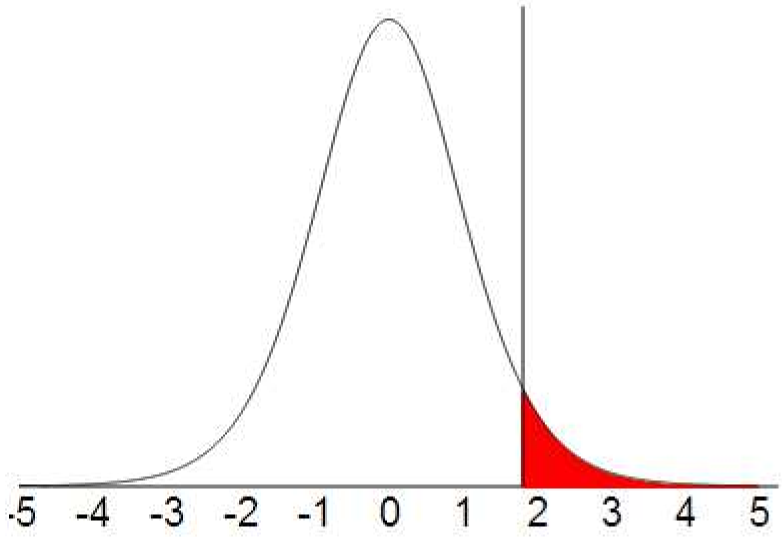
Step 2: Critical region

$\alpha = .05$

One-tailed

$df = n - 1 = 11 - 1 = 10$

$t_{critical} = 1.812$ (from a table of critical t values, one-tailed, df = 10, α = .05)



Step 3: Calculate $t_{observed}$

Load the class data set into SPSS. Click on Analyze | Compare Means | One Sample T Test. Move the Points Expected variable into the Test Variable(s) box on the right. In the Test Value box, type 248. Click OK.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Points expected	11	270.36	17.985	5.423

One-Sample Test

	Test Value = 248					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Points expected	4.124	10	.002	22.364	10.28	34.45

Step 4: Decision
Because this is a one-tailed test, we need to compare the observed t to the critical t. The observed t (4.124) is in the tail cut off by the critical t (1.812). Thus we reject H_0. It is likely that students expect to earn a B- or better in statistics.

Cohen's d:
d = (M – μ) / s = (270.36 – 248) / 17.985 = 1.24
This is a large effect.