

1. Below is a sample of scores. Estimate the parameters of the population from which the sample was drawn. [5 pts]

2  
2  
3  
4  
4

$$\hat{\mu} = \bar{X} = \frac{\sum X}{n} = \frac{15}{5} = 3$$

$$SS = \sum X^2 - \frac{(\sum X)^2}{n} = 49 - \frac{15^2}{5} = 49 - 45 = 4$$

$$\hat{\sigma}^2 = s^2 = \frac{SS}{n-1} = \frac{4}{4} = 1$$

$$\hat{\sigma} = s = \sqrt{s^2} = 1$$

2a. What is the Central Limit Theorem and why is it important for the sampling distribution of the mean? [3 pts]

**For any population with mean  $\mu$  and standard deviation  $\sigma$ , the distribution of sample means for sample size  $n$  will have a mean of  $\mu$  and a standard deviation of  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ , and will approach a normal distribution as  $n$  approaches infinity.**

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?) [10 pts]

**The z-score that cuts off the upper and lower 5% of the distribution would be 1.645. Thus, the lower limit would be 261.4 and the upper limit would be 271.3.**

3b. Suppose that for this sample of 64 smokers, mean gestation period = 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, then tell me what you would conclude (be explicit!!). [9 pts]

**Decision Rule: If  $|z_{\text{obt}}| \geq 1.96$ , reject  $H_0$ .**

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{16}{8} = 2$$

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

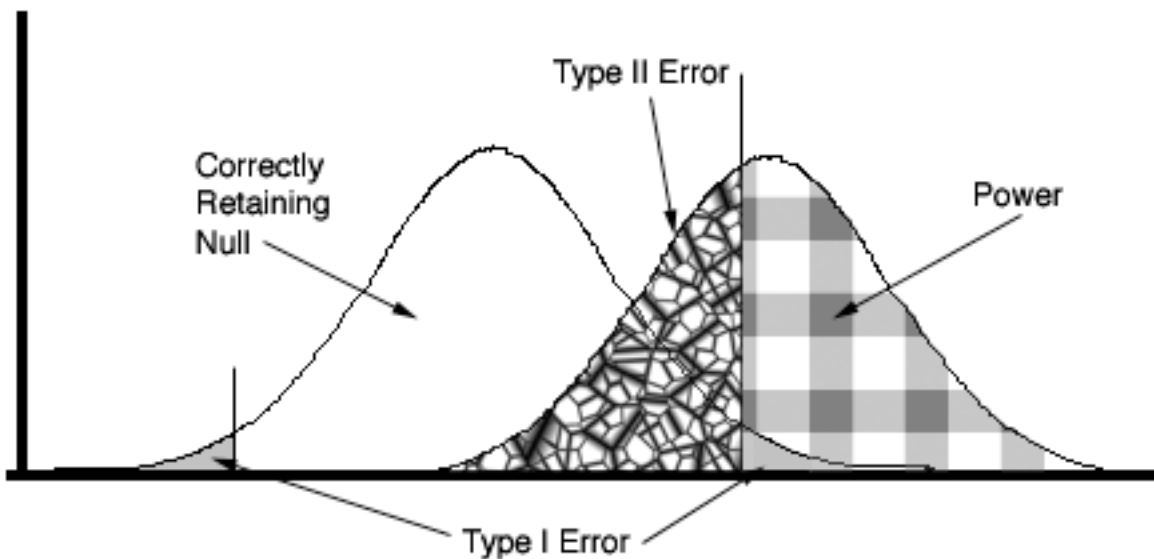
**Reject  $H_0$ , because  $z_{\text{obt}}$  falls in the rejection region.**

**Thus, it appears that these women were sampled from a population with  $\mu < 268$ .**

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

**With your decision, you could be making a Type I Error, which is concluding that the sample mean was drawn from a population with  $\mu < 268$ , when in fact, the sample was drawn from a population with  $\mu = 268$ .**

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



4a. SAT scores are normally distributed with  $\mu = 500$  and  $\sigma = 100$ . What is the probability that a person would receive an SAT score between 350 and 450? [5 pts]

$$z = \frac{350 - 500}{100} = -1.5$$

$$z = \frac{450 - 500}{100} = -0.5$$

**SAT scores lower than 450 would occur with a probability of .3085. SAT scores lower than 350 would occur with a probability of .0668. Thus, .2417 (roughly 24%) would have SAT scores between 350 and 450.**

4b. What is the probability that a person would receive an SAT score less than 550? [5 pts]

$$z = \frac{550 - 500}{100} = 0.5$$

**Z-score of 0.5 in Column B yield a probability of .6915 (roughly 69%).**

4c. The upper 20% of people taking the SAT would receive what scores? [5 pts]

**Looking up .20 in Column C yields a z-score of 0.84. Thus, people who have SAT scores of 584 or higher would be the upper 20% of SAT scores.**