

SOCI 102 – Quiz 5 answers

1. If random samples, each with $n = 4$ scores, are selected from a normal population with mean = 80 and standard deviation = 10, then the distribution of sample means will have a standard error of _____.

- a -- 2.5
- b -- 5
- c -- 10
- d -- 80

This question is asking you to calculate the Standard Error for samples sized 4 ($N = 4$) drawn from a population with a mean of 80 and a standard deviation of 10.

The formula for the Standard Error is:

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{10}{\sqrt{4}} = \frac{10}{2} = 5$$

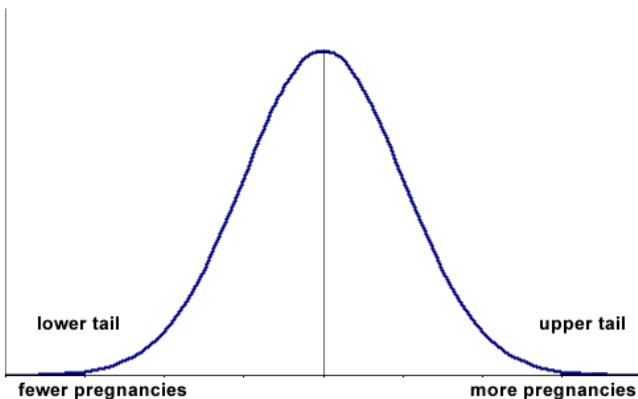
So the correct answer would be 5 or choice b.

2. Do sex education classes and free clinics that offer counseling for teenagers reduce the number of pregnancies among teenagers? The appropriate type of hypothesis to test this would be _____

- a -- a one-tailed test (upper tail critical)
- b -- a one-tailed test (lower tail critical)
- c -- a two-tailed test
- d -- a three-tailed test

This question is asking about the type of hypothesis we need to use. Since we want to know if the classes and free clinics REDUCE pregnancies, we need to use a one-tailed test. A two-tailed test would be appropriate if we wanted to know if the classes and clinics had an effect either way (reduced or increased), but since we are only interested in one of those two outcomes (reduced), then we should use a one-tail test.

Since the direction we are interested in is a reduction in pregnancies, then the lower tail would be the appropriate one. The upper tail would be appropriate if we wanted to know if the clinics increased pregnancies.



So the answer is b.

3. Comparing one- and two-tailed tests (with a constant alpha level and sample size), the probability of rejection (of H_0) will be higher for

- a** -- the two-tailed test
- b** -- the one-tailed test, if you have correctly predicted the direction of the difference
- c** -- neither, the probability of rejection does not change
- d** -- the test with the most conservative test statistic

Your alpha level IS the probability of rejecting H_0 . So the answer to this question is c.

4. When we decide on a value for alpha, we are

- a** -- defining the likelihood of accepting the alternative hypothesis
- b** -- establishing whether the test will be one or two tailed
- c** -- setting the probability of committing a Type I error
- d** -- setting the probability of a one-tailed test

α = level of significance = type I error

Correct answer is c.

5. All other things being equal, with which of the following alpha levels would we be most likely to reject the null hypothesis?

- a** -- .01
- b** -- .001
- c** -- .05
- d** -- .10

Since α is the probability of rejecting H_0 , then the smaller α is, the less likely we are to reject H_0 , and the larger α is, the more likely we are to reject H_0 .

So the answer the largest number, or d.

6. The t distribution, compared to the Z distribution, is

- a** -- more skewed
- b** -- more peaked for small samples but increasingly like the Z distribution as N increases
- c** -- bimodal
- d** -- flatter for small sample sizes but increasingly like the Z distribution as N increases

This question made it into the quiz by mistake. It is from Chapter 9 (pg.236). If you got it right, I will give you extra credit for it, otherwise, I will give you the points for it as though you had gotten it right.

Right answer would be d.

7, 8, 9 & 10. A researcher investigates whether or not a new cold medication disrupts mental alertness (lowers scores). It is known that scores on a standardized test containing a variety of problem-solving tasks are normally distributed with $\mu = 64$ and $\sigma = 8$. A random sample of $n = 16$ subjects are given the drug and then tested. For this sample, the mean is $M = 58$.

This question is asking us, what is the probability that we could pull a sample of 16 individuals with a mean score of 58, from a population that normally scores an average of 64 points on this standardized test (standard deviation of 8). If this medication lowers mental alertness, we should expect that our sample will average lower scores than people who have not taken the drug. Since we are likely to get samples from the population of people who are not on the drug that average a score other than 64, just noting that there is a difference between our sample's score (58) and the population's average score (64) means little if we can't judge how much of a difference is a likely difference due to chance alone, and how much of a difference would be unlikely to be due to chance alone. Since we have the population parameters μ and σ , we can do a z-test to answer this question. Questions 7 – 10 are all based on the same problem, so let's do the whole problem and then go back to provide the answers to each individual question.

Step 1 – Set up your hypotheses

We want to know if the medicine **LOWERS** scores. This is a one-tailed hypothesis. One way to set up your null and alternative hypotheses is to begin with what you are looking for, that is the alternative hypothesis. What we want to find is that our sample (people that took the medicine) have lower scores on this test than people who did not take the medicine. In other words, our sample comes from a population of people who took the medicine that have lower scores than the population of people that did not take the medicine.

$$H_1 = \mu < 64$$

After you set up the alternative hypothesis, the null hypothesis is anything not covered by the alternative hypothesis.

$$H_0 = \mu \geq 64$$

So we have

$$H_0 = \mu \geq 64$$

$$H_1 = \mu < 64$$

Step 2 – Calculate a Standard Error

Using the Standard Error formula, plug in the numbers for the population standard deviation, and our sample size.

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{8}{\sqrt{16}} = \frac{8}{4} = 2$$

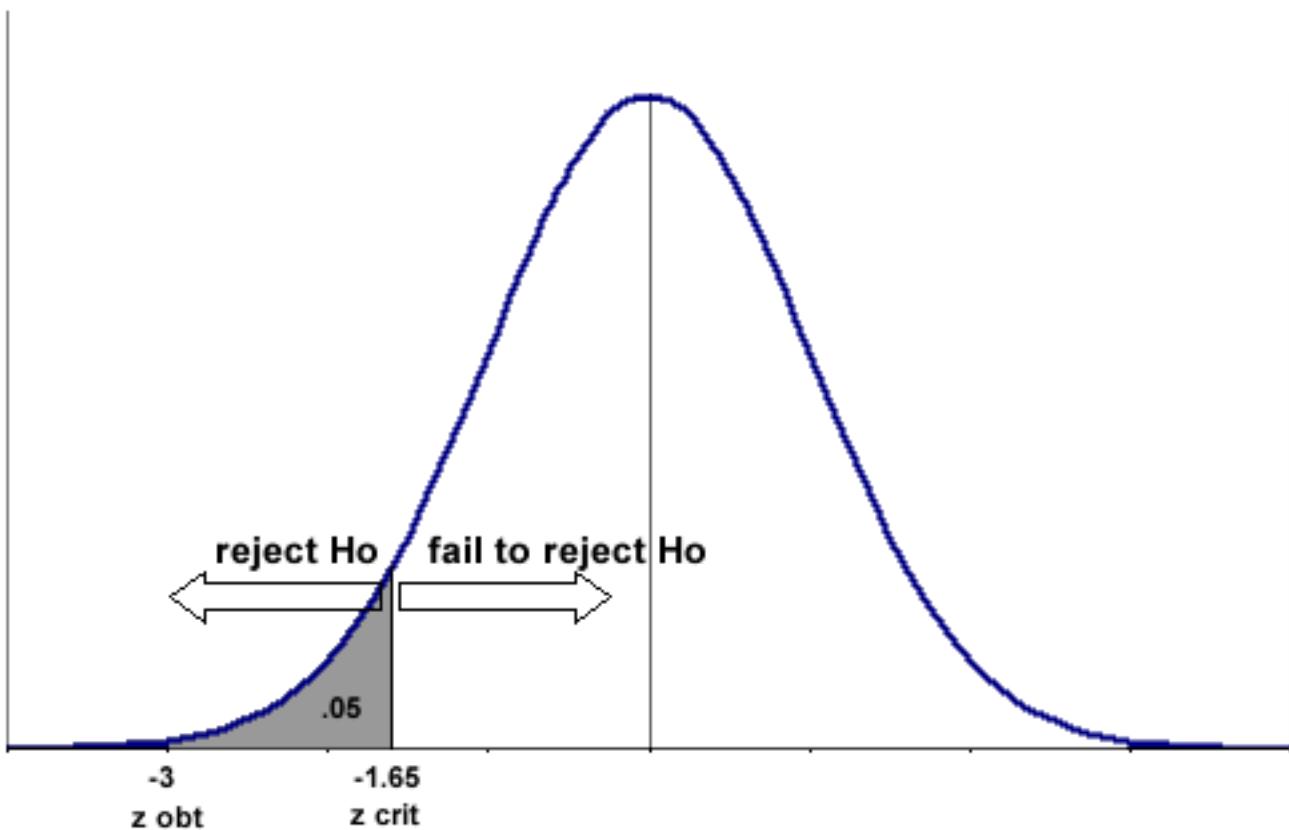
Step 3 – Calculate z_{obt} (the z we obtain from this test, often times we just drop the “obt”)

Use the z_{obt} formula, and plug into it our sample mean, the population mean we are comparing it against, and the standard error we calculated in the last step.

$$z_{\text{obt}} = \frac{M - \mu}{\sigma_M} = \frac{58 - 64}{2} = \frac{-6}{2} = -3$$

Step 4 – Determine z_{crit} (the critical value of z for rejecting H_0) and interpret the z_{obt} we just calculated.

In our class we will always use a level of significance of .05, and this is a one-tailed hypothesis with the lower tail critical because we are looking for our sample mean to be LOWER than the population mean we are comparing it against. The critical value of z for a one-tailed test is 1.65, and since this is a lower tail critical test we need to make that a negative (-1.65).



The gray area is the rejection area. It is the most extreme 5% (.05) in the lower tail of this distribution. Since our obtained z was -3 , which is beyond the critical z value of -1.65 , we can reject the null hypothesis. So it would be very unlikely to get a sample of 16 people from a population that actually had average scores of 64, with an average score of 58. Conclusion, the medicine does seem to lower scores.

So the answers to 7 through 10 are:

$$7 - b, z_{\text{obt}} = -3.0$$

8 - c, reject the null hypothesis

$$9 - a, \sigma_M = 2.0$$

10 - d,

$$H_0 = \mu \geq 64$$

$$H_1 = \mu < 64$$