STAR511: HW 4

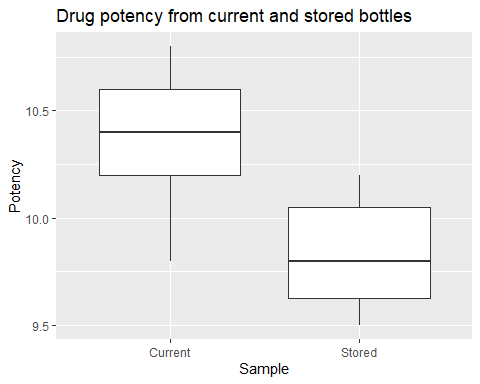
Megan Sears

# Q1

A sample size of 15 per group is required to achieve a 90% power using alpha = 0.05.

##   
## Two-sample t test power calculation   
##   
## n = 14.48098  
## delta = 1.5  
## sd = 1.2  
## sig.level = 0.05  
## power = 0.9  
## alternative = two.sided  
##   
## NOTE: n is number in \*each\* group

# Q2



# Q3

| Sample | Mean | StDev |
| --- | --- | --- |
| Current | 10.37 | 0.32 |
| Stored | 9.83 | 0.24 |

# Q4

Since the max standard deviation (Current samples) and min standard deviation (Stored samples) ratio is less than 2, we can assume “equal” variances and use a pooled two-sample t-test. Since the sample sizes are equal, the effect of unequal variances on the t-test is minimal. However, pooled test is preferred since the standard deviation ratio is less than 2.

## [1] 1.333333

# Q5

##   
## Two Sample t-test  
##   
## data: Potency by Sample  
## t = 4.2368, df = 18, p-value = 0.0004959  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 0.2722297 0.8077703  
## sample estimates:  
## mean in group Current mean in group Stored   
## 10.37 9.83

## t   
## 4.24

## [1] 0.0004959478

The null hypothesis is mu1 - mu2 (Current standard deviation - Stored standard deviation) equal zero and the alternative hypothesis is that it does not equal 0.

The test statistics is 4.24.

The p-value is 4.9594777^{-4}.

The p-value is less than 0.05. Therefore, the null hypothesis should be rejected. We find evidence that there is a difference in means.

# Q6

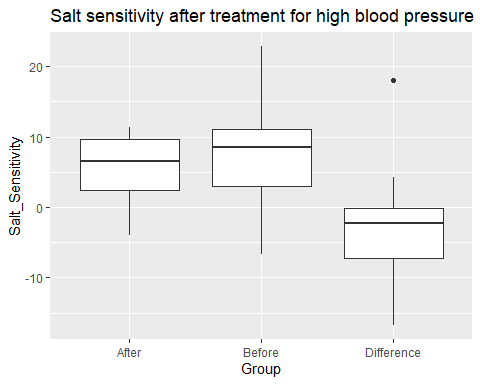
The p-value is the probability that a new sample would produce would produce a test statistic at least as large as 4.24 in magnitude if the null hypothesis were true.

# Q7

The 95% CI for the difference between the two population means is (0.27, 0.81). Since the CI does not include 0, we have evidence that there is a difference between the population means.

##   
## Two Sample t-test  
##   
## data: Potency by Sample  
## t = 4.2368, df = 18, p-value = 0.0004959  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 0.2722297 0.8077703  
## sample estimates:  
## mean in group Current mean in group Stored   
## 10.37 9.83

# Q8



# Q9

A. The statistical hypotheses are the null hypothesis is the population difference in means are equal to 0 and the alternative hypothesis is they are not equal to 0.

##   
## Paired t-test  
##   
## data: salt$After and salt$Before  
## t = -0.86098, df = 9, p-value = 0.4116  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -9.373261 4.205261  
## sample estimates:  
## mean of the differences   
## -2.584

## t   
## -0.8609794

## [1] 0.4115991

B. T-test output above. The test statistic is -0.8609794 and the p-value is 0.4115991.

C. The confidence interval is -9.37 to 4.21.

# Q10

##   
## Exact Wilcoxon-Pratt Signed-Rank Test  
##   
## data: y by x (pos, neg)   
## stratified by block  
## Z = -1.1722, p-value = 0.2754  
## alternative hypothesis: true mu is not equal to 0

# Q11



Based on the qqplot above, the differences are not normally distributed. Therefore, the Wilcoxon paired signed rank test will be used to discuss the salt sensitivity before and after treatment for high blood pressure. The p-value (0.28) is greater than alpha, which indicates failing to reject the null hypothesis. Therefore, we did not find evidence that there is a difference between means. Since there is not a difference between there is likely no change in salt sensitivity before and after treatment for high blood pressure.

# Appendix

#Retain (and do not edit) this code chunk!!!  
library(knitr)  
knitr::opts\_chunk$set(echo = FALSE)  
knitr::opts\_chunk$set(message = FALSE)  
  
library(tidyverse)  
library(here)  
library(coin)  
  
#Q1  
pool\_sd <- 1.2  
delta <- 1.5  
alpha <- 0.05  
power <- 0.9  
  
power.t.test(delta = delta, sd = pool\_sd,   
 sig.level = alpha, power = power,   
 type = 'two.sample', alternative = 'two.sided')  
  
  
#Q2  
potency <- read\_csv(here('./HW4/ex6-59.txt'), quote = "'")  
  
pot\_long <- potency %>%  
 rename(Current = Sample1,  
 Stored = Sample2) %>%  
 pivot\_longer(everything(), names\_to = 'Sample',  
 values\_to = 'Potency')  
  
boxplot <- ggplot(pot\_long, aes(x=Sample, y=Potency)) + geom\_boxplot() +  
 ggtitle("Drug potency from current and stored bottles")  
  
boxplot  
  
#Q3  
pot\_long\_summ <- pot\_long %>%  
 group\_by(Sample) %>%  
 summarize(Mean = mean(Potency),  
 StDev = round(sd(Potency),2))  
  
kable(pot\_long\_summ)  
  
#Q4  
sd\_ratio <- 0.32/0.24  
sd\_ratio  
  
#Q5  
q5test <- t.test(data = pot\_long, Potency ~ Sample, var.equal = T)  
q5test  
  
ts <- round(q5test$statistic, 2)  
ts  
  
pval <- q5test$p.value   
pval  
  
#Q7  
q5test  
  
#Q8  
salt <- read\_csv(here('./HW4/ex6-28.txt'), quote = "'")  
  
salt\_long <- salt %>%  
 mutate(Difference = After - Before) %>%  
 pivot\_longer(everything(), names\_to = 'Group',  
 values\_to = 'Salt\_Sensitivity')   
  
salt\_boxp <- ggplot(salt\_long, aes(x=Group, y=Salt\_Sensitivity)) +  
 geom\_boxplot() +  
 ggtitle('Salt sensitivity after treatment for high blood pressure')  
  
salt\_boxp  
  
#Q9  
salt <- salt %>%  
 mutate(Difference = After - Before)  
  
q9 <- t.test(salt$After, salt$Before, paired = T)  
q9  
  
ts <- q9$statistic  
ts  
  
pval <- q9$p.value  
pval  
  
#Q10  
wilcoxsign\_test(After ~ Before, data = salt, distribution = 'exact')  
  
#Q11  
ggplot(salt, aes(sample = Difference)) +   
 stat\_qq() + stat\_qq\_line() +  
 xlab('Theoretical quantiles') +  
 ylab('Sample quantiles')