Homework #8

Due: April 14, 2017

Thomas Jefferson (1743-1826):

> Determine never to be idle. No person will have occasion to complain of the want of time who never loses any. It is wonderful how much may be done if we are always doing.

For the hypothesis tests, perform all six steps outlined in class. This includes checking the assumptions of the test, and writing a conclusion in terms of the problem. If a significance level is not given to you in the problem, use $\alpha = .05$.

1. Do exercise 10.2. Assume that $n = 20$ individuals is large enough to use the normal approximation for the distribution of $\hat{p}$ in parts (a)-(e).

2. Do exercise 10.24 using a rejection region to make a decision. Perform and clearly label all six steps of the hypothesis test outlined in class.

3. Do exercise 10.23. For part (c), perform and clearly label all six steps of the hypothesis test outlined in class. Even though your book advocates using a z-test, use a pooled t-test for this problem. When checking assumptions (SRS? 5%? n big enough?), also check whether the two samples are independent of each other). Also:

   (d) Argue why pooling is appropriate for this problem.

   (e) Redo the hypothesis test, this time without pooling.

   (f) Argue why not pooling may be more preferable than pooling.

   (g) Check your answers using R's t.test function, and include the R-code and R-output. Check out the example at the course web site: t.test(summer,spring,var.equal=TRUE) in

   http://www.math.montana.edu/ parker/courses/STAT422/AlligatorExampleInR.pdf.

   t.test(summer,spring,var.equal=TRUE) uses a pooled variance estimate; t.test(summer,spring,var.equal=FALSE) uses the un-pooled variance estimate.

4. Regarding Exercise 10.50, suppose that a fat-cat airline executive wants to maintain $\alpha = 0.05$ and $\beta = 0.01$ (if the true mean occupancy is 59%) when conducting the test of non-profitability. Assume that a z-test is appropriate for the test of the population mean occupancy. What is the minimum number of flights n that must be used?

5. Refer to Exercise 10.50, when using $n = 120$ flights and $\alpha = 0.10$, find the probability of making a Type II error if the true occupancy rate is 59%. Be sure to draw a picture that shows the probabilities of Type I and Type II errors!

6. Read the AP article *Bad News For Male Mountain Bikers* reported by CBS News in December of 2002 available at http://www.cbsnews.com/stories/2002/12/02/health/main531381.shtml (an active link is also available on the STAT422 web site).

   (a) What hypotheses should be tested to determine if a higher proportion of male "extreme" mountain bike riders have low sperm counts and scrotal abnormalities when compared to other males.

   (b) Perform the rest of the hypothesis test by hand, being sure to check your assumptions! Even if the assumptions are not satisfied, conduct the test. Use the test statistic $\hat{p}_c = \frac{Y_1+Y_2}{n_1+n_2}$ (which results in the "'most powerful test").

   (c) Even if the assumptions for the test you just performed were met, could the results of this study be used to justify the assertion:

   > Frequent mountain biking may reduce fertility in men, according to a small Austrian study ... The research suggests frequent jolts and vibration caused by biking over rough terrain may cause abnormalities, including small scars within the scrotum and impaired sperm production.

Why or why not?

(d) Check your answers using R's prop.test function, and include the R-code and R-output in your solutions. For example, to test $H_0 : p_1 = p_2$ versus $H_a : p_1 > p_2$ with $\alpha = 0.01$ based on sample data of $\hat{p}_1 = 1/100$ and $\hat{p}_2 = 2/200$, you would implement prop.test(c(1,2),c(100,200),conf.level=.99,alternative="greater",correct=F).

Other practice problems:

Chapter 10: 1, 3, 17-43 odd, 51, 55, 57, 61-77 odd, 89, 101