ass3

```r
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.4     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   2.0.1     v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```r
library(xlsx)
data <- read.xlsx("~/Desktop/204 R/LEADMOSS.xlsx",sheetIndex = 1)

y=data$LEAD
x1=data$ELEVATION
x2=data$SLOPE
mod1=lm(y~x1*x2)
summary(mod1)
```

```
##
## Call:
## lm(formula = y ~ x1 * x2)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.9695 -2.9344 -1.0941  0.2766 22.1018
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.0701418  6.2503485   0.811    0.421
## x1           0.0007367  0.0024516   0.301    0.765
## x2          -0.8796772  8.5747512  -0.103    0.919
## x1:x2        0.0003999  0.0033833   0.118    0.906
##
## Residual standard error: 5.338 on 56 degrees of freedom
## Multiple R-squared:  0.005896,   Adjusted R-squared:  -0.04736
## F-statistic: 0.1107 on 3 and 56 DF,  p-value: 0.9535
```

```r
library(psych)
```

```
##
## Attaching package: 'psych'

## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
x2.factor=factor(x2)
describeBy(y,x2.factor)
```

```
##
##  Descriptive statistics by group
## group: 0
##    vars  n mean   sd median trimmed  mad  min   max range skew kurtosis   se
## X1    1 29 6.92 5.78   5.21    5.92 1.79 2.64 24.38 21.74 2.12     3.21 1.07
## ----------------------------------------------------------------
## group: 1
##    vars  n mean   sd median trimmed  mad  min   max range skew kurtosis   se
## X1    1 31 7.01 4.72    6.5    6.31 2.63 2.63 29.13  26.5 3.25    12.71 0.85
```

```
par(mfrow=c(1,2))
qqnorm(subset(y,x2.factor==0),main="Group 1")
qqline(subset(y,x2.factor==0))
qqnorm(subset(y,x2.factor==1),main="Group 2")
qqline(subset(y,x2.factor==1))
```
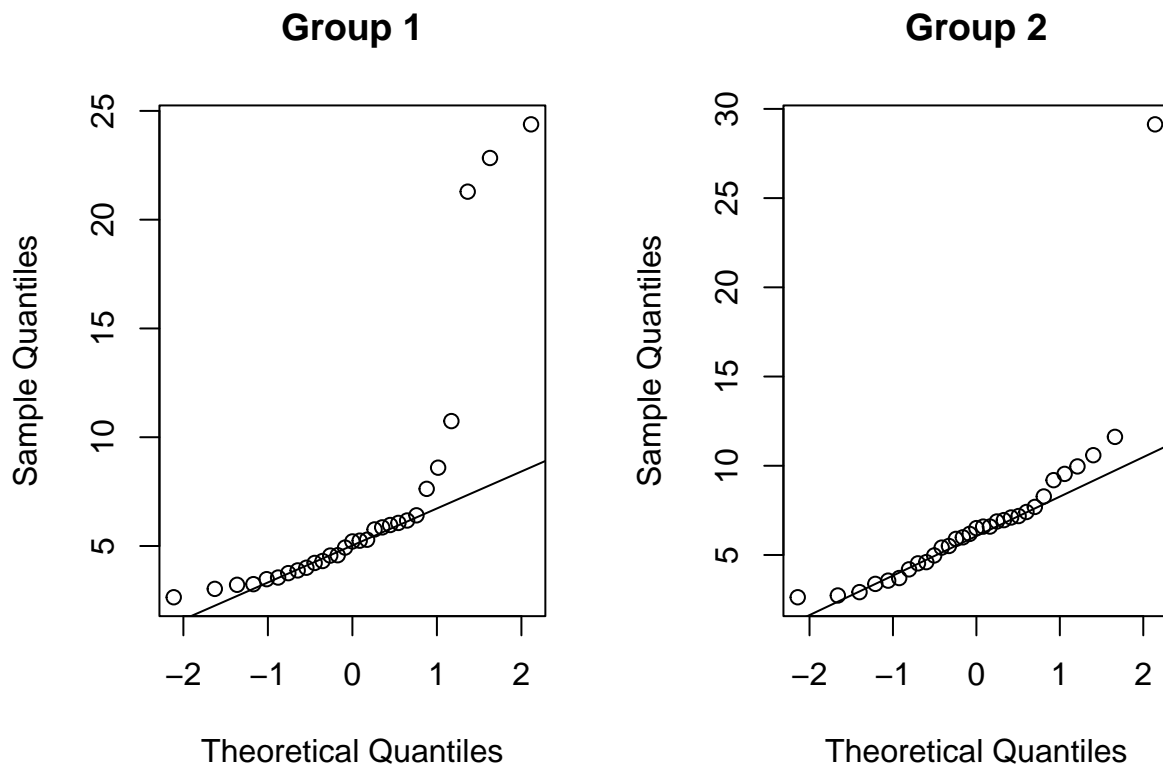
```
plot(x=data$ELEVATION[data$SLOPE==1],y=data$LEAD[data$SLOPE==1],xlab="elevation",ylab="lead level",col=
lines(x=data$ELEVATION[data$SLOPE==0],y=data$LEAD[data$SLOPE==0],col="blue",pch=20,type='p')
abline(a=5.0701418,b=0.0007367,col="blue")
abline(a=4.190465,b=0.0011366,col="red")

legend(2000,30,legend=c("slope face=0","slope face=1"),col=c("blue","red"),lty=c(1,1),bty="n")
```
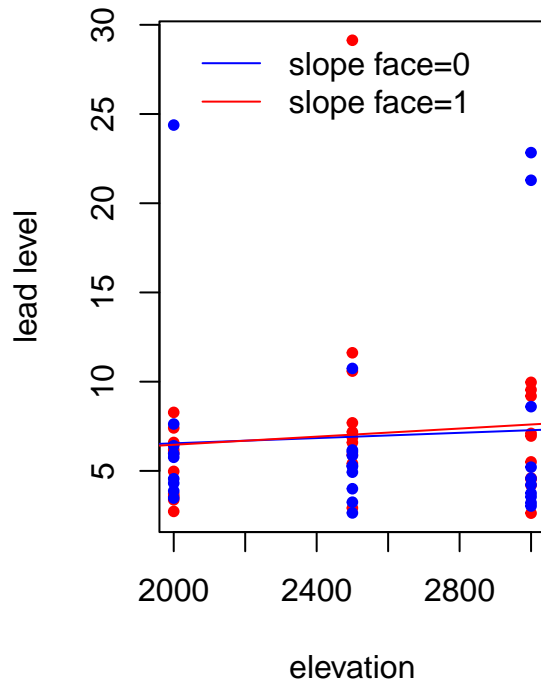


```
anova(mod1)
```

```
## Analysis of Variance Table
##
## Response: y
##           Df  Sum Sq Mean Sq F value Pr(>F)
## x1         1    8.85  8.8492  0.3105 0.5796
## x2         1    0.22  0.2181  0.0077 0.9306
## x1:x2      1    0.40  0.3982  0.0140 0.9063
## Residuals 56 1595.83 28.4970
```

```
t=lm(y~y)
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on the
## right-hand side and was dropped
```

```
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 1 in
## model.matrix: no columns are assigned
```

```
t1=lm(y~x1)
t2=lm(y~x2)
t3=lm(y~x1+x2)
t4=lm(y~x1*x2)
summary(t)
```

```
##
## Call:
## lm(formula = y ~ y)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3398 -2.8252 -1.1627  0.2672 22.1633
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.9707     0.6734   10.35 6.94e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.216 on 59 degrees of freedom
```

```
summary(t1)
```

```
##
## Call:
## lm(formula = y ~ x1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -4.810 -2.918 -1.093  0.338 22.163
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.6190000  4.2026043   1.099    0.276
## x1          0.0009407  0.0016591   0.567    0.573
##
## Residual standard error: 5.246 on 58 degrees of freedom
## Multiple R-squared:  0.005512,   Adjusted R-squared:  -0.01163
## F-statistic: 0.3215 on 1 and 58 DF,  p-value: 0.5729
```

```
summary(t2)
```

```
##
## Call:
## lm(formula = y ~ x2)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3828 -2.8461 -1.1383  0.2242 22.1202
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  6.92469    0.97690   7.088 2.08e-09 ***
## x2           0.08915    1.35908   0.066    0.948
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.261 on 58 degrees of freedom
## Multiple R-squared:  7.418e-05,  Adjusted R-squared:  -0.01717
## F-statistic: 0.004303 on 1 and 58 DF,  p-value: 0.9479
```

summary(t3)

```
##
## Call:
## lm(formula = y ~ x1 + x2)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.8715 -2.9213 -1.0907  0.2796 22.1049
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.5415238  4.3289852   1.049    0.299
## x1          0.0009467  0.0016748   0.565    0.574
## x2          0.1207421  1.3682614   0.088    0.930
##
## Residual standard error: 5.292 on 57 degrees of freedom
## Multiple R-squared:  0.005648,   Adjusted R-squared:  -0.02924
## F-statistic: 0.1619 on 2 and 57 DF,  p-value: 0.8509
```

summary(t4)

```
##
## Call:
## lm(formula = y ~ x1 * x2)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.9695 -2.9344 -1.0941  0.2766 22.1018
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.0701418  6.2503485   0.811    0.421
## x1           0.0007367  0.0024516   0.301    0.765
## x2          -0.8796772  8.5747512  -0.103    0.919
## x1:x2        0.0003999  0.0033833   0.118    0.906
##
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## F-statistic: 0.1107 on 3 and 56 DF,  p-value: 0.9535
```

```
moda=lm(y~x1*x2)
modb=update(moda,.~.-x1:x2)
anova(modb,moda)
```

```
## Analysis of Variance Table
##
## Model 1: y ~ x1 + x2
## Model 2: y ~ x1 * x2
##   Res.Df    RSS Df Sum of Sq     F Pr(>F)
## 1     57 1596.2
## 2     56 1595.8  1   0.39822 0.014 0.9063
```

```
modc=update(moda,.~.-x1)
anova(modc,modb)
```

```
## Analysis of Variance Table
##
## Model 1: y ~ x2 + x1:x2
## Model 2: y ~ x1 + x2
##   Res.Df    RSS Df Sum of Sq F Pr(>F)
## 1     57 1598.4
## 2     57 1596.2  0   2.1753
```

```
modd=update(moda,.~.-x2)
anova(modd,modb)
```

```
## Analysis of Variance Table
##
## Model 1: y ~ x1 + x1:x2
## Model 2: y ~ x1 + x2
##   Res.Df    RSS Df Sum of Sq F Pr(>F)
## 1     57 1596.1
## 2     57 1596.2  0   -0.0983
```

```
mode=update(modd,.~.-x1)
anova(mode,modd)
```

```
## Analysis of Variance Table
##
## Model 1: y ~ x1:x2
## Model 2: y ~ x1 + x1:x2
##   Res.Df    RSS Df Sum of Sq     F Pr(>F)
## 1     58 1604.4
## 2     57 1596.1  1   8.2846 0.2959 0.5886
```