STAT 205, Spring 2015

Homework 5

Out: Tuesday March 3. Due in: Tuesday March 14

Answer all questions on one side of the same sheet of paper.

1. Page 214: Problems 6.S.2(b,c) and 6.S.3(a,b) (see next page for questions). The data are

   ```
   stem=c(2.3,2.6,2.4,2.2,2.3,2.5,1.9,2.0)
   ```

   For 6.S.2(b) use `t.test(stem)`; for 6.S.3(b) use `qqnorm(stem)`.

2. Soap manufacturers sell special antibacterial soaps. However, ordinary soap might also kill bacteria. A researcher placed ordinary soap (treatment) onto $n_1 = 7$ petri dishes and sterile water (control) on $n_2 = 8$ other perti dishes; E. Coli was added to all petri dishes. After 24 hours the number of bacterial colonies was counted on each dish. The data, given in Problem 6.6.9 (p. 205), are

   ```
   control=c(30,36,66,21,63,38,35,45)
   soap=c(76,27,16,30,26,46,6)
   ```

   (a) In R, obtain normal probability plots from each group treatment and control and comment on whether we can assume the data are normal in each group; e.g. `qqnorm(control)` and `qqnorm(soap)`. Include the plots in your writeup.

   (b) In R, obtain a 95% confidence interval for the difference in mean number of bacterial colonies 1-2 in soap vs. no-soap. Include the R output in your writeup (just the portion that reports the confidence interval). You will use something like `t.test(soap,control)`.

   (c) Interpret the confidence interval, i.e. write "With 95% confidence, the true mean difference in soap vs. no-soap bacterial colony counts are..."

6.S.1 To study the conversion of nitrite to nitrate in the blood, researchers injected four rabbits with a solution of radioactively labeled nitrite molecules. Ten minutes after injection, they measured for each rabbit the percentage of the nitrite that had been converted to nitrate. The results were as follows:[48]

51.1 55.4 48.0 49.5

(a) For these data, calculate the mean, the standard deviation, and the standard error of the mean.

(b) Construct a 95% confidence interval for the population mean percentage.

(c) Without doing any calculations, would a 99% confidence interval be wider, narrower, or the same width as the confidence interval you found in part (b)? Why?

6.S.2 The diameter of the stem of a wheat plant is an important trait because of its relationship to breakage of the stem, which interferes with harvesting the crop. An agronomist measured stem diameter in eight plants of the Tetrastichon cultivar of soft red winter wheat. All observations were made three weeks after flowering of the plant. The stem diameters (mm) were as follows:[49]

2.3 2.6 2.4 2.2 2.3 2.5 1.9 2.0

The mean of these data is 2.275 and the standard deviation is 0.238.

(a) Calculate the standard error of the mean.

(b) Construct a 95% confidence interval for the population mean.

(c) Define in words the population mean that you estimated in part (b). (See Example 6.1.1.)

6.S.3 Refer to Exercise 6.S.2.

(a) What conditions are needed for the confidence interval to be valid?

(b) Are these conditions met? How do you know?

(c) Which of these conditions is most important?

6.S.4 Refer to Exercise 6.S.2. Suppose that the data on the eight plants are regarded as a pilot study, and that the agronomist now wishes to design a new study for which he wants the standard error of the mean to be only 0.03 mm. How many plants should be measured in the new study?

6.S.5 A sample of 20 fruitfly (*Drosophila melanogaster*) larva were incubated at 37 °C for 30 minutes. It is theorized that such exposure to heat causes polytene chromosomes located in the salivary glands of the fly to unwind, creating puffs on the chromosome arm that are visible under a microscope. The following normal probability