

1. Answer the following questions assuming that they are dealing with a population of SAT-M scores, which are normally distributed with $\mu = 500$ and $\sigma = 100$.

a. What is the probability that a person would achieve SAT-M scores between 550 and 650? [3 pts]

Convert to z-score	Determine Probability	Subtract smaller probability from the larger probability to yield answer => .2417.
$z = \frac{550 - 500}{100} = .5$.1915	
$z = \frac{650 - 500}{100} = 1.5$.4332	

b. What is the probability that a person would achieve SAT-M scores between 430 and 480? [3 pts]

Convert to z-score	Determine Probability	Subtract smaller probability from the larger probability to yield answer => .1787.
$z = \frac{430 - 500}{100} = -.7$.2580	
$z = \frac{480 - 500}{100} = -.2$.0793	

c. What SAT-M scores would be achieved by the lower 65% of the population? [3 pts]

Look up .65 in the body of the distribution (Column B), then find the z-score (Column A), which is .385. Then, use the z-score formula to determine the SAT-M score => 538.5.	$.385 = \frac{X - 500}{100}, X = 538.5$
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d. What SAT-M scores would be achieved by the upper 5% of the population? [3 pts]

Look up .05 in the tail of the distribution (Column C), then find the z-score (Column A), which is 1.645. Then, use the z-score formula to determine the SAT-M score => 664.5.	$1.645 = \frac{X - 500}{100}, X = 664.5$
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e. What is the probability that a sample of $n = 25$ would yield a mean (M) SAT-M of 440 or less from this population? [4 pts]

Convert the $M = 440$ to a z-score, which means that you must first compute the standard error (20). Look up the probability for $z = -3$ in the tail of the distribution (Column C) => .0013.	$\sigma_{\bar{x}} = \frac{100}{\sqrt{25}} = 20$ $z = \frac{440 - 500}{20} = -3$
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f. For samples of $n = 100$, what mean SAT-M scores would comprise the middle 90% of the sampling distribution of the mean? [4 pts]

Look up .05 in the tail (Column C) to find the corresponding z-score => 1.645. Then, determine the standard error (10) and use the z-score formula to determine the means.	$\sigma_{\bar{x}} = \frac{100}{\sqrt{100}} = 10$ $1.645 = \frac{\bar{X} - 500}{10}, \bar{X} = 516.45$ $-1.645 = \frac{\bar{X} - 500}{10}, \bar{X} = 483.55$
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2a. Below is a sample of quiz scores. *Estimate* μ , σ^2 , and σ of the population from which the sample was drawn. [5 pts]

	Quiz	Quiz ²	
	8	64	$\bar{X} = M = \hat{\mu} = \frac{107}{15} = 7.13$ $SS = 819 - \frac{107^2}{15} = 55.7$ $s^2 = \hat{\sigma}^2 = \frac{55.7}{14} = 3.98$ $s = \hat{\sigma} = 1.995$
	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	
	8	64	
Sum	107	819	

2b. If you were testing $H_0: \mu = 8.5$, what statistic would you use? Why? [2 pts]

You'd use a *t*-test, because σ isn't known.

2c. If you were testing $H_0: \mu = 8.5$, what would be your effect size d ? [3 pts]

$$d = \frac{7.13 - 8.5}{1.995} = .69$$

3a. As you know, gestation periods are normally distributed with $\mu = 268$ and $\sigma = 16$. Imagine that you are giving a talk to 64 pregnant women who happen to be cigarette smokers. Suppose that you want to tell them what the average (mean) gestation period would be for a group that size and you want to be 90% confident in your estimate. What would you tell them about the upper and lower limits that would encompass the typical mean gestation period for a group of 64 women? (In other words, what gestation periods cut off the upper and lower 5% of the distribution?) [5 pts]

<p>Look up .05 in the tail (Column C) to find the corresponding <i>z</i>-score => 1.645. Thus, ± 1.645 are the <i>z</i>-scores that cut off the upper and lower 5%. Compute σ_M and then use the <i>z</i>-score formula to determine the lower (264.7) and upper (271.3) values.</p>	$\sigma_{\bar{X}} = \frac{16}{\sqrt{64}} = 2 \quad 1.645 = \frac{\bar{X} - 268}{2}, \quad \bar{X} = 271.3$ $-1.645 = \frac{\bar{X} - 268}{2}, \quad \bar{X} = 264.7$
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3b. Suppose that for this sample of 64 smokers, the mean gestation period $M = 260$ days. How likely is it that your group was sampled from the normal distribution described in 3a?

State the null and alternative hypotheses you would be using to test the assertion. [1 pt]

$H_0: \mu = 268$

$H_1: \mu \neq 268$

Test the null hypothesis. What you would conclude? (Be explicit!!) [9 pts]

Decision Rule: If $|z| \geq 1.96$, then reject H_0 .

$$z = \frac{260 - 268}{2} = -4$$

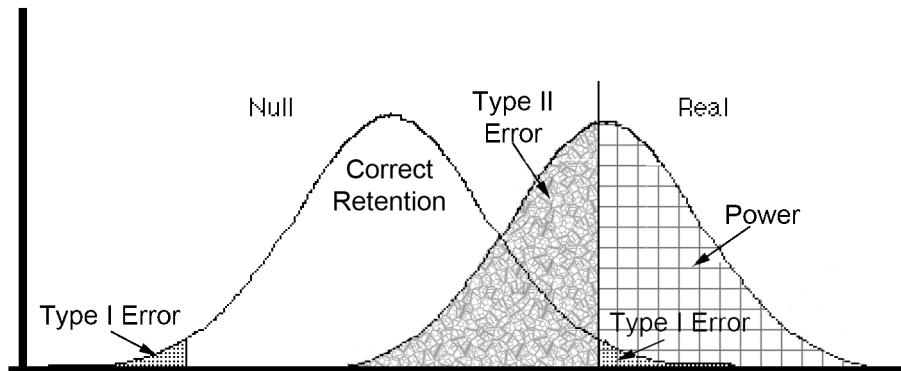
Decision: Reject H_0 , because $|-4| \geq 1.96$.

Conclude: Sample likely came from a population with $\mu < 268$.

Tell me, in words, what kind of error you might be making in your conclusion. [2 pts]

Because you're rejecting H_0 , you could be making a Type I error (rejecting H_0 when H_0 is true).

4. On the curves seen below, label the areas that represent Type I Errors, Type II Errors, Power, and Correct "Retention." [5 pts]



5. What is the general formula for all standard scores? [2 pts]

$$\frac{\text{Score of Interest} - \text{Mean of Distribution}}{\text{Standard Deviation of Distribution}}$$

6. Suppose that you take one sample of $n = 16$ and another sample of $n = 100$. What does the Central Limit Theorem tell you about the shape and variability of the sampling distribution of the mean from which each sample mean would have been drawn? [5 pts]

Mean of the sampling distribution would be μ . However, the variability of the sampling distribution of the mean would decrease as the sample size increases. Thus, with $n = 16$, the standard error would be the population standard deviation divided by 4 and with $n = 100$ the standard error would be the population standard deviation divided by 10. Moreover, as the sample size increases, the sampling distribution of the mean would become increasingly normal in shape.

7. What is the (small) advantage of using the standard deviation instead of the variance as a measure of variability? [2 pts]

The standard deviation is expressed in the same units of measurement of the scores (e.g., inches) instead of squared scores (e.g., inches squared).

8. Under which conditions might the median be a better measure of central tendency than the mean? [2 pt.]

When the distribution is skewed.

9. Interpret the PASW/SPSS output below as completely as you can. (In other words, what is the statistic, what are the scores, how would you interpret the results, etc.) [3 pts]

	N	Mean	Std. Deviation	Std. Error Mean
Quiz	15	7.1333	1.99523	.51517

	Test Value = 8.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Quiz	-2.653	14	.019	-1.36667	-2.4716	-.2617

It's a single-sample t -test on quiz scores. $H_0: \mu = 8.5$ and $H_1: \mu \neq 8.5$. With $t(14) = -2.653$, $p = .019$. Because $p \leq .05$, you would reject H_0 and conclude that the sample was drawn from a population with $\mu < 8.5$.

10. Adding a constant (e.g., 3) to a set of scores has what effect on the mean and standard deviation of the transformed scores? [2 pts]

The mean would increase by that constant and the standard deviation would be unchanged.

11. Transforming a set of scores into z -scores has what effect on the mean and standard deviation of the transformed scores? [2 pts]

The mean would be 0 and the standard deviation would be 1.

12. Signal Detection Theory shares many characteristics with Null Hypothesis Significance Testing (NHST). [2 pts]

What would be the Signal Detection analog of effect size?	d'
What would be the NHST analog of proportion hits?	power

13. The probability of making a Type I Error is typically set to **5%**. [1 pt]

14. As the sample size approaches infinity, what happens to the value of t_{Critical} and why? [2 pts]

Because the distribution of t would become more normal, t_{Critical} would become 1.96.

15. In a positively skewed distribution, what is the relationship between the mode, median, and mean? [2 pts]

Mean > Median > Mode