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I didn't work with other students.

ECO 602 – Week 7 Reading Questions

**Readings**

McGarigal 6c: Confidence Interval Primer

For Questions 1 - 4, assume you are working with a population that is normally-distributed with mean $\mu$ and standard deviation $\sigma$. Note that although these population parameters exist, you cannot know their exact values and you must estimate them through sampling.

1. **Q1 (1 pt.):** Explain the effect, if any, of the population mean on the width of CIs for a population that is normally-distributed. If population mean does not affect the widths of CIs explain why not.

The population mean does not impact the width of CIs for a population that is normally-distributed. The sampling distribution is standardized to calculate the critical values, which are used as part of the CI calculation. Since we are able to standardize any normally distributed sample by subtracting the mean, the actual value of the mean doesn't impact the width of the CIs.

2. **Q2 (1 pt.):** Explain the effect, if any, of the population standard deviation on the width of CIs. If population standard deviation does not affect the widths of CIs explain why not.

A larger population standard deviation will result in a wider CI. If the population standard deviation is large then we would generally expect the sample standard deviation to also be large if we have a sample that adequately represents the source population. We use the sample standard deviation to calculate the standard error and then the standard error is used to calculate the CIs. Since the standard error is multiplied by the critical value to get the CI radius, a larger standard error results in a wider CI.

3. **Q3 (1 pt.):** Explain the effect, if any, of the *population size* on the width of CIs. If *population size* does not affect the widths of CIs explain why not.

The population size does not impact the width of the CIs. The size of the source population doesn't necessarily impact the population standard deviation and therefore shouldn't impact any of the parameters we use to calculate CIs.

4. **Q4 (1 pt.):** Explain the effect, if any, of the *sample size* on the width of CIs. If *sample size* does not affect the widths of CIs explain why not.

   A smaller sample size results in a wider CI because the sample standard error is larger. We use the sample standard error to calculate the CI. With a larger sample size, the standard error decreases and the width of the CI also decreases.

5. **Q5 (4 pts.):** Interpreting a CI. Use a narrative example of a real (or made up) dataset to describe what a Frequentist 95% confidence interval really means.
    a. Make sure you cover any relevant assumptions of the Frequentist paradigm.
    b. You answer must be in non-technical language.
    c. Imagine you were explaining confidence intervals to an audience of teenagers, or perhaps a family member who doesn't have training in statistics.

    I'm studying the local tick populations to learn if there are areas where people might be more likely to be exposed to a tick-borne disease such as Lyme Disease. We are going out to different areas where people spend time outdoors and collecting samples of ticks. We will bring the ticks we collect back to the lab to identify the species and test them to see if they are carrying the bacteria that causes Lyme Disease. It would be impossible for us to collect every single tick in our study areas to learn the true percentage of ticks that are carrying the bacteria that causes Lyme Disease. However, we are collecting as many samples as we can so that we can use those ticks to estimate the percentage of infected ticks in the larger population. We don't know if our estimate is exactly the same as the true value for that population of ticks, so we use a 95% confidence interval to give some information about how sure we are that our estimate is correct. The interval means that if we were able to collect an infinite number of samples of ticks from that population, we would expect the true percentage of infected ticks to be included in the confidence interval about 95% of the time. So there is still a 5% chance that our estimate AND the confidence interval doesn't actually include the true value.