Case-based Social Statistics I  
CSSS 321  
Professor: Mark S. Handcock  

Solutions to Laboratory 10  
Due Friday, March 11, 2005

Problems to be handed in:

1) Submit electronically exercises 1 and 2 from Unit C-1 of *CyberStats* entitled “Confidence Intervals - The Concepts”

2) Submit electronically exercises 1-4, and 9-11 from Unit C-2 of *CyberStats* entitled “Confidence Intervals for the Mean.”
Exercises 1

1. Set the confidence level to 80%. Click animate! When 100 confidence intervals have been generated, click stop! What percentage of the intervals captured the true mean, 300?

   About 80% of the intervals should contain the population mean 300.

2. What does it mean to be "80% confident"?

   If numerous confidence intervals were calculated from different random samples from the population, we’d expect about 80% of them to contain the true population parameter.

3. Set the confidence level to 98%. Click animate! When 100 confidence intervals have been generated, click stop! What percentage of the intervals captured the true mean, 300?

   About 98% of the intervals should contain the population mean 300.

4. What does it mean to be "98% confident"?

   If numerous confidence intervals were calculated from different random samples from the population, we’d expect about 98% of them to contain the true population parameter.

5. Set the confidence level to 68%. Click sample! What is the length of the interval generated?

   One such 68% confidence interval was 286.9 to 302.8, so the width of the interval is 302.8 - 286.9, or 15.9.

6. Set the confidence level to 80%. Click sample! What is the length of the interval generated?

   One such 80% confidence interval was 288.7 to 309.3, so the width of the interval is 309.3 - 288.7, or 20.6.

7. Set the confidence level to 95%. Click sample! What is the length of the interval generated?

   One such 95% confidence interval was 289.9 to 321.2, so the width of the interval is 321.2 - 289.9, or 31.3.

8. In general, as the confidence level is increased, what happens to the length of a confidence interval?

   As the confidence level is increased, the width of the interval increases.

9. Calculate a 95% confidence interval for the actual percentage of 13- to 15-year-olds who have had sex.

   The lower limit of a 95% confidence interval is 13% - 4%, or 9%. The upper limit of a 95% confidence interval is 13% + 4%, or 17%. So, a 95% confidence interval is 9% to 17%. We can be 95% confident that between 9% and 17% of all 13- to 15-year old teenagers would report having had sex.

10. Calculate a 95% confidence interval for the actual percentage of 16- to 17-year-olds who have had sex.
C-2 Confidence Intervals for the Mean

Exercises 1

1. a. Based on a sample size of 100  
   b. Based on a sample size of 200

   **Which confidence interval, if either, would be wider?**

   Confidence interval a., since as sample size decreases, the width of the confidence interval increases.

2. a. A 90% confidence level  
   b. A 96% confidence level

   **Which confidence interval, if either, would be wider?**

   Confidence interval b., since as confidence level increases, the width of the confidence interval increases.

3. a. A sample standard deviation of 5  
   b. A sample standard deviation of 2

   **Which confidence interval, if either, would be wider?**

   Confidence interval a., since as sample standard deviation increases, the width of the confidence interval increases.

4. a. Calculated for a population of 1,000,000 people  
   b. Calculated for a population of 250,000,000 people

   **Which confidence interval, if either, would be wider?**

   Neither. Population size doesn't affect the width of the confidence interval.

5. **What is the appropriate z multiplier for an 82% confidence interval for a mean?**

   1.34

6. **What is the appropriate z multiplier for an 87% confidence interval for a mean?**

   1.51

7. **What is the appropriate z multiplier for a 97% confidence interval for a mean?**

   2.17

8. **Would the z multiplier for a 99.5% interval be larger or smaller than the z multiplier for a 99% interval? Justify your answer.**

   The z multiplier for a 99.5% confidence interval is larger than the z multiplier for a 99% confidence interval. The interval is an attempt to find the population mean; this attempt will be more successful if a wider range of values is included.
9. Calculate a 95% confidence interval for the average amount of time the liberal arts majors spent studying.

Your DataTools output should look like:

```
95% Confidence interval results:
Variable   Estimate   Std. Err.   L. Lim   U. Lim
LibArts    2.535      0.2062      2.131    2.939
```

We can be 95% confident that liberal arts majors at Penn State study, on average, between 2.1 and 2.9 hours a day.

10. Calculate a 95% confidence interval for the average amount of time the science majors spent studying.

Your DataTools output should look like:

```
95% Confidence interval results:
Variable   Estimate   Std. Err.   L. Lim   U. Lim
Science    3.797      0.3875      3.037    4.556
```

We can be 95% confident that science majors at Penn State study, on average, between 3.0 and 4.6 hours a day.

11. Compare the two confidence intervals, and draw an appropriate conclusion.

Because the two confidence intervals do not overlap, we can conclude that science majors at Penn State, on average, study longer daily than liberal arts majors at Penn State.

Exercises 2

12. What would the temperature, in degrees Fahrenheit, be for you on an ideal day? A meteorologist posed this question to a random sample of 18 people. Their average response was 75 degrees with a standard deviation of 6 degrees. If appropriate, use a z confidence interval for a mean to calculate a 99% confidence interval for the average ideal temperature. If you think it is not appropriate, explain why.

It is not appropriate to use the z confidence interval for a mean with small samples. A sample of 18 people is considered too small to use a Z confidence interval for a mean.

13. Estimate the average amount of time the student population watched TV on the night in question.

Using the sample standard deviation of 1.721 to estimate sigma, a 95% confidence interval for the mean as calculated using Data Tools is:

```
95% Confidence interval results:
Variable   Estimate   Std. Err.   L. Lim   U. Lim
TVhours    1.475      0.1924      1.098    1.852
```

That is, we can be 95% confident that, on average, Penn State students in introductory statistics classes watched between 1.1 and 1.9 hours of TV on the night in question.

14. How likely is it that the range of estimates you obtained in 13 contains the true average amount?

Since we calculated a 95% confidence interval, there is a 95% chance that the confidence interval contains the true average.

15. Are you willing to conclude that the average amount of time the population of students watched TV was more than 1 hour? Why or why not?