Exam 1 PS 217, Fall 2011

On this page, questions are worth 1 point.

1. If you were to add a constant to all the scores in a sample, what would happen to the sample variance?
Stay the same.

2. The null hypothesis
   a. predicts that the treatment will have an effect
   b. is denoted by the symbol H_1
   c. is always stated in terms of population parameters
   d. all of the above

3. Holding everything else constant, increasing sample size
   a. decreases standard error
   b. increases the magnitude of the *t* statistic
   c. increases degrees of freedom
   d. all of the above

4. A population with $\mu = 48$ and $\sigma = 12$ is transformed into a new population with $\mu = 100$ and $\sigma = 20$. What is the value in the new distribution for a score of X = 54 from the original population?
   a. 106
   b. 110
   c. 120
   d. 160

5. The value of α is determined by
   a. the size of the sample (*n*)
   b. the magnitude of the treatment effect
   c. α is selected by the researcher or researchers in the discipline
   d. the standard deviation of the scores

6. For the sample of five scores below, compute the appropriate measure of central tendency.

   100, 101, 102, 104, 10000

The distribution is skewed, so the best measure of central tendency would be the median, which is 102.

7. Suppose that you are computing a *t*-test with $t_{Crit} = 1.96$. What can you tell me about that *t*-distribution?

It would have a very large *n* (approaching infinity), which would make the distribution normal.

8. Suppose that for a sample of *n* = 25, $\bar{X} = 5$. Generally speaking, if you add another score (new *n* = 26), the variability of the sample (s^2 or *s*) would increase. However, there is one score you could add to the sample without increasing its variability. What would that score be?

Adding a score at the mean (5) wouldn't increase the variability.

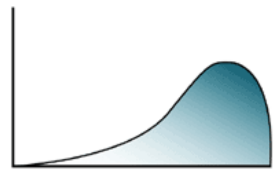
9. If you are looking for a small effect (low *d*), what would you need in order to be able to reject H_0?

You'd need lots of power to detect a small effect size.

10. Suppose that you knew that the probability of a Type II Error in your study was .40, what level of power would you have in that study? **.60 (complement of Type II Error)**

11. You are dealing with a negatively skewed distribution. [5 pts]

a. First, sketch what a negatively skewed distribution look like:



b. Which score is smaller (lower), the mean or the mode? **mean**

c. Which score is smaller (lower), the median or the mode? **median**

You next convert all the scores in this negatively skewed distribution to *z*-scores.

d. What is the mean of this distribution of *z*-scores? **0**

e. What is the standard deviation of this distribution of *z*-scores? **1**

f. What would be the shape of the distribution of *z*-scores? **negatively skewed (unchanged)**

12. What is α? [1 pt] **The probability of Type I Error, typically set to .05.**

13. If you were interested in estimating σ^2 for some (typically large) population, what would you do? [2 pts]

Take a (large) sample (randomly sampled?) from the population and compute s^2 as the best estimate of σ^2.

14. Given what you know about hypothesis testing, you should see a connection to the legal system. For instance, the notion of "innocent until proven guilty" means that the null hypothesis in the courtroom is "defendant is not guilty." Amanda Knox was found "not guilty" in her trial appealing her original guilty verdict. In null hypothesis significance testing terms, in what *two* ways might you explain that verdict? [2 pts]

1. Knox was really innocent, so she was correctly found to be innocent in her retrial
2. Knox was really guilty, so she was incorrectly found to be innocent in her retrial (a Type II error)

15. Suppose that during impersonal social interactions (that is, with business or casual acquaintances) people in the United States maintain a mean social distance of $\mu = 3$ feet from the other individual. This distribution is normal and has $\sigma = 1.5$. Use that information to answer the following questions. [10 pts]

a. What is the probability that impersonal social interactions in the U.S. would take place between 3.5 and 6 feet?

$z = \frac{3.5-3}{1.5} = .33$ $z = \frac{6-3}{1.5} = 2$ **Using the probabilities associated with the two *z*-scores, the probability would be**

.3707 - .0228 = .3479.

b. What two interpersonal distances determine the middle 60% of impersonal interaction distances in the population?

The middle 60% is equivalent to placing 20% in each tail of the distribution. The *z*-score associated with .20 in the tail (Column C) is .84, thus

$.84 = \frac{X-3}{1.5}, X = 4.26$ $-.84 = \frac{X-3}{1.5}, X = 1.74$

So, 1.74 feet and 4.26 feet bound the middle 60% of impersonal social interactions.

c. What is the probability of drawing a sample of $n = 25$ people and finding a mean impersonal social interaction distance of more than 3.6 feet?

You're now dealing with the sampling distribution of the mean, so the standard error is $\sigma_{\bar{X}} = \sigma/\sqrt{n}$

$z = \frac{3.6-3}{.3} = 2$**, and the probability of a *z*-score that large or larger (i.e., Column C) is .0228.**

d. A researcher examines wants to examine whether or not this finding is true for other cultures. A random sample of $n = 9$ people of Middle Eastern culture is observed in an impersonal interaction. For this sample, the mean distance is 2.0 feet ($\bar{X} = 2.0$). Test the hypothesis that the Middle Eastern sample was drawn from a population like that in the U.S. (normally distributed with $\mu = 3$ and $\sigma = 1.5$).

H_0: $\mu = 3$ **H_1: $\mu \neq 3$** **$z_{Critical} = 1.96$, so if $\lvert z_{Obtained} \rvert \geq z_{Critical}$, reject H_0.**	$z = \frac{2-3}{1.5/\sqrt{9}} = -2$ **Decision: Reject H0, because |-2| > 1.96.** **Conclude: People from Middle Eastern cultures have a mean interpersonal distance that is significantly less than 3.**

e. What kind of error might you be making in your decision above in *d*? Why? **Type I error, because the decision is to reject H_0.**

16a. Dr. Seymour Statz is interested in the measuring reaction times (RTs) for people who are asked to press a button upon detecting a target. These RTs are measured in milliseconds (msecs, one-thousandths of a second). Suppose that Dr. Statz was interested in the impact of aging on reaction time, so he collected a sample of nine people ($n = 9$) all of whom were between 75 and 80 years of age. First, estimate the typical populations parameters for central tendency and variability. (To aid you in your computations, I've provided ΣX and ΣX^2.) [5 pts]

	RT (X)	RT^2 (X^2)
	480	230400
	500	250000
	460	211600
	490	240100
	610	372100
	730	532900
	590	348100
	540	291600
	530	280900
Sum	4930	2757700

$$\bar{X} = \hat{\mu} = \sum X / n = 4930/9 = 547.78$$

$$SS = 2757700 - \frac{4930^2}{9} = 57155.6$$

$$s^2 = \hat{\sigma}^2 = \frac{SS}{n-1} = \frac{57155.6}{8} = 7144.45$$

$$s = \sqrt{s^2} = 84.52$$

16b. Next, assume that for the entire population of people, these reaction times are normally distributed with a mean (μ) of 450 msec. Show Dr. Statz how you could use the sample data above to determine whether or not older people have reaction times that are consistent with the entire population. [5 pts]

H_0: μ = 450 **H_1: μ ≠ 450** **$t_{Crit}(8) = 2.306$** **Reject H_0 if $\lvert t_{Obtained}\rvert \geq t_{Critical}$**	$t = \dfrac{547.78 - 450}{84.52/\sqrt{9}} = 3.47$ **Decision: Reject H_0, because 3.47 > 2.306** **Conclude: Older people have reaction times that are significantly slower than those found in the entire population.**

17. In a subsequent study looking at a different question, Dr. Statz obtained the following output. Tell me all that you can about the study (e.g., number of participants, H_0, etc.), what Dr. Statz should conclude, etc. [5 pts]

T-Test

[DataSet0]

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
RT	16	471.0000	60.04221	15.01055

One-Sample Test

	Test Value = 500					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
RT	-1.932	15	.072	-29.00000	-60.9942	2.9942

There is a sample of *n* = 16 (old) people in the study. Dr. Statz is testing H_0: μ = 500, with H_1: μ ≠ 500.

Because $t_{Obtained}$ results in a probability ≥ .05 (.072), you would retain H_0. Thus, you would conclude that it is possible that this sample mean (471) could have come from a population with μ = 500.

18. What effect size would the above results produce? [2 pts]

$$d = \frac{471 - 500}{60.04} = -.48$$

19. In the lab for *z*-scores, we looked at how *z*-scores were intrinsic to signal detection theory. The specific application of signal detection theory was a recognition memory experiment. In such an experiment, what would d' indicate? In NHST (Null Hypothesis Significance Testing) terms, what is d' most like? [2 pts]

d' is a measure of sensitivity and is quite similar in concept to effect size (e.g., *d*)

20. A parameter is always indicated by what kind of letter? [1 pt] **Greek letter**