PADM8410.SP18. Homework #4

1. We sample a group of 25 graduate students. We want to know if they come from the general population of students on GRE-QUANT at the $\alpha = .05$ level.

   $\mu = 160$ $\sigma = 10$
   $M = 165$

   a. State your research hypothesis.
   The sample of graduate students score differently on the GRE-QUANT than the general student population.

   b. State you statistical hypotheses.
   $H_0 = \mu = 160$
   $H_1 = \mu \neq 160$

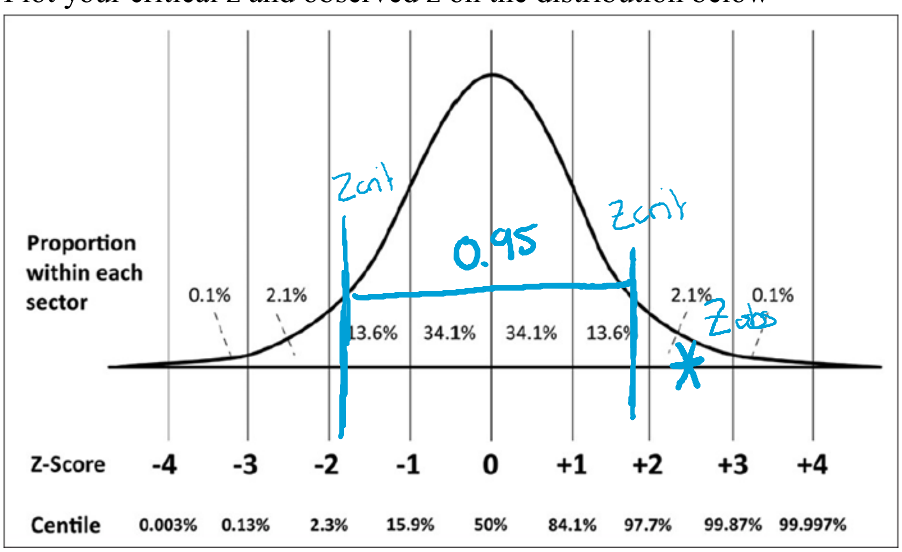
   c. What are your criteria for rejection (α)? What are your critical z values?
   $\alpha = .05$
   $z_{crit} = \pm 1.96$

   d. Calculate your test statistic.

$$\sigma_M = \frac{10}{\sqrt{25}} = \frac{10}{5} = 2$$

$$z = \frac{M - \mu}{\sigma_M} = \frac{(165 - 160)}{2} = 2.5$$

   e. Plot your critical z and observed z on the distribution below



   f. What is your decision in regards to H_0?

Reject H_0

g. What is your interpretation? What can we say about the students?

The observed value of the test statistic exceeds the critical value ($p < .05$). Therefore, the mean GRE-QUANT score from the sample of graduate students (M=165) is significantly different than the general student population mean score of 160. It is unlikely that this difference is due to chance.

2. We sample a group of 36 parents. We want to know if they come from the general population of parents on physical discipline at the $\alpha = .05$ level.

$\mu = 10$ $\sigma = 4.8$

$M = 9$

a. State your research hypothesis.

The parents in the sample have a different acceptance rate and/or use of physical discipline than the parents in the general population.

b. State you statistical hypotheses.

$H_0 = \mu = 10$

$H_1 = \mu \neq 10$

c. What are your criteria for rejection (α)? What are your critical z values?

$\alpha = .05$

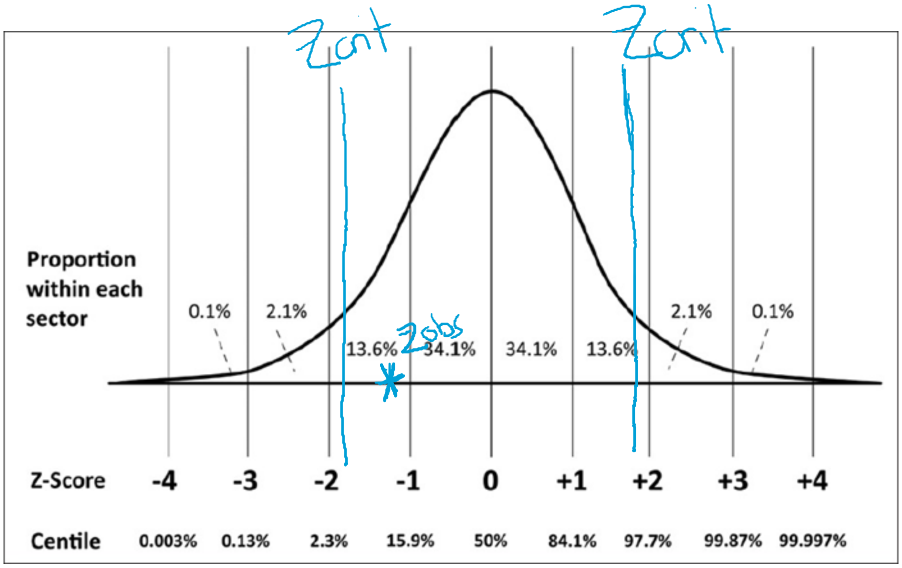
$z_{crit} = \pm 1.96$

d. Calculate your test statistic.

$$\sigma_M = \frac{4.8}{\sqrt{36}} = \frac{4.8}{6} = 0.8$$

$$z = \frac{M - \mu}{\sigma_M} = \frac{(9 - 10)}{0.8} = -1.25$$

e. Plot your critical z and observed z on the distribution below



f. What is your decision in regards to H_0?
   Fail to Reject H_0
g. What is your interpretation? What can we say about the students?
   The observed value of the test statistic did not exceed the critical value ($p > .05$). Therefore, we cannot conclude that there is a difference between the parents in the study and the general population in regard to physical discipline. The study parents are likely from the same population as the general population of parents with a $\mu = 10$.

What Your Earwax Says About You

A new study suggests earwax is not the same between races, with some people having more odor-causing chemical compounds in their earwax than others.

The number of volatile organic compounds, which are molecules that often produce a smell, is generally higher in Caucasians than in East Asians, found researchers from the Monell Center.

"Our previous research has shown that underarm odors can convey a great deal of information about an individual, including personal identity, gender, sexual orientation, and health status," study researcher George Preti, Ph.D., an organic chemist at Monell, said in a statement. "We think it possible that earwax may contain similar information." Indeed, researchers noted that past findings have shown that people of East Asian descent, as well as people of Native American descent, possess a form of a gene that makes them have dry-type earwax -- versus wet, yellow-brown ear wax -- and less underarm body odor.

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For the study, published online in the Journal of Chromatography B, researchers examined the earwax from eight healthy Caucasian men and eight healthy East Asian men. They heated the collected earwax in vials for 30 minutes so that the volatile organic compounds would be released from the earwax, which is known scientifically as cerumen. Then, researchers used a device to collect the compounds from the vials before using gas chromatography-mass spectrometry to analyze the compounds.

Twelve different volatile organic compounds were identified in all the study participants' earwax. But the *levels* of these compounds differed between the Caucasian men and the East Asian men: The Caucasian men had higher levels of 11 of the 12 compounds, compared with the East Asian men.

We collected earwax from all Clemson students and found that the average amount of volatile compounds in the ear was 9 grams (μ=9) and the standard deviation for the population was 3 grams (σ=3). Earwax was collected from our class of 9 students and found to contain 11 grams (*M* = 11). Is our sample is from a population with a mean of 9 grams?

Let's go through the steps to test a hypothesis to address this question

a. State your research hypothesis.
   Our class of students have different amounts of volatile compounds in their earwax than the general Clemson student population.

b. State you statistical hypotheses.
   $H_0 = \mu = 9$
   $H_1 = \mu \neq 9$

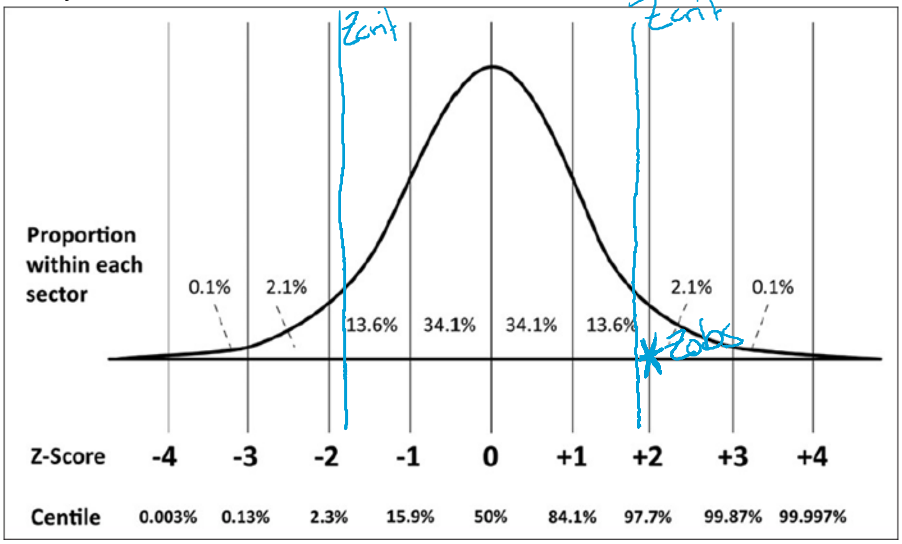
c. What are your criteria for rejection (α)? What are your critical z values?
   $\alpha = .05$
   $z_{crit} = \pm 1.96$

d. Calculate your test statistic.

$$\sigma_M = \frac{3}{\sqrt{9}} = \frac{3}{3} = 1$$

$$z = \frac{M - \mu}{\sigma_M} = \frac{(11 - 9)}{1} = 2$$

e. Plot your critical z and observed z on the distribution below



f. What is your decision in regards to H_0?
Reject H_0

g. What is your interpretation? What can we say about our class?
The observed value of the test statistic exceeds the critical value ($p < .05$). Therefore, the mean amount of earwax volatile compounds in our sample participants ($M = 11$) is significantly different than the amount of earwax volatiles general student population $\mu = 9$. It is unlikely that this difference is due to chance.

Study: People Check Their Cell Phones Every Six Minutes, 150 Times A Day (adapted)

While it seems as if people are constantly on their smartphones, it may not be so far from the truth, as new research suggests that people, on average, check their phones every six-and-a-half minutes.

The study, commissioned by Nokia, found that the first thing that most people do is check their phones, as many people use their phones as alarms.

The research also showed that in a sample of 100 people most people look at their phone right before bed, to set alarms, check messages and put it on silent.

It doesn't take a genius to see how prevalent phone use is in between, as you're more than likely to see someone on theirs while in public.

In the 16 hours awake per day, the average person checks his or her phone a whopping 150 times.

This isn't just reserved for smartphone users, however, as people with less sophisticated phones are also just as likely to check their phones frequently.

It's time to unplug, smile at the person across from you on the train and have a face to face conversation. You never know what could come from it...

Suppose you were able to measure phone usage in the entire population. You find out that people overall check their phones about 145 times a day (μ=145) and the standard deviation for the population was 2.5 usages per day (σ=2.5). Is the sample in this study likely to be from this population in terms of phone usage?

Let's go through the steps to test a statistical hypothesis to address our question.

a. State your research hypothesis.
   The Nokia study participants check their phones at a different rate than the general population of phone users.

b. State you statistical hypotheses.
   $\mathbf{H_0 = \mu = 145}$
   $\mathbf{H_1 = \mu \neq 145}$

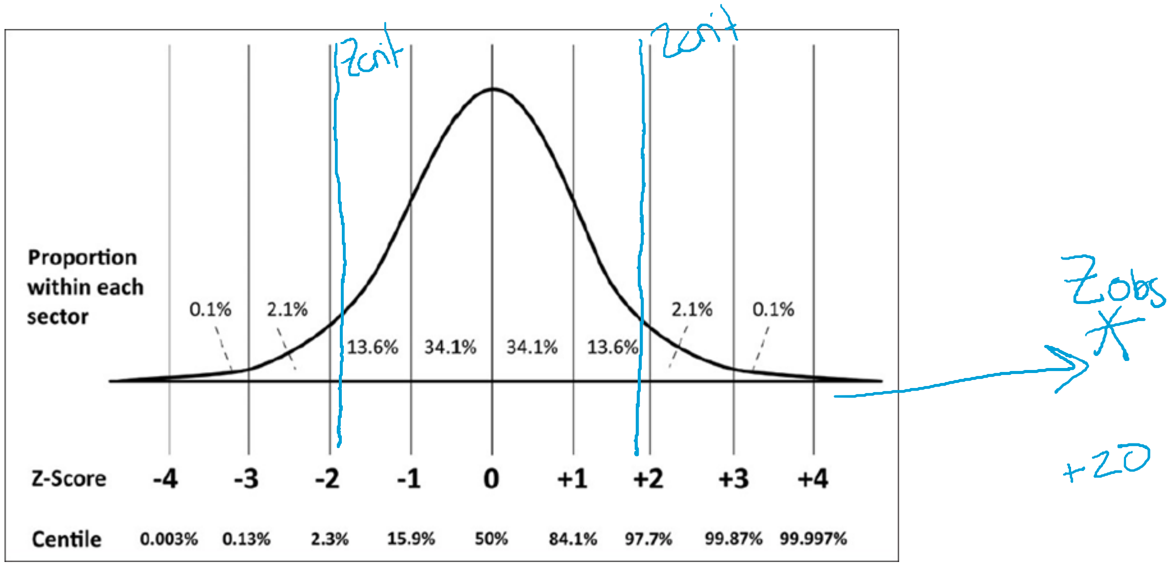
c. What are your criteria for rejection (α)? What are your critical z values?
   $\alpha = .05$
   $z_{crit} = \pm 1.96$

d. Calculate your test statistic.

$$\sigma_M = \frac{2.5}{\sqrt{100}} = \frac{2.5}{10} = 0.25$$

$$z = \frac{M - \mu}{\sigma_M} \quad = \; = \frac{(150 - 145)}{0.25} = 20$$

e. Plot your critical z and observed z on the distribution below



f. What is your decision in regards to H_0?
Reject H_0

g. What is your interpretation? What can we say about the kids in this study sample?
The observed value of the test statistic exceeds the critical value ($p < .05$). Therefore, the mean number of phone checks from the sample participants ($M=150$) is significantly different than the number of phone checks from the general population $\mu = 145$. The test statistic value shows it is highly unlikely that this difference is due to chance.