Exam 1 PS 217, Spring 2006

1. What is another name for the standard deviation of the sampling distribution of the mean?
standard error

2. The distribution of family incomes in the U.S. is positively skewed. Suppose that you were to convert all of those incomes into *z*-scores. How would you describe that *z*-score distribution in terms of:

mean	standard deviation	shape
0	**1**	**positively skewed**

3. In the last lab, we talked about how one might test hypotheses using single-sample *t*-tests. For which data set did we test H_0: $\mu = 200$ kg?
A sample of weight-lifters from the 2004 Athens Olympics. (Examining the mean snatch weight.)

4. 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?
Sensitivity, which in this particular case indicates better memory because a person with a high d' says that most new items are new and most old items are old.

5. If you were interested in estimating σ^2 for some (typically large) population, what would you do?
Take a random sample of reasonably large size (e.g., 50) and compute s^2 as an unbiased estimate of σ^2.

6. 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." Michael Jackson was found "not guilty" in his trial. In null hypothesis significance testing terms, in what two ways might you explain that verdict?
Jackson was actually not guilty, which would be a correct retention of H_0.
Jackson was actually guilty, which would be a Type II Error (or, in signal detection terms, a miss).

7. If you think of IQ scores as normally distributed with $\mu = 100$ and $\sigma = 15$, you should be able to answer the following questions: [3 pts each]

a. What proportion of IQ scores would fall between 120 and 130?

$$z = \frac{120 - 100}{15} = 1.33$$

$$z = \frac{130 - 100}{15} = 2.0$$

.9772 - .9082 = .069

b. What proportion of IQ scores would fall below 110?

$$z = \frac{110 - 100}{15} = 0.66$$

.7454

c. If you wanted to consider yourself smarter than 95% of people, what IQ score would you need to earn?

$$1.645 = \frac{X - 100}{15} = \frac{124.675 - 100}{15}$$

124.7

d. If you administered an IQ test to a random sample of $n = 25$ people, what is the probability that their mean IQ would be greater than 109?

$$z = \frac{109 - 100}{15/\sqrt{25}} = 3.0$$

.0013 (a very unlikely event)

e. If you were about to take a random sample of $n = 25$ people and you wanted to estimate the mean IQ of the sample, you might consider that it should fall in the middle 95% of the distribution. Thus, their mean would likely fall between what two scores?

$$1.96 = \frac{X - 100}{15/\sqrt{25}} = \frac{105.88 - 100}{3}$$

$$-1.96 = \frac{X - 100}{15/\sqrt{25}} = \frac{94.12 - 100}{3}$$

So, between 94.1 and 105.9.

8. I never know how a population of statistics students might perform on one of the quizzes I construct. However, I could think of the performance of students in my course as a non-random sample of quiz scores. Suppose that on a recent quiz, students produced the following scores:

	X	X^2
	9	81
	7	49
	8	64
	7	49
	6	36
	9	81
	10	100
	9	81
	8	64
Sum (Σ)	73	605

Calculate the mean, variance, and standard deviation of this sample. [8 pts]

$$\overline{X} = \frac{\sum X}{n} = \frac{73}{9} = 8.1$$

$$SS = \sum X^2 - \frac{\left(\sum X\right)^2}{n} = 605 - \frac{73^2}{9} = 12.89$$

$$s^2 = \frac{SS}{n-1} = \frac{12.89}{8} = 1.6$$

$$s = \sqrt{s^2} = \sqrt{1.6} = 1.27$$

9. Test the hypothesis that the above quiz scores were randomly sampled from a population with $\mu = 9.5$. [10 pts]

H_0: $\mu = 9.5$
H_0: $\mu \neq 9.5$

$t_{Crit}(8) = 2.306$

$$t = \frac{\overline{X} - \mu}{s_{\overline{X}}} = \frac{8.1 - 9.5}{1.27 / \sqrt{9}} = \frac{-1.4}{0.42} = -3.33$$

Decision: Reject H_0, because $t_{Obtained} \geq t_{Critical}$

Conclusion: Quiz scores are likely to have been sampled from a population with a mean (μ) less than 9.5.

10. What would you estimate the effect size to be in the above example? [2 pts]

$$d = \frac{\text{mean difference}}{\text{sample standard deviation}} = \frac{1.4}{1.27} = 1.1$$

11. For the following StatView analysis of a set of quiz scores, tell me H_0, sample size (*n*), and how you would interpret the results. [5 pts]

One Sample t-test
Hypothesized Mean = 9

	Mean	DF	t-Value	P-Value
Quiz Scores	8.100	19	-2.714	.0138

H_0: $\mu = 9$
H_1: $\mu \neq 9$

$n = \text{df} + 1 = 20$

Because $p < .05$, I would reject H_0 and conclude that the sampled mean ($M = 8.1$) was significantly lower than the hypothesized population mean of 9.

12. Suppose that you are dealing with an effect size (e.g., *d*) that is considered to be small. If you were interested in testing such an effect (e.g., using a *t*-test), what might you do to ensure that you found a significant effect (i.e., were able to reject H_0)? [2 pts]

You would use a large sample size (*n*) to give you sufficient power to detect a small effect size.

13. If you reject H_0, what is the probability of making a Type II error? [1 pt]

0 (If you reject H_0 you could be making a Type I error, but you can only make a Type II error when you retain H_0.)

14. Under which circumstances would you be able to test a null hypothesis using a *z*-score? [1 pt]

When you know the population variance or standard deviation, which is to say virtually never.

15. Given that we typically think of an experimental effect as an additive constant, it's important to understand the implications of adding a constant to all the scores in a distribution. Suppose that the sample had a mean of 10 and variance of 3. If we added a constant of 5 to all the scores in the sample, what would be the mean and variance of the new sample? [1 pt]

Mean would be 10 + 5 = 15 and the variance would remain 3.

16. What are the names of the authors of your textbook? ☺
Gravetter & Wallnau