homework3

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9/7/2021

Problem 2.28

part a

```
var.test(mane6313_homework3$p2_28_type1,mane6313_homework3$p2_28_type2,altern
ative = "two.sided",conf.level = 0.95)
```

```
##
##  F test to compare two variances
##
## data:  mane6313_homework3$p2_28_type1 and mane6313_homework3$p2_28_type2
## F = 0.97822, num df = 9, denom df = 9, p-value = 0.9744
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.2429752 3.9382952
## sample estimates:
## ratio of variances
##          0.9782168
```

The p-value for the F-test is 0.9744. Using α= 0.05, the conclusion of the hypothesis test $H_0 : \frac{\sigma_1^2}{\sigma_2^2} = 1$ versus $H_1 : \frac{\sigma_1^2}{\sigma_2^2} \neq 1$ is fail to reject H_0. Thus, it can be assumed that the variances are equal.

Part b

Conduct a two-sample t-test to determine if the means are equal. Use $\alpha = 0.05$.

```
t.test(mane6313_homework3$p2_28_type1,mane6313_homework3$p2_28_type2,alternat
ive = "two.sided",mu=0,paired=FALSE,var.equal=TRUE, conf.level = 0.95)
```

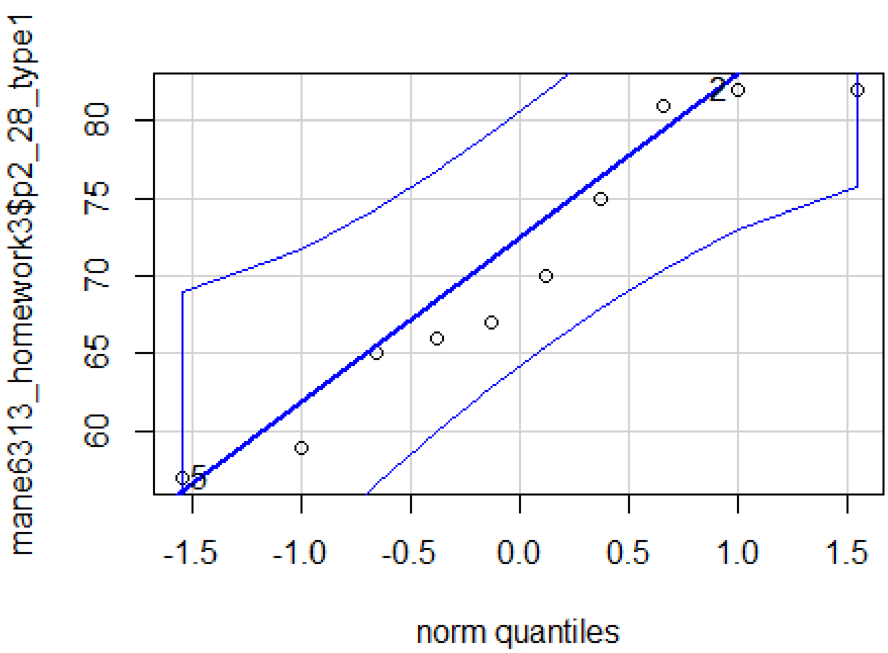
```
##
##  Two Sample t-test
##
## data:  mane6313_homework3$p2_28_type1 and mane6313_homework3$p2_28_type2
## t = 0.048008, df = 18, p-value = 0.9622
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.552441  8.952441
## sample estimates:
## mean of x mean of y
##      70.4      70.2
```

The p-value for the t-test is 0.9622. Using α= 0.05, the conclusion of the hypothesis test $H_0: \mu_1 = \mu_2 = 0$ versus $H_1: \mu_1 \neq \mu_2$ is fail to reject H_0. Thus, it can be assumed that the means are equal.

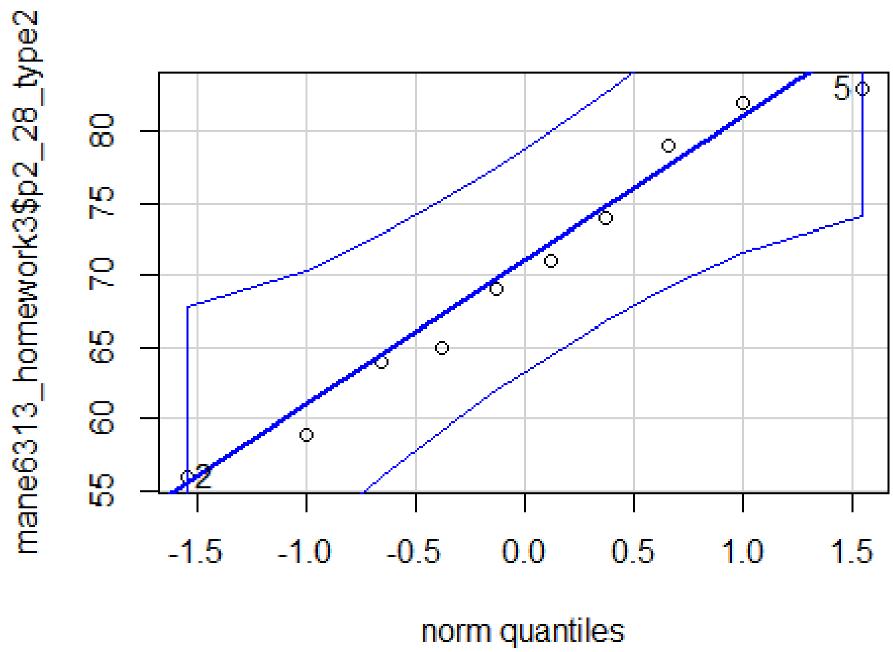
Part c

Test for normality.

```
library(car)

## Loading required package: carData

qqPlot(mane6313_homework3$p2_28_type1)
```




```
## [1] 5 2

qqPlot(mane6313_homework3$p2_28_type2)
```




```
## [1] 2 5
```

Observing both normal probability plots (qqPlots), all points for both plots lie within the confidence bands. Therefore, it can be assume that both samples are from a normal distribution.

Problem 2.33

Part a

Construct a 95% confidence interval for σ^2.

```
library(EnvStats) # import library

##
## Attaching package: 'EnvStats'

## The following object is masked from 'package:car':
##
##     qqPlot

## The following objects are masked from 'package:stats':
##
##     predict, predict.lm
```

```
## The following object is masked from 'package:base':
##
##     print.default
```

```
varTest(mane6313_homework3$p2_33,alternative = "two.sided", conf.level =
0.95, sigma.squared=1.0)
```

```
##
##  Chi-Squared Test on Variance
##
## data:  mane6313_homework3$p2_33
## Chi-Squared = 15.019, df = 19, p-value = 0.5572
## alternative hypothesis: true variance is not equal to 1
## 95 percent confidence interval:
##  0.4571524 1.6862395
## sample estimates:
##  variance
## 0.7904484
```

From the output, the 95% confidence interval for σ^2 is (0.4571524, 1.6862395)

Part b

Perform a hypothesis test of $H_0: \sigma^2 = 1$ versus $H_1: \sigma^2 \neq 1$. Use $\alpha = 0.05$.

```
library(EnvStats) # import library
varTest(mane6313_homework3$p2_33,alternative = "two.sided", conf.level =
0.95, sigma.squared=1.0)
```

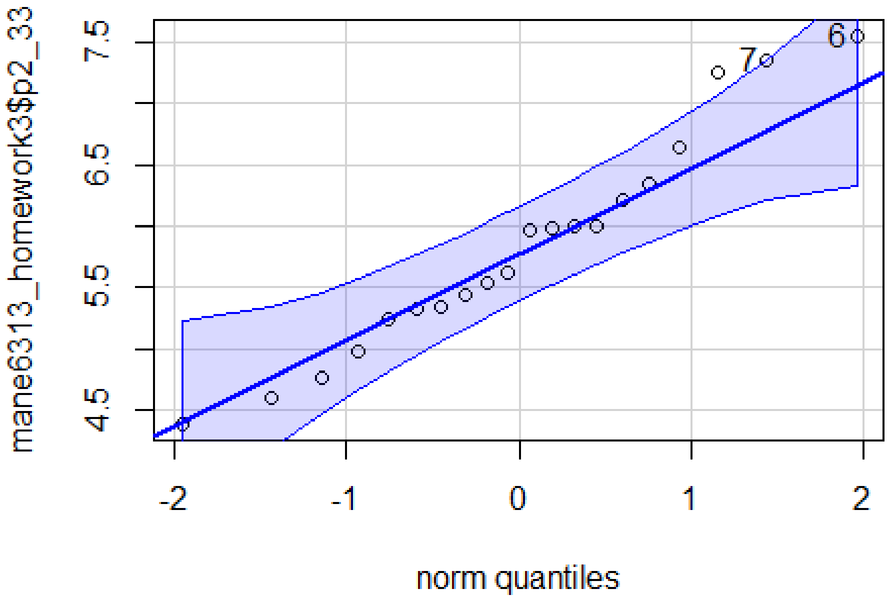
```
##
##  Chi-Squared Test on Variance
##
## data:  mane6313_homework3$p2_33
## Chi-Squared = 15.019, df = 19, p-value = 0.5572
## alternative hypothesis: true variance is not equal to 1
## 95 percent confidence interval:
##  0.4571524 1.6862395
## sample estimates:
##  variance
## 0.7904484
```

From the varTest output, the p-value is 0.5572. Since p-value is greater than α, the conclusion is fail to reject H_0 and accept the null hypothesis that σ^2 is equal to one.

Part c

Check the assumption of normality.

```
library(car)
car::qqPlot(mane6313_homework3$p2_33)
```




```
## [1] 6 7
```

Notice that a point is beyond the confidence bands. Therefore, the data is not from a normal distribution and it is not appropriate to use the t-test. A non-parametric test such as Kruskall-Wallis test should be used.

Problem 2.34

Part a

Conduct a test of hypothesis using $\alpha = 0.05$ to determine if $H_0{:}\, \mu_d = 0$ versus $H_1{:}\, \mu_d \neq 1$.

```
t.test(mane6313_homework3$p2_34_caliper1,mane6313_homework3$p2_34_caliper2,al
ternative = "two.sided",mu=0,paired=TRUE, conf.level = 0.95)

## 
##  Paired t-test
## 
## data:  mane6313_homework3$p2_34_caliper1 and
mane6313_homework3$p2_34_caliper2
## 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
```

The critical value for the rejection region is given below.

```
qt(.975,11)

## [1] 2.200985
```

Since the absolute value of the test statistics is not greater than the critical value, 2.200985. The conclusion is to fail to reject H_0 and accept the null hypothesis that the means are equal.

Part b

The p-value, observed from the part a output, is 0.6742.

Part c

The value of the two-sided 95% confidence interval, found in the part a output, is (-0.001024344, 0.001524344).