Project #1
STAT 875
Spring 2019

Complete the following problems below. Within each part, include your R program output with code inside of it and any additional information needed to explain your answer. Your R code and output should be formatted in the exact same manner as in the lecture notes.

1. (12 total points) Exercise #1 of Chapter 1 describes a number of experiments that can be used to estimate π. Now, I would like you to come up with your own experiment! Complete the following using your data from the experiment.

   (a) (3 points) Describe your experiment. Discuss conditions that are needed in order to satisfy the five assumptions for using the binomial distribution as outlined in Section 1.1.1.

   (b) (2 points) Find $\hat{\pi}$.

   (c) (5 points) Calculate a 95% confidence interval for π. While normally only one interval would be calculated in practice, calculate the interval using the Wilson, Agresti-Coull, and Clopper-Pearson expressions. Compare these intervals.

   (d) (2 points) Interpret the Wilson interval from (c) in the context of your experiment.

   Because M&M color experiments are very common in these settings, I will not accept one of these for this problem.

2. (14 total points) Complete #14 in the Chapter 1 exercises with the following modifications

   (a) (3 points) Complete the problem as given.

   (b) (3 points, extra credit) Skip this problem or complete it for extra credit

   (c) Skip this problem because it is in the homework

   (d) (2 points) Only discuss the problems that occur when $\hat{\pi} = 0$ or 1. Note that the `binom.confint()` function uses the Clopper-Pearson interval.

   (e) (6 points) Complete the problem using `binom.confint()` to calculate the interval. Do not use the `binom.coverage()` function.

   (f) Skip this problem because it is in the homework

   (g) (3 points) Additional problem: Simplify the expression for

   $$\frac{\exp\left[\log\left(\frac{\pi}{1-\pi}\right)\right]}{1+\exp\left[\log\left(\frac{\pi}{1-\pi}\right)\right]}$$

   to its smallest form and show each step of the process. Use this result to justify the logit confidence interval expression.

3. (20 total points) Complete #17 in the Chapter 1 exercises with the following modifications.

   (a) (4 points) Complete the problem as given.

   (b) (4 points) Perform the score test only.

   (c) (4 points) Complete the problem as given.

   (d) (4 points) Complete the problem as given.

   (e) (4 points) Complete the problem as given.