Chapter 11, Question 35:

I run my analysis with a null hypothesis H0: µControl - µOzone = 0 and alternative hypothesis H1: µControl - µOzone != 0. I use an unpaired unequal variance t-test.

Running the code, we can see that we get a p-value of about 0.02, which is quite low. If we test at a 5% significance level, we would reject the null hypothesis that the population means are equal, based on this low p-value. Looking at the 95% confidence interval for µControl - µOzone, we have (1.99, 20.85), which heavily implies the two means are different.

In other words, I believe that the means of both datasets are different, implying that Ozone does have an effect on the weight of rats over a period of regular exposure.

R Code:

x <- c(41, 38.4, 24.9, 25.9, 21.9, 18.3, 13.1, 27.3, 28.5, -16.9, 17.4, 21.8, 15.4,

27.4, 19.2, 22.4, 17.7, 26, 29.4, 21.4, 22.7, 26, 26.6) #Control

y <- c(10.1, 6.1, 20.4, 7.3, 14.3, 15.5, -9.9, 6.8, 28.2, 17.9, -12.9, 14, 6.6, 12.1,

15.7, 39.9, -15.9, 54.6, -14.7, 44.1, -9, -9) #Ozone

#This data gives no reason to be paired. Examining their sample variance:

s\_X2 <- var(x)

s\_Y2 <- var(y)

#We see their variances are very far from each other, implying their population variances are

#different. Hence, we will use the unpaired unequal variance t-test.

#H0: Mu.x - Mu.y = 0

#H1: Mu.x - Mu.y != 0

sample\_mean\_difference <- mean(x) - mean(y)

n <- length(x)

m <- length(y)

#SE when variances are unequal

se\_unequal <- sqrt(s\_X2/n + s\_Y2/m)

t\_statistic = sample\_mean\_difference/se\_unequal

#Saitherwaite approximation

degree = ((s\_X2/n) + (s\_Y2/m))^2/(((s\_X2/n)^2)/(n-1) + ((s\_Y2/m)^2)/(m-1))

pvalue <- pt(t\_statistic, df = degree, lower.tail = FALSE)\*2

#These findings can be summarised by the t.test() function below.

t.test(x, y, var.equal = FALSE, alternative = "two.sided")