

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 H_0 when it is true.

b. What is the definition of power?

Correctly rejecting H_0 .

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 r^2

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 H_0 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 H_0 ?

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]

	Quiz	Quiz ²
	8	64
	7	49
	3	9
	8	64
	9	81
	10	100
	7	49
	6	36
	8	64
	9	81
	7	49
	6	36
	8	64
	3	9
	4	16
	8	64
Sum	111	835

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

$$SS = \sum X^2 - \frac{(\sum X)^2}{n} = 835 - \frac{111^2}{16} = 64.94$$

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

$$s = \hat{\sigma} = \sqrt{s^2} = 2.08$$

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

[Because σ is not known, the appropriate statistic is t .]

$$H_0: \mu = 8$$

$$H_1: \mu \neq 8$$

$$t_{\text{crit}}(15) = 2.131$$

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

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

Decision: Retain H_0 , because $t_{\text{obtained}} < t_{\text{critical}}$.

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-score of 0

600 \Rightarrow z-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-score of 1

650 \Rightarrow z-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-score of -0.5

575 \Rightarrow z-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 \Rightarrow 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