PSTAT122 HW1

2.25 The following are the burning times (in minutes) of chemical flares of two different formulations. The design engineers are interested in both the mean and the variance the burning times.

```
Type1 <- c(65,81,57,66,82,82,67,59,75,70)
Type1
```

```
##  [1] 65 81 57 66 82 82 67 59 75 70
```

```
Type2 <- c(64,71,83,59,65,56,69,74,82,79)
Type2
```

```
##  [1] 64 71 83 59 65 56 69 74 82 79
```

(a) Test the hypothesis that the two varaiances are equal. Use $\alpha = .05$. $H_0 : \sigma 1^2 = \sigma 1$ $H_1 : \sigma 1^2 \neq \sigma 1$

We are going to use an F-test at $\alpha = .05$.

```
ybar1 <-mean(Type1)
ybar1
```

```
## [1] 70.4
```

```
Variance_ybar1 <-var(Type1)
Variance_ybar1
```

```
## [1] 85.82222
```

```
ybar2 <- mean(Type2)
ybar2
```

```
## [1] 70.2
```

```
Variance_ybar2 <- var(Type2)
Variance_ybar2
```

```
## [1] 87.73333
```

```
f <- Variance_ybar1 / Variance_ybar2
f
```

```
## [1] 0.9782168
```

```
qf(.975,9,9)
```

```
## [1] 4.025994
```

```
qf(.025,9,9)
```

```
## [1] 0.2483859
```

```
pf(0.9782168,9,9)
```

```
## [1] 0.4871832
```

Since our observed F statistic is lower than our critical F distribution we can conclude that we fail to reject H_0

(b) using the results of part (a), test the hypothesis that the mean burning times are equal. Use $\alpha = .05$. What is the P-value for this test?

```
n1 = 10
n2 =10
ybar1 <-mean(Type1)
ybar1
```

```
## [1] 70.4
```

```
ybar2 <- mean(Type2)
ybar2
```

```
## [1] 70.2
```

```
Variance_type1 <-var(Type1)
Variance_type1
```

```
## [1] 85.82222
```

```
Variance_type2 <- var(Type2)
Variance_type2
```

```
## [1] 87.73333
```

```
sp_num = ((n1-1)*Variance_type1) + ((n2-1)*Variance_type2)
sp_den = n1 + n2 -2
sp = sqrt(sp_num / sp_den)
sp
```

```
## [1] 9.315459
```

```
t_stat <-(ybar1 - ybar2)/ (sp* (sqrt((1/n1)+(1/n2))))
t_stat
```

```
## [1] 0.04800768
```

```
qt(.025,n1 + n2-2, lower.tail = F)
```

```
## [1] 2.100922
```

```
pt(t_stat, n1+n2-2)
```

```
## [1] 0.5188806
```

Concluding to fail to reject the null H_0

(c) Disscuss the role of the normaliity assumption in this problem. Check the assumption of normality for both types of flares.

```
Type1 <- c(65,81,57,66,82,82,67,59,75,70)
Type1
```

```
##  [1] 65 81 57 66 82 82 67 59 75 70
```

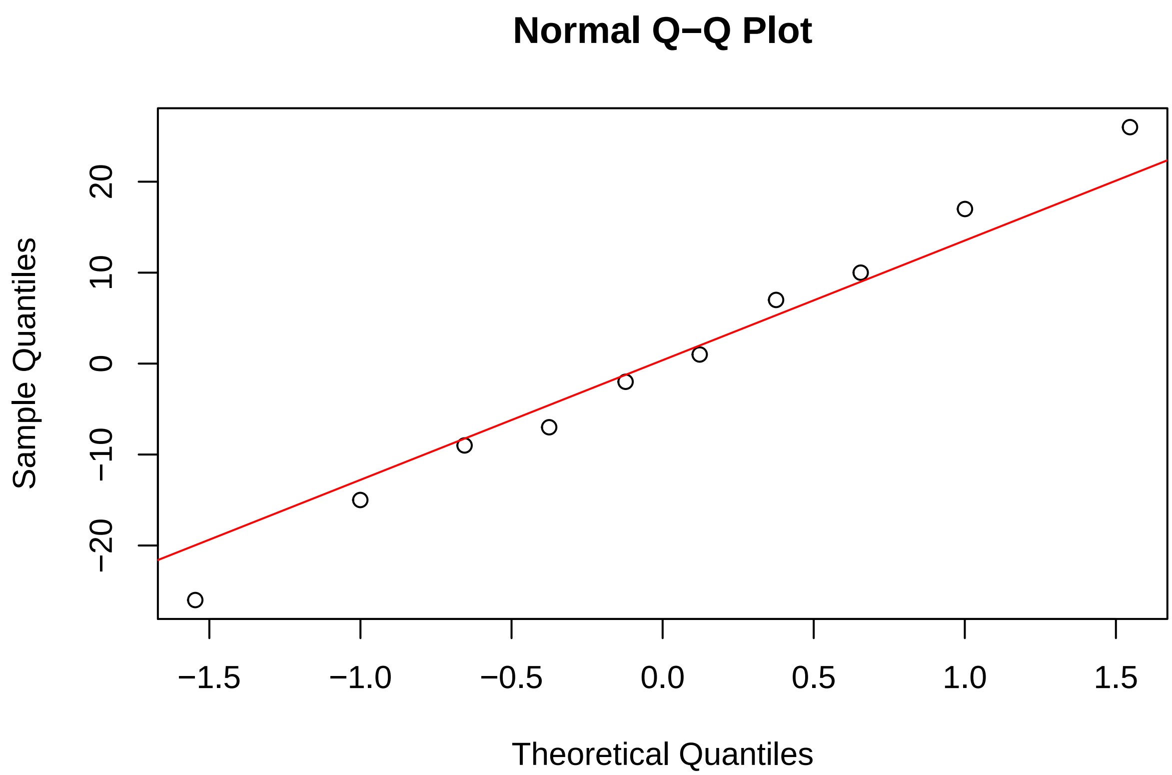
```
Type2 <- c(64,71,83,59,65,56,69,74,82,79)
Type2
```

```
##  [1] 64 71 83 59 65 56 69 74 82 79
```

```
Type1_Type2_Diff = Type1 - Type2
Type1_Type2_Diff
```

```
##  [1]   1  10 -26   7  17  26  -2 -15  -7  -9
```

```
qqnorm(Type1_Type2_Diff)
qqline(Type1_Type2_Diff, col = 'red')
```



There is 2 data points that are relativley fat from the data that follows the line realtiviley well, so the overall trend seems to be normally distributed.

2.29 The Diameter of a ball bearing was measured by 12 inspectors, each using two different kinds of calipers. The results are as follows:

```
Inspector <- c(1,2,3,4,5,6,7,8,9,10,11,12)
Inspector
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12
```

```
Caliper_1<- c(.265,.265,.266,.267,.267,.265,.267,.267,.265,.268,.268,.265)
Caliper_1
```

```
##  [1] 0.265 0.265 0.266 0.267 0.267 0.265 0.267 0.267 0.265 0.268 0.268 0.265
```

```
Caliper_2 <- c(.264,.265,.264,.266,.267,.268,.264,.265,.265,.267,.268,.269)
Caliper_2
```

```
##  [1] 0.264 0.265 0.264 0.266 0.267 0.268 0.264 0.265 0.265 0.267 0.268 0.269
```

(a) Is there significant difference between the means of the population of measurements from which the two samples were selected? $\alpha = .05$

$H_0 : \mu_1 = \mu_2$ $H_1 : \mu_1 \neq \mu_2$

```r
mean_caliper1 <- mean(Caliper_1)
mean_caliper1
```

```
## [1] 0.26625
```

```r
mean_caliper2<-mean(Caliper_2)
mean_caliper2
```

```
## [1] 0.266
```

```r
Caliper_Order_Diff = Caliper_1 - Caliper_2
sdsqd <- (1/11)*sum((Caliper_Order_Diff - mean(Caliper_Order_Diff))^2)
sdsqd
```

```
## [1] 4.022727e-06
```

```r
t <-mean(Caliper_Order_Diff)/(sqrt(sdsqd)/sqrt(12))
t
```

```
## [1] 0.4317878
```

```r
t.test(Caliper_1,Caliper_2, paired = TRUE)
```

```
##
##  Paired t-test
##
## data:  Caliper_1 and Caliper_2
## t = 0.43179, df = 11, p-value = 0.6742
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.001024344  0.001524344
## sample estimates:
## mean of the differences
##                 0.00025
```

No, are test statistic is 0.4317878 there isn't a significant diference between the mean of the following populations from the Calipers selected.

**(b) Find the P-value for the test in part (a)*

#Due to the t.test we were given a p-value of 0.6742

(c) Construct a 95 percent confidence Interval on the difference in mean diameter measurements for the two types of calipers.

```r
upper_bound <- mean(Caliper_Order_Diff) +qt(.025,11,lower.tail = FALSE)*sqrt(sdsqd)/sqrt(12)
upper_bound
```

```
## [1] 0.001524344
```

```r
lower_bound <- mean(Caliper_Order_Diff) -qt(.025,11,lower.tail = FALSE)*sqrt(sdsqd)/sqrt(12)
lower_bound
```

```
## [1] -0.001024344
```

```r
t.test(Caliper_1,Caliper_2, paired = TRUE)
```

```
##
##  Paired t-test
##
## data:  Caliper_1 and Caliper_2
```

```
## t = 0.43179, df = 11, p-value = 0.6742
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.001024344  0.001524344
## sample estimates:
## mean of the differences
##                 0.00025
```

As shown in our t.test output The 95% condidence interval of the mean diameter measurments for the two types of calipers is (-0.001024344 0.001524344).