STAT 303 Sections 503–504 Confidence Interval Problems, Spring 1996

March 6, 1996

1 Doing Confidence Intervals

The following steps are used in finding confidence intervals:

1. Identify the parameter of interest.
2. Verify that the required assumptions are satisfied.
3. Run the Calculating Confidence Interval Lab.
4. Choose the correct case.
5. Fill in the information required for that case.
6. Read the results in the results window.

This handout contains a variety of examples of confidence interval problems. In the problems you are assigned, make sure to copy the output from the results window to Word and to include any graphs you are asked to find.

2 Homework

Problems 2, 6, 10, 11, 15, 16, 17, 21 are due Wednesday, March 20.

3 The Problems

1. Use `Calculator -> Inverse statistical tables` to find the following quantities:
   (a) $Z_{.05}$ and $Z_{.95}$.
   (b) $t_{.05,10}$ and $t_{.05,100}$.
   (c) $\chi^2_{.05,10}$ and $\chi^2_{.95,100}$.
   (d) $F_{.025,10,10}$ and $F_{.975,30,30}$.
2. Use `Calculator -> Inverse statistical tables` to find the following quantities:
   (a) $Z_{.10}$ and $Z_{.90}$.
   (b) $t_{.025,10}$ and $t_{.025,100}$.
   (c) $\chi^2_{.025,10}$ and $\chi^2_{.975,100}$.
   (d) $F_{.05,10,10}$ and $F_{.95,30,30}$.
3. In a study of the keyboard height that typists prefer, a sample of 31 trained typists was selected and their preferred heights determined. The resulting average height was 80 cm. Assuming that the population of all typists preferred heights is normally distributed with standard deviation 2 cm, find a 95% confidence interval for the mean of the population.
4. Consider an industrial process producing parts that are classified either as defective or nondefective. In a random sample of 200 units 6 are found to be defective. Find a 95% confidence interval for the proportion of all units that are defective. Use both the exact and approximate methods. Is the approximate method valid in this instance?
5. To compare two teaching methods, a school found 45 students who were as similar in backgrounds as they could and randomly selected 25 students to receive the first method and 20 students for the second. At the end of the school year, the same test was administered to both classes and the results recorded as follows: $\bar{X}_1 = 75$, $\bar{X}_2 = 79$, $s_1^2 = 9$, and $s_2^2 = 16$.
   (a) Assuming that the populations of test scores are normally distributed, use a 95% confidence interval to decide if it is reasonable to assume that the variability in the two populations is the same.
   (b) Based on your result in part (a), use a 95% confidence interval to decide if it is reasonable to conclude that the two testing methods lead to the same average test score.
6. A savings and loan association that finances a large number of home purchases in a particular region wanted information on the extent to

which mortgage payments reduced the amount of disposable income during the initial year of occupancy for first-time home buyers. A sample of 35 recently granted mortgage applications was obtained, and for each the amount of the monthly mortgage payment as a percent of take-home income was computed. The sample average percentage was found to be 24.7, with a standard deviation of 3.2. Assuming that percentage is a normally distributed variable (among all applicants), compute a 90% confidence interval for the true average percentage.

7. A sample of 250 petitioners who files for bankruptcy between 1964 and 1967 waited an average of 35.41 months to acquire the debts listed on the petitions, with a sample standard deviation of 21.34. Find a 99% confidence interval for the average number of months for all such petitioners.

8. The results of a test applied to samples of sand led to the following results

```
26.7 25.8 24.0 24.9 26.4 25.9 24.4 21.7
24.1 25.9 27.3 26.9 27.3 24.8 23.6
```

   (a) From a normal quantile plot, decide whether it seems reasonable to proceed as though this is a sample from a normal population.
   (b) If the normality assumption is reasonable, find a 95% confidence interval for the mean result of the test for all sand.

9. The following are data from a study on the amount of stress is experienced by a certain class of workers:

```
14.70 15.10 16.90 17.40 19.00 20.00 20.30
21.00 21.90 22.00 22.90 23.80 23.90 24.80
25.00 25.80 27.00
```

   If the data appear normal (check the normal quantile plot), find a 95% confidence interval for the standard deviation of the population of stresses.

10. The following observations were made on the hardness of a certain kind of steel

```
69.5 71.9 72.6 73.1 73.3 73.5 75.5
75.7 75.8 76.1 76.2 76.2 77.0 77.9
78.1 79.6 79.7 79.9 80.1 82.2 83.7 93.7
```

   If the data appear normal (check the normal quantile plot), find a 90% confidence interval for the standard deviation of hardness of this steel.

11. In Problem 7.18 (p. 523) in Moore and McCabe, use a 95% confidence interval to decide if it matters whether the knob is right or left threaded. (This is a paired data problem. You will have to find the mean and variance of the differences by 1) reading the data, 2) getting a new variable (called `diff`) by using `Data -> Generate/Replace`, and 3) finding the mean and standard deviation of `diff`. You will have to get s_d^2 using the standard calculator.)

12. Problem 7.15 (p. 522) of Moore and McCabe except in Part (b), use a 95% confidence interval instead of doing the test.

13. Part (c) of Problem 7.44 (p. 552) in Moore and McCabe.

14. Parts (a) and (c) of Problem 7.45 (p. 552) in Moore and McCabe.

15. In Problem 7.81 (p. 569) of Moore and McCabe, find a 95% confidence interval for the ratio of population variances for the two groups of dogs. Is it reasonable to conclude that the two variances are the same? Based on your conclusion, find a 95% confidence interval for the difference of population means in the two groups.

16. Problem 7.86 (p. 571) in Moore and McCabe.

17. Parts (a) and (c) of Problem 8.21 (p.596) in Moore and McCabe.

18. Part (b) of Problem 8.29 (p. 598) in Moore and McCabe.

19. Parts (a) and (b) of Problem 8.31 (p. 599) in Moore and McCabe.

20. Recall that a $100(1-\alpha)\%$ confidence interval for the mean of a normal population when the variance is known is given by $\bar{X} \pm Z_\alpha \sigma/\sqrt{n}$.

   (a) Show that the width of the interval is $2Z_\alpha \sigma/\sqrt{n}$.
   (b) To get an interval half as wide, how much must n be increased?

21. Do the Questions Based on the Lab on Page 108 of the lecture notes.