In-Class Assignment 15

For this problem, we will use the mtcars dataset.

1. The fuel efficiency of a set of 25 cars is calculated to be 22.3 mpg with a standard deviation of 5. We want to determine whether this value is statistically different from 20.09 mpg, which is the mean mpg value in the mtcars dataset, at the 95% confidence level.

(a) State the null hypothesis. Is it one-sided or two-sided?

(a) The null hypothesis is that the fuel efficiency is =20.09 mpg. This is two-sided

(b) Determine whether the null hypothesis is or is not falsified, by

(i) examining an appropriate confidence interval

22.3 - 5/sqrt(25) * qt(0.95, 24) =20.58912

22.3 + 5/sqrt(25) * qt(0.95, 24) = 24.01088

(ii) finding the p-value of the test result.

stand_error <- 5/sqrt(25)

t_val <- ((22.3 - 20.09) / stand_error)

pt <- pt(t_val, 24)

2* (1 - pt) = 0.03688981 (multiply by two because two sided)

So our null hypothesis is rejected

2. Sellers typically sell on average $5,300 in product per day. A new ad campaign has started for the products, and over the last several days sellers have sold $5,425 in products per day, with a standard deviation of $500, covering 38 person-days. We want to determine whether, at a 90% confidence level, sales have improved.

(a) State the null hypothesis. Is it one-sided or two-sided?

(a) Average = 5300 in product per day, one-sided because just looking at an increase

(b) Determine whether the null hypothesis is or is not falsified, by

(i) examining an appropriate confidence interval

5425 - 500/sqrt(38) * qt(0.90,37) = 5319.162

which is greater than So rejected

(ii) finding the p-value of the test result.

stand_error2 <- 500/sqrt(38)

t_val2 <- ((5425 - 5300) / stand_error2)

pt <- pt(t_val2, 37)

1 - pt = 0.0659008

(c) Suppose the mean value of $5,425 continues to be the case. How many person-days would it take to say that the ad campaign worked at a 99% confidence level?

n = 90

stand_error2 <- 500/sqrt(n)

t_val2 <- ((5425 - 5300) / stand_error2)

pt <- pt(t_val2, n-1)

1 - pt = 0.009930927

So 90 days