1. You’ve learned about the process of hypothesis testing. The following questions are related to that process. [3 pts]

   a. What is a Type I Error?

   **Rejecting H₀ when it is true.**

   b. What is the definition of power?

   **Correctly rejecting H₀.**

   c. 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 (because power and Type II Error are complementary)**

2. You’ve also learned about the important concept of effect size. [4 pts]

   a. What two measures of effect size have you learned to compute?

   **Cohen’s d and r²**

   b. In general, how would you define effect size (i.e., what are the measures of effect size measuring)?

   **In the circumstances you’ve been studying, effect size is the distance between the H₀ mean and the actual mean of the population from which the sample was drawn.**

   c. If you were dealing with a situation in which you were investigating a small effect size, what sort of strategy would you invoke to ensure that you would best be able to reject H₀?

   **Increasing sample size would increase power, making it easier to detect a small effect.**

3. What does the Central Limit Theorem say should become increasingly true as your sample size increases? [3 pts]

   **As n approaches infinity, the sampling distribution of the mean approaches normality and**

   \[ \mu_\bar{x} = \mu_M = \mu \]

   \[ \sigma_\bar{x} = \sigma_M = \frac{\sigma}{\sqrt{n}} \]
4a. For the sample of quiz scores shown below, estimate the parameters of the population from which they were drawn: [15 pts for a and b]

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<tr>
<th>Quiz</th>
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| Sum  | 111 | 835 |

\[
\bar{X} = M = \frac{\sum X}{n} = \frac{111}{16} = 6.94
\]

\[
SS = \sum X^2 - \frac{\left(\sum X\right)^2}{n} = 835 - \frac{111^2}{16} = 64.94
\]

\[
s^2 = \hat{\sigma}^2 = \frac{SS}{n-1} = \frac{64.94}{15} = 4.33
\]

\[
s = \hat{\sigma} = \sqrt{s^2} = 2.08
\]

4b. Using the data above, test \( H_0: \mu = 8 \).

[Because \( \sigma \) is not known, the appropriate statistic is \( t \).]

\( H_0: \mu = 8 \)
\( H_1: \mu \neq 8 \)
\( t_{crit}(15) = 2.131 \)

\[
s_{\bar{X}} = s_M = \frac{2.08}{\sqrt{16}} = .52
\]

\[
t = \frac{6.94 - 8}{.52} = -2.04
\]

Decision: Retain \( H_0 \), because \( t_{obtained} < t_{critical} \). The sample could have been drawn from a population with \( \mu = 8 \).
5. Answer the following questions assuming that they are dealing with a population of SAT-M scores, which are normally distributed with \( \mu = 500 \) and \( \sigma = 100 \). [25 pts]

a. What is the probability that a person would achieve SAT-M scores between 500 and 600?

\[ 500 \Rightarrow z\text{-score of } 0 \]
\[ 600 \Rightarrow z\text{-score of } 1 \]

The area between 500 and 600 would be .3413 (or 34%).

b. What is the probability that a person would achieve SAT-M scores between 600 and 650?

\[ 600 \Rightarrow z\text{-score of } 1 \]
\[ 650 \Rightarrow z\text{-score of } 1.5 \]

The area between 600 and 650 would be .0919.

c. What is the probability that a person would achieve SAT-M scores between 450 and 575?

\[ 450 \Rightarrow z\text{-score of } -0.5 \]
\[ 575 \Rightarrow z\text{-score of } 0.75 \]

The area between 450 and 575 would be .4649.

d. What SAT-M scores would be achieved by the lower 85% of the population?

With an associated \( z \) of 1.04, that would mean SAT-M scores of 604 or less.

e. What SAT-M scores would be achieved by the upper 2.5% of the population?

With an associate \( z \) of 1.96, that would mean SAT-M scores of 696 or more.
f. What is the probability that you would obtain a sample mean ($M$) SAT-M of 550 or more from this population with $n = 25$?

$$\sigma_{\bar{X}} = \sigma_M = \frac{100}{\sqrt{25}} = 20$$

**550 => z-score of 2.5**

The area of 550 and above would be .0062 (of 0.62%).

g. For samples of $n = 16$, what mean SAT-M scores would comprise the middle 90% of the sampling distribution of the mean?

$$\sigma_{\bar{X}} = \sigma_M = \frac{100}{\sqrt{16}} = 25$$

A z-score of ±1.645 cuts off the upper and lower 5% of a distribution, so the SAT-M scores would be 458.0 and 541.1.

6. In the lab exercise for z-scores, you learned about signal detection theory in the context of a memory experiment. [mystery bonus]

What memory paradigm was used in that laboratory?

**Recognition memory**

What is the name of the first psychologist to study memory systematically?

**Ebbinghaus**

What does $d'$ measure?

**Sensitivity**