*YOUR TA’S NAME*:

*Lecture Worksheet*

*Thursday 10/8/2020*

**MAIN POINTS OF LECTURE**

1. A confidence interval is a range of values that is “likely” to contain the population parameter (for example, a mean or proportion)
2. Just how “likely” it is that the confidence intervals contains the population proportion is called the confidence level
3. Confidence intervals can be written as: $Sample Estimate \pm Multiplier × Standard Error$, where the “multiplier” is the Z or t score we use to set our confidence level (e.g., a “multiplier” of 1.96 would correspond to a 95% confidence level)
4. **Confidence Intervals for Proportions**

Use $\hat{p}$ to infer *p*, the population proportion

$$se\_{\hat{p}}= \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

1. **Confidence Intervals for Means**

Use $\bar{Y}$ to infer **Y, the population mean of Y

$$se\_{\overline{Y}}= \frac{s\_{Y}}{\sqrt{n}}$$

1. **Confidence Intervals for Differences in Proportions**

 Use $\hat{p}\_{1}-\hat{p}\_{2}$to infer difference between two population proportions, *p*1 and *p*2

$$se\_{\hat{p}\_{1}-\hat{p}\_{2}}=\sqrt{\frac{\hat{p}\_{1}(1-\hat{p}\_{1})}{n\_{1}}+\frac{\hat{p}\_{2}(1-\hat{p}\_{2})}{n\_{2}}}$$

1. **Confidence Intervals for Differences in Means**

Use $\bar{Y}\_{1}-\bar{Y}\_{2}$ to infer the difference between two population means, **Y1 and **Y2

$$se\_{Y-X}=\sqrt{\frac{s\_{Y}^{2}}{n\_{Y}}+\frac{s\_{X}^{2}}{n\_{X}}}$$

**QUESTIONS**

1. [From the recorded lecture:] How many Americans cannot name the governor of the state in which they live? In 1987, the General Social Survey asked 1,819 people for the name of the governor of their state. 447 people gave incorrect answers. Construct and interpret a 99% confidence interval for p

$$\hat{p} \pm Z\_{α/2} × \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$0.246 \pm 2.575 × \sqrt{\frac{0.246(1-0.246)}{1819}}$$

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$$0.246 \pm 0.026$$

Between 22.0% and 27.2% can’t name their governor

1. [From the recorded lecture:] We sampled 1,600 people and observed their IQ scores. We got a sample mean of 103 and a standard deviation of 15. Construct a 90% confidence interval for the population mean .

$$\overline{Y}\pm t\_{a/2}\frac{s\_{Y}}{\sqrt{n}}$$

$$103\pm 1.646\frac{15}{\sqrt{1600}}$$

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$$103\pm 0.62$$

Mean IQ is between 102.38 and 103.62

1. [From the recorded lecture:] Every year the General Social Surveys asks people whether they agree or disagree that "a working mother can establish just as warm and secure a relationship with her children as a mother who does not work." In 1977, 735 of 1,503 respondents agreed. In 2012, 939 of 1,301 respondents agreed. Construct a 99% confidence interval for the difference in population proportions between 1977 and 2012.

$$\hat{p}\_{1}-\hat{p}\_{2}\pm Z\_{α/2}\sqrt{\frac{\hat{p}\_{1}(1-\hat{p}\_{1})}{n\_{1}}+\frac{\hat{p}\_{2}(1-\hat{p}\_{2})}{n\_{2}}}$$

$$0.489-0.722\pm 2.575\sqrt{\frac{0.489(1-0.489)}{1503}+\frac{0.722(1-0.722)}{1301}}$$

$$-0.233\pm 0.046$$

The difference was between -0.279 and -0.187. So, the percentage who agreed with that statement was between 18.7 and 27.9 percentage points higher in 2012 than in 1977

1. [From the recorded lecture:] Every year the General Social Surveys administers a 10-item vocabulary knowledge test. In 1974, the 1,447 respondents had a mean score of 6.0 (our of 10) with a standard deviation of 2.2. In 2012, the 1,280 respondents had a mean score of 5.9 with a standard deviation of 2.0. Construct a 99% confidence interval for the difference in population means between 1974 and 2012.

$$\overline{Y}-\overline{X}\pm t\_{α/2}\sqrt{\frac{s\_{Y}^{2}}{n\_{Y}}+\frac{s\_{X}^{2}}{n\_{X}}}$$

$$6.0-5.9\pm 2.581\sqrt{\frac{2.2\_{}^{2}}{1447}+\frac{2.0\_{}^{2}}{1280}}$$

$$0.1\pm 0.21$$

Thus, with 99% confidence we can say that between 1974 and 2012 the average score changed by between -0.11 and 0.31 points.