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Week 7 Reading Questions

**All questions answered alone*

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 has an effect on the width of the CIs because that mean is what's being measured within the confidence interval, i.e., it's the idea that you can get a representation of the mean of some value 95% of the time if you measured 100 times. So, if the mean is small, the other measures used to calculate the CIs (standard deviation and standard error) will also change, affecting the width of the CIs.

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.

The population standard deviation affects the width of the CIs because the standard deviation goes into the calculation of the CIs by way of the standard error. If the sample size is small, the standard deviation is large, which increases the width of the CIs. But if the sample size is large, the standard deviation of the CIs stabilizes around the true variation of the population, meaning that it shrinks, which narrows the CIs.

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.

As your population size increases, the standard error, or the measure of variance in the sampled population, shrinks. This is because as a population increases in size, the standard deviation stabilizes. Since the standard error is calculated by taking the standard deviation (which is shrinking) divided by the square root of the sample size (which has been adjusted for "twice" the sample size), then the standard error will also shrink. This shrinkage of standard deviation and standard error should cause the width of the CIs to shrink as well.

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.

As sample size grows, the estimates we have of population parameters improve, stabilizing around true parameters such as the population mean and standard deviation. Since the means stabilize (peak) around the true mean and the standard deviation stabilizes (shrinks), the width of the CIs gets narrower with larger sample sizes.

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.

- Make sure you cover any relevant assumptions of the Frequentist paradigm.
- Your answer must be in non-technical language.

- **Imagine you were explaining confidence intervals to an audience of teenagers, or perhaps a family member who doesn't have training in statistics.**

Let's say I measured body size of the Common Eastern Bumble Bee, *Bombus impatiens*. If I wanted to understand more about whether my measurements were accurate and representative of *B. impatiens* populations, I could test that using something called confidence intervals. The idea behind confidence intervals is that if I repeated my measures of *B. impatiens* body size 100 times, 95 of those times, the values that I got for my own measurements would contain the true value that I'm looking for, in this case, the true mean body size of *B. impatiens*. The calculation I performed would then give me an idea of whether the measurements that I did have some degree of accuracy across the population.