Homework Week 03

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9/18/2022

```r
# Answer to the problem 2.32.(b).
Inspector <- c (1:12)
Caliper1 <- c(0.265,0.265,0.266,0.267,0.267,0.265,0.267,0.267,0.265,0.268,0.268,0.265)
Caliper2 <- c(0.264,0.265,0.264,0.266,0.267,0.268,0.264,0.265,0.265,0.267,0.268,0.269)
Inspector <- as.character(Inspector)
Caliper1 <- as.numeric(Caliper1)
Caliper2 <- as.numeric(Caliper2)
dat <- data.frame(Inspector,Caliper1,Caliper2)
dat
```

```
##    Inspector Caliper1 Caliper2
## 1          1    0.265    0.264
## 2          2    0.265    0.265
## 3          3    0.266    0.264
## 4          4    0.267    0.266
## 5          5    0.267    0.267
## 6          6    0.265    0.268
## 7          7    0.267    0.264
## 8          8    0.267    0.265
## 9          9    0.265    0.265
## 10        10    0.268    0.267
## 11        11    0.268    0.268
## 12        12    0.265    0.269
```

```r
str(dat)
```

```
## 'data.frame':    12 obs. of  3 variables:
##  $ Inspector: chr  "1" "2" "3" "4" ...
##  $ Caliper1 : num  0.265 0.265 0.266 0.267 0.267 0.265 0.267 0.267 0.265 0.268 ...
##  $ Caliper2 : num  0.264 0.265 0.264 0.266 0.267 0.268 0.264 0.265 0.265 0.267 ...
```

```r
t.test(dat$Caliper1,dat$Caliper2,paired=TRUE,alternative = c("two.sided"))
```

```
##
##  Paired t-test
##
## data:  dat$Caliper1 and dat$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
```

```r
# P-value is 0.67

# Answer to the problem 2.34.(b).
grider <- c("S1/1","S2/1","S3/1","S4/1","S5/1","S2/1","S2/2","S2/3","S2/4")
Kmethod <- c(1.186,1.151,1.322,1.339,1.200,1.402,1.365,1.537,1.559)
Lmethod <- c(1.061,0.992,1.063,1.062,1.065,1.178,1.037,1.086,1.052)
grider <- as.factor(grider)
Kmethod <- as.numeric(Kmethod)
Lmethod <- as.numeric(Lmethod)
dat <- data.frame(grider,Kmethod,Lmethod)
dat
```

```
##   grider Kmethod Lmethod
## 1   S1/1   1.186   1.061
## 2   S2/1   1.151   0.992
## 3   S3/1   1.322   1.063
## 4   S4/1   1.339   1.062
## 5   S5/1   1.200   1.065
## 6   S2/1   1.402   1.178
## 7   S2/2   1.365   1.037
## 8   S2/3   1.537   1.086
## 9   S2/4   1.559   1.052
```

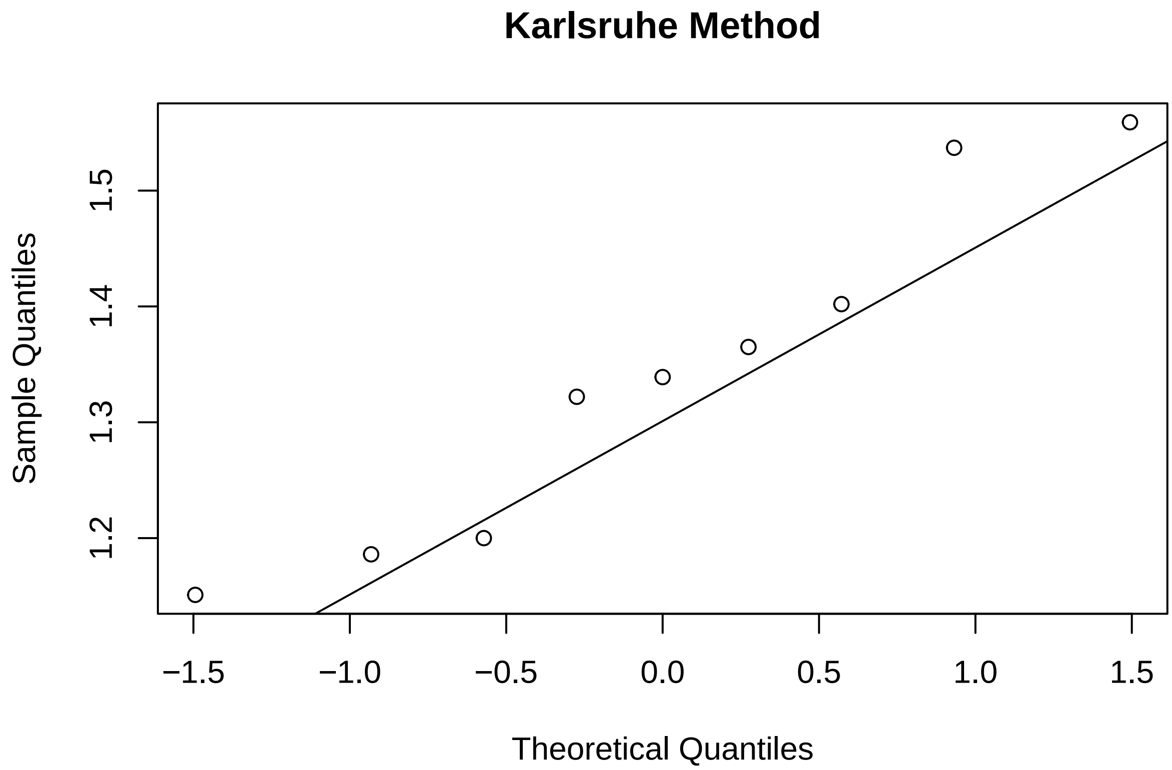
```r
str(dat)
```

```
## 'data.frame':    9 obs. of  3 variables:
##  $ grider : Factor w/ 8 levels "S1/1","S2/1",..: 1 2 6 7 8 2 3 4 5
##  $ Kmethod: num  1.19 1.15 1.32 1.34 1.2 ...
##  $ Lmethod: num  1.061 0.992 1.063 1.062 1.065 ...
```

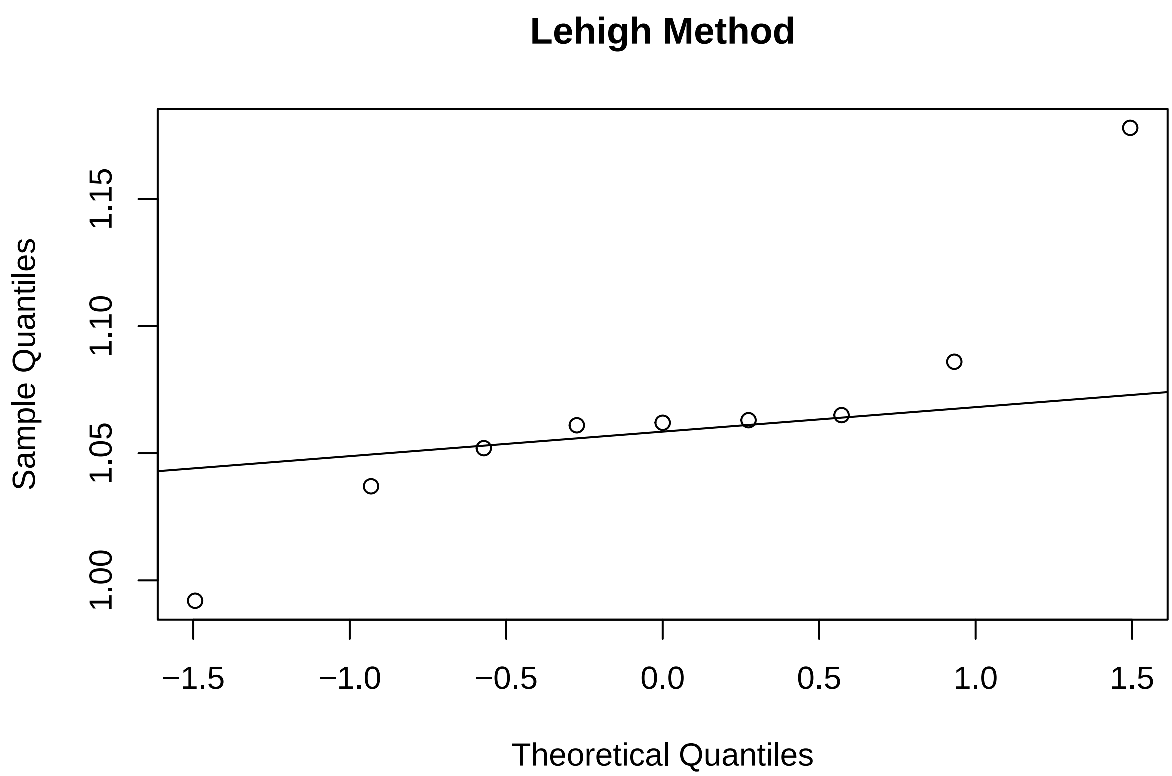
```r
t.test(dat$Kmethod,dat$Lmethod,paired=TRUE,alternative = c("two.sided"))
```

```
##
##  Paired t-test
##
## data:  dat$Kmethod and dat$Lmethod
## t = 6.0819, df = 8, p-value = 0.0002953
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.1700423 0.3777355
## sample estimates:
## mean of the differences
##               0.2738889
```

```r
# P-value is 0.0002953

# Answer to the problem 2.34.(d).
qqnorm(dat$Kmethod,main="Karlsruhe Method")
qqline(dat$Kmethod)
```

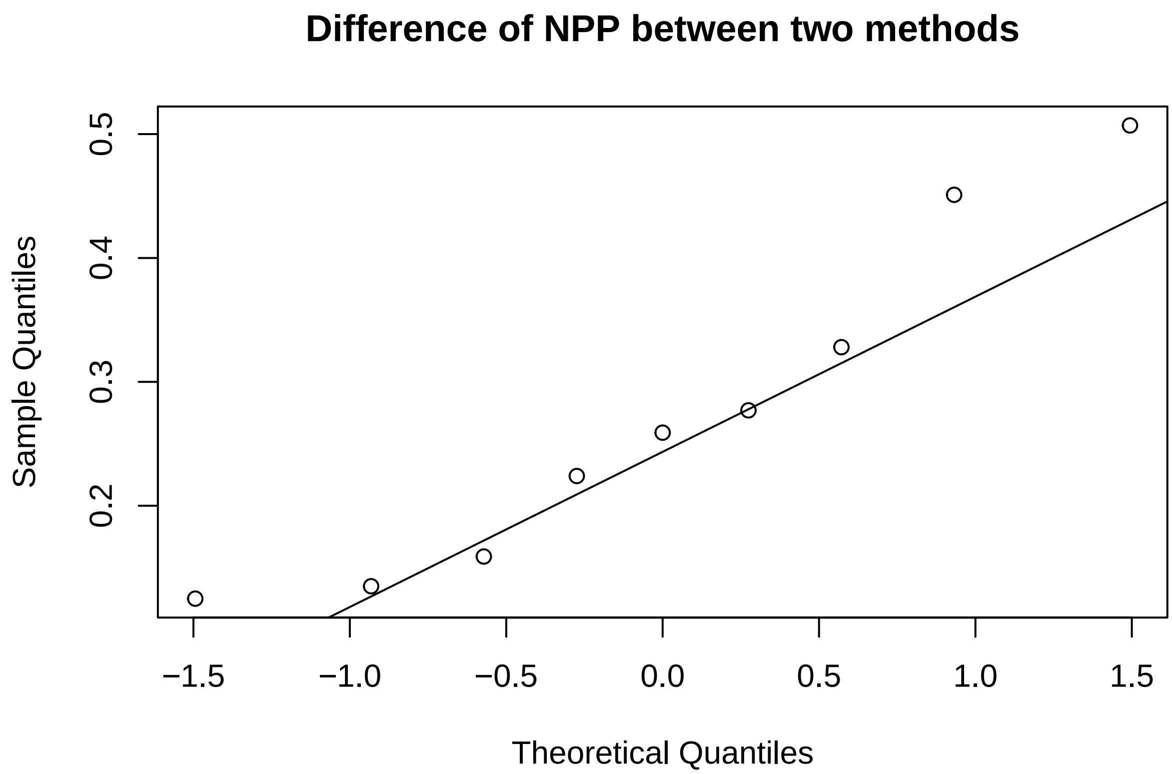



```
qqnorm(dat$Lmethod,main = "Lehigh Method")
qqline(dat$Lmethod)
```




```
# If we ignore some outliers especially from Lehigh Method then both the sample's
# are approximately normally distributed. Since, almost all points fall
```

```
# on a straight line.

# Answer to the problem 2.34.(e).
qqnorm(dat$Kmethod-dat$Lmethod,main="Difference of NPP between two methods")
qqline(dat$Kmethod-dat$Lmethod)
```

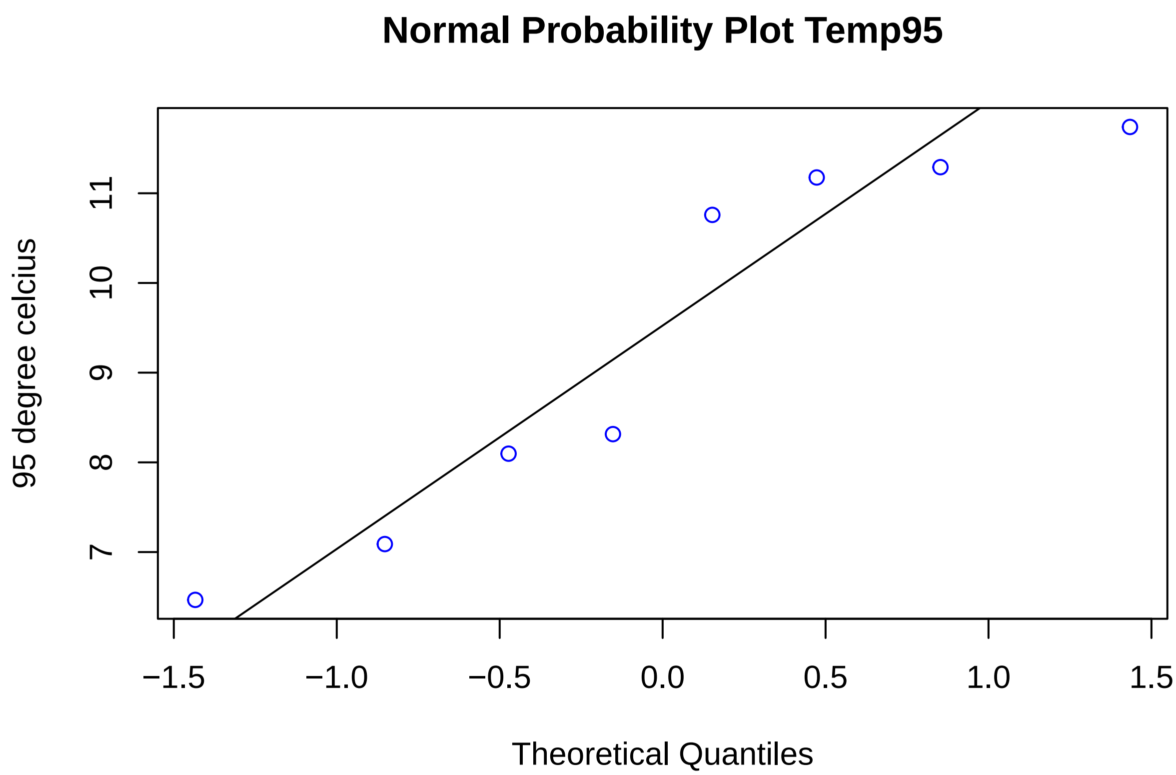



```
# If we ignore some outliers for the diffrence in ratios of the two method's
# then it is approximately normally distributed. Since, almost all points fall
# on a straight line.

# Answer to the problem 2.34.(f).
# As in any t-test, the assumption of normality is of only little importance.
# In the paired t-test, the assumption of normality applies to the distribution
# of the differences. That is, the individual sample measurements do not have
# to be normally distributed, but their difference.

# Answer to the problem 2.29.(e).
Temp95 <- c(11.176,7.089,8.097,11.739,11.291,10.759,6.467,8.315)
Temp100 <- c(5.263,6.748,7.461,7.015,8.133,7.418,3.772,8.963)
dat <- data.frame(Temp95,Temp100)
dat
```

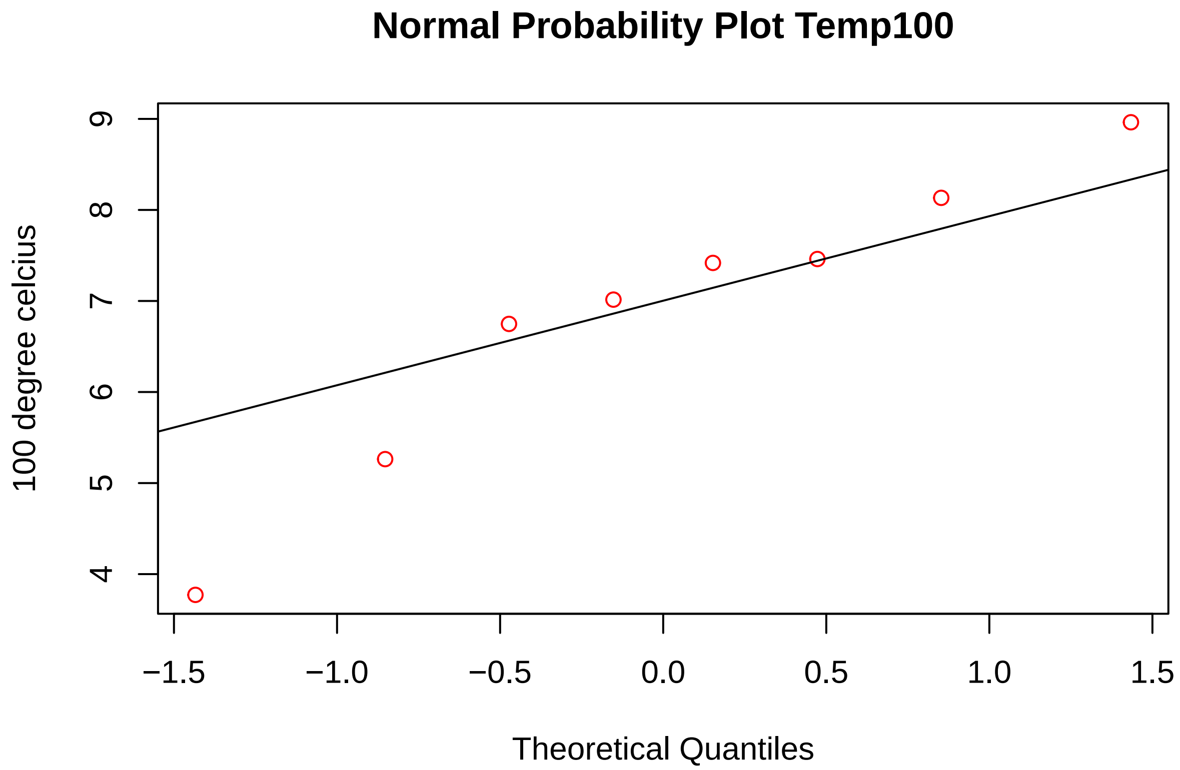
```
##   Temp95 Temp100
## 1 11.176   5.263
## 2  7.089   6.748
## 3  8.097   7.461
## 4 11.739   7.015
## 5 11.291   8.133
## 6 10.759   7.418
## 7  6.467   3.772
```

```
## 8  8.315   8.963
```

```r
# Normality assumptions check
qqnorm(dat$Temp95,main="Normal Probability Plot Temp95",col="blue",ylab="95 degree celcius")
qqline(dat$Temp95)
```




```r
qqnorm(dat$Temp100,main="Normal Probability Plot Temp100",col="red",ylab="100 degree celcius")
qqline(dat$Temp100)
```




```
# No significant deviations been observed from both (Temp 95 and Temp 100) of the
# the normality assumptions.

# Answer to the problem 2.29.(f).
library(pwr)
pwr.t.test(n=8,d=1.34,sig.level = 0.05,power = NULL,type = c("two.sample"), alternative = c("two.sided")
```

```
##
##      Two-sample t test power calculation
##
##               n = 8
##               d = 1.34
##       sig.level = 0.05
##           power = 0.7030143
##     alternative = two.sided
##
## NOTE: n is number in *each* group
```

Source Code

```
Inspector <- c (1:12)
Caliper1 <- c(0.265,0.265,0.266,0.267,0.267,0.265,0.267,0.267,0.265,0.268,0.268,0.265)
Caliper2 <- c(0.264,0.265,0.264,0.266,0.267,0.268,0.264,0.265,0.265,0.267,0.268,0.269)
Inspector <- as.character(Inspector)
Caliper1 <- as.numeric(Caliper1)
Caliper2 <- as.numeric(Caliper2)
dat <- data.frame(Inspector,Caliper1,Caliper2)
dat
str(dat)
t.test(dat$Caliper1,dat$Caliper2,paired=TRUE,alternative = c("two.sided"))
grider <- c("S1/1","S2/1","S3/1","S4/1","S5/1","S2/1","S2/2","S2/3","S2/4")
```

```
Kmethod <- c(1.186,1.151,1.322,1.339,1.200,1.402,1.365,1.537,1.559)
Lmethod <- c(1.061,0.992,1.063,1.062,1.065,1.178,1.037,1.086,1.052)
grider <- as.factor(grider)
Kmethod <- as.numeric(Kmethod)
Lmethod <- as.numeric(Lmethod)
dat <- data.frame(grider,Kmethod,Lmethod)
dat
str(dat)
t.test(dat$Kmethod,dat$Lmethod,paired=TRUE,alternative = c("two.sided"))
qqnorm(dat$Kmethod,main="Karlsruhe Method")
qqline(dat$Kmethod)
qqnorm(dat$Lmethod,main = "Lehigh Method")
qqline(dat$Lmethod)
qqnorm(dat$Kmethod-dat$Lmethod,main="Difference of NPP between two methods")
qqline(dat$Kmethod-dat$Lmethod)
Temp95 <- c(11.176,7.089,8.097,11.739,11.291,10.759,6.467,8.315)
Temp100 <- c(5.263,6.748,7.461,7.015,8.133,7.418,3.772,8.963)
dat <- data.frame(Temp95,Temp100)
dat
qqnorm(dat$Temp95,main="Normal Probability Plot Temp95",col="blue",ylab="95 degree celcius")
qqline(dat$Temp95)
qqnorm(dat$Temp100,main="Normal Probability Plot Temp100",col="red",ylab="100 degree celcius")
qqline(dat$Temp100)
library(pwr)
pwr.t.test(n=8,d=1.34,sig.level = 0.05,power = NULL,type = c("two.sample"), alternative = c("two.sided")
```