Tutorial 4

Question 1

(10.64) A coin-operated soft drink machine was designed to discharge, on the average, 7 ounces of beverage per cup. In a test of the machine, ten cupfuls of beverage were drawn from the machine and measured. The mean and standard deviation of the 10 measurements were 7.1 ounces and 0.12 ounces, respectively.

(a) Do these data present sufficient evidence to indicate that the mean discharge differs from 7 ounces? Use $\alpha = 0.05$.

(b) What is the conclusion if $\alpha = 0.10$?

(c) R Find the p-value of the test statistic.

Question 2

(10.78) A manufacturer of hard safety hats for construction workers is concerned about the mean and the variation of the forces its helmets transmit to wearers when subjected to a standard external force. The manufacturer desires the mean force transmitted by helmets to be 800 pounds (or less), well under the legal 1000-pound limit, and desires σ to be less than 40. Tests were run on a random sample of $n = 40$ helmets, and the sample mean and variance were found to be equal to 825 pounds and 2350 pounds^2, respectively.

(a) If $\mu = 800$ and $\sigma = 40$, is it likely that any helmet subjected to the standard external force will transmit a force to a wearer in excess of 1000 pounds? Explain.

(b) Do the data provide sufficient evidence to indicate that when subjected to the standard external force, the helmets transmit a mean force exceeding 800 pounds?

(c) Do the data provide sufficient evidence to indicate that σ exceeds 40?

Question 3

The `t4.rds` data set contains the sample means and sample standard deviations of 200 samples of size 60. Suppose we wish to test the following hypotheses 200 times:

$$H_0 : \mu \leq 3.1 \quad \text{vs} \quad H_1 : \mu > 3.1.$$

For each part, assume that $\alpha = 0.05$.

(a) R Compute the values of the test statistics, their (approximate) p-values, and record whether the p-values result in a rejection of the null hypothesis.

(b) R Compute lower confidence bounds for the true mean and record whether the lower confidence bounds contain the value of 3.1.

(c) R What is the proportion of hypothesis tests where you rejected the null hypothesis? What is the proportion of lower confidence bounds that contained the value of 3.1? What do you notice?

(d) If the true value of μ was 4, in how many hypothesis tests did you commit an error? What type of error is this?