SML ASSIGNMENT 1

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Exercice 1

```
mnist <- read_mnist() # Read in the MNIST data
```

```
### loading train set
xtrain <- mnist$train$images
ytrain <- mnist$train$labels
ytrain <- as.factor(ytrain)

### loading test set

xtest <- mnist$test$images
ytest <- mnist$test$labels
ytest <- as.factor(ytest)

#### loading only 1 and 7 from train set

xtrain17 <- xtrain[ytrain==1 | ytrain==7,]
ytrain17 <- ytrain[ytrain==1 | ytrain==7]
ytrain17 <- as.factor(as.numeric(as.vector(ytrain17)))

#### loading only 1 and 7 from test set

xtest17 <- xtest[ytest==1|ytest==7,]
ytest17 <- ytest[ytest==1|ytest==7]
ytest17 <-  as.factor(as.numeric(as.vector(ytest17)))
```

Question 1 Let extract a fragment of the large data set

In order to have a good representation of the level '1' and '7' and because we are going to do a classification , stratifed sampling is a good approach. This function below come from the Rmarkdown file of the lecturer Enerst FOKOUE.

It allow to do a stratified sampling and also respect de proportion for train set and test set according to the way it is in the MNIST data set.

The proportion test/train =0.167.

According to percentage of representation of each level we can deduce the n and m.

Percentage of level=0.4

n=5203 m=865

```
stratified.holdout <- function(y, ptr)
   {
     n              <- length(y)
     labels         <- unique(y)       # Obtain classifiers
     id.tr          <- id.te <- NULL
     # Loop once for each unique label value

     y <- sample(sample(sample(y)))

     for(j in 1:length(labels))
     {
        sj    <- which(y==labels[j])  # Grab all rows of label type j
        nj    <- length(sj)           # Count of label j rows to calc proportion below

        id.tr <- c(id.tr, (sample(sample(sample(sj))))[1:round(nj*ptr)])
      }                               # Concatenates each label type together 1 by 1

      id.te  <- (1:n) [-id.tr]          # Obtain and Shuffle test indices to randomize

      return(list(idx1=id.tr,idx2=id.te))
   }




hold  <- stratified.holdout(ytrain17, 0.4)
   id.tr <- hold$idx1
   ntr   <- length(id.tr)

   p   <- ncol(xtrain)



   hold  <- stratified.holdout(ytest17, 0.4)
   id.te <- hold$idx1
   nte   <- length(id.te)


   xtr <- xtrain17[id.tr,]
   ytr17 <- ytrain17[id.tr]
   xte <- xtest17[id.te,]
   yte17 <- ytest17[id.te]
```

In the MNIST dataset we have the number of input that is 784 . In order to make our machine faster we will accept to lose a bit in accuracy using the reputated tool PCA. It consist of reducing the number of variable based on the fact that some of them are correlated.

```
    pca.tr17 <- prcomp(xtr)

   pv <- cumsum((summary(pca.tr17)$sdev)^2)


   lambda <- (summary(pca.tr17)$sdev)^2
   pv <- cumsum(lambda/sum(lambda))
```

```
   q <- min(which(pv>0.90))

   q
```

```
## [1] 59
```

```
   xtr17 <- predict(pca.tr17,xtr)[,1:q]
   xte17 <- predict(pca.tr17,xte)[,1:q]
```

Question 2 Let find the confusion matrice for each data set and for each machine.

####For the first machine 1NN

```
##### 1NN

ytr.1nn <- knn(xtr17, xtr17, ytr17, k=1)

   conf.mat.tr.1nn <- table(ytr17, ytr.1nn)

   #conf.mat.tr.1nn

yte.1nn <- knn(xtr17, xte17, ytr17, k=1)

   conf.mat.te.1nn <- table(yte17, yte.1nn)

   #conf.mat.te.1nn
   print(conf.mat.tr.1nn)
```

```
##      ytr.1nn
## ytr17    1    7
##     1 2684    0
##     7    0 2519
```

```
   print(conf.mat.te.1nn)
```

```
##      yte.1nn
## yte17   1   7
##     1 477   0
##     7   6 382
```

```
#### 9NN
ytr.9nn <- knn(xtr17, xtr17, ytr17, k=9)

   conf.mat.tr.9nn <- table(ytr17, ytr.9nn)

   #conf.mat.tr.1nn

yte.9nn <- knn(xtr17, xte17, ytr17, k=9)

   conf.mat.te.9nn <- table(yte17, yte.9nn)

   #conf.mat.te.1nn
   print(conf.mat.tr.9nn)
```

For the second machine 9NN

```
##      ytr.9nn
## ytr17    1    7
##     1 2678    6
##     7   31 2488
```

```
   print(conf.mat.te.9nn)
```

```
##      yte.9nn
## yte17   1   7
##     1 477   0
##     7  11 377
```

```
ytr.18nn <- knn(xtr17, xtr17, ytr17, k=18)

   conf.mat.tr.18nn <- table(ytr17, ytr.18nn)

   #conf.mat.tr.1nn

yte.18nn <- knn(xtr17, xte17, ytr17, k=18)

   conf.mat.te.18nn <- table(yte17, yte.18nn)

   #conf.mat.te.1nn
   print(conf.mat.tr.18nn)
```

For the third machine 18NN

```
##      ytr.18nn
## ytr17    1    7
##     1 2678    6
##     7   47 2472
```

```
   print(conf.mat.te.18nn)
```

```
##      yte.18nn
## yte17   1   7
##     1 477   0
##     7  12 376
```

```
### 27NN


ytr.27nn <- knn(xtr17, xtr17, ytr17, k=27)

   conf.mat.tr.27nn <- table(ytr17, ytr.27nn)

   #conf.mat.tr.1nn

yte.27nn <- knn(xtr17, xte17, ytr17, k=27)

   conf.mat.te.27nn <- table(yte17, yte.27nn)
```

```
   #conf.mat.te.1nn
   print(conf.mat.tr.27nn)
```

For the fourth machine 27NN

```
##      ytr.27nn
## ytr17    1    7
##     1 2676    8
##     7   52 2467
```

```
   print(conf.mat.te.27nn)
```

```
##      yte.27nn
## yte17   1   7
##     1 477   0
##     7  13 375
```

Question 3 Let display the ROC curves for each data set applying for KNN

```
roc.tr1nn <- roc(ytr17,as.numeric(as.vector(ytr.1nn)))
```

For the train set

```
## Setting levels: control = 1, case = 7
```

```
## Setting direction: controls < cases
```

```
roc.tr9nn <- roc(ytr17,as.numeric(as.vector(ytr.9nn)))
```

```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

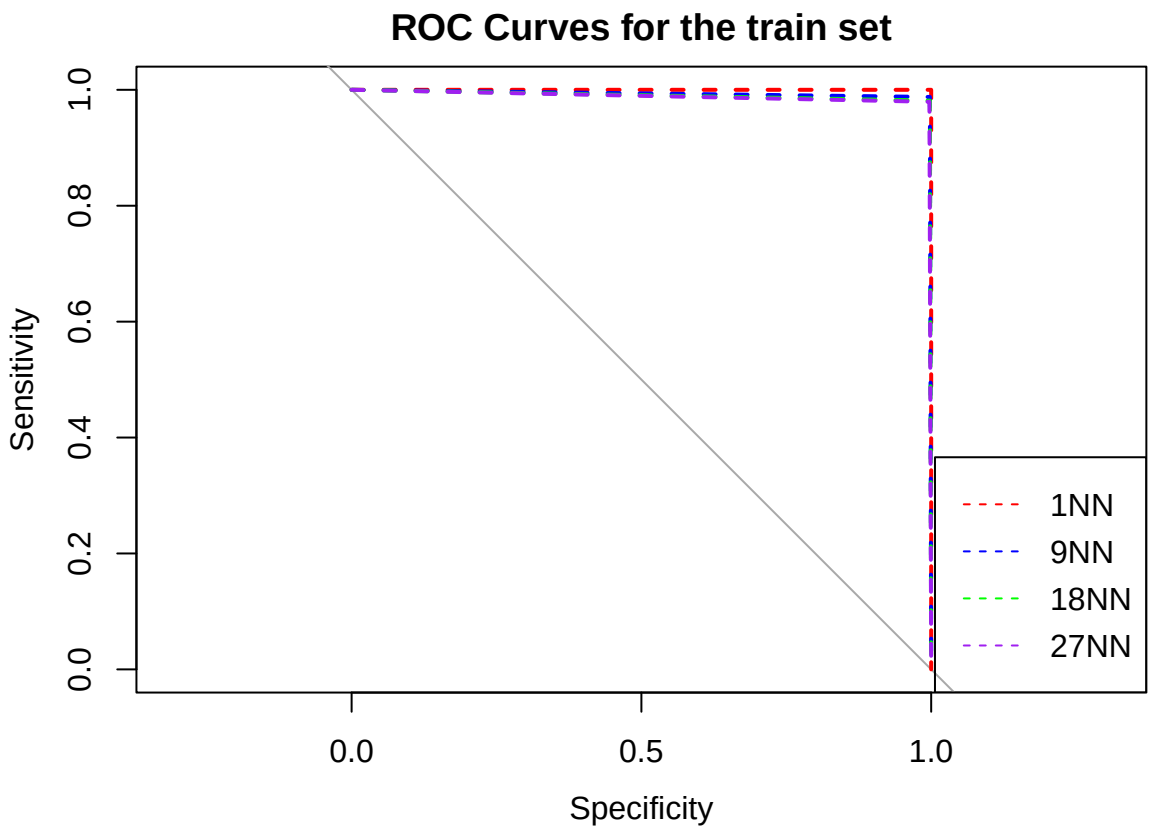
```
roc.tr18nn <- roc(ytr17,as.numeric(as.vector(ytr.18nn)))
```

```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

```
roc.tr27nn <- roc(ytr17,as.numeric(as.vector(ytr.27nn)))
```

```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

```
plot(roc.tr1nn,main="ROC Curves for the train set",
     col = "red", lty = 2, xlim = c(0, 1), ylim = c(0, 1))
lines(roc.tr9nn, col = "blue", lty = 2)
lines(roc.tr18nn, col = "green", lty = 2)
lines(roc.tr27nn, col = "purple", lty = 2)
legend("bottomright", legend = c("1NN", "9NN", "18NN", "27NN"),
       col = c("red", "blue", "green", "purple"), lty = 2)
```




```
roc.te1nn <- roc(yte17,as.numeric(as.vector(yte.1nn)))
```

For the test set

```
## Setting levels: control = 1, case = 7
```

```
## Setting direction: controls < cases
```

```
roc.te9nn <- roc(yte17,as.numeric(as.vector(yte.9nn)))
```

```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

```
roc.te18nn <- roc(yte17,as.numeric(as.vector(yte.18nn)))
```

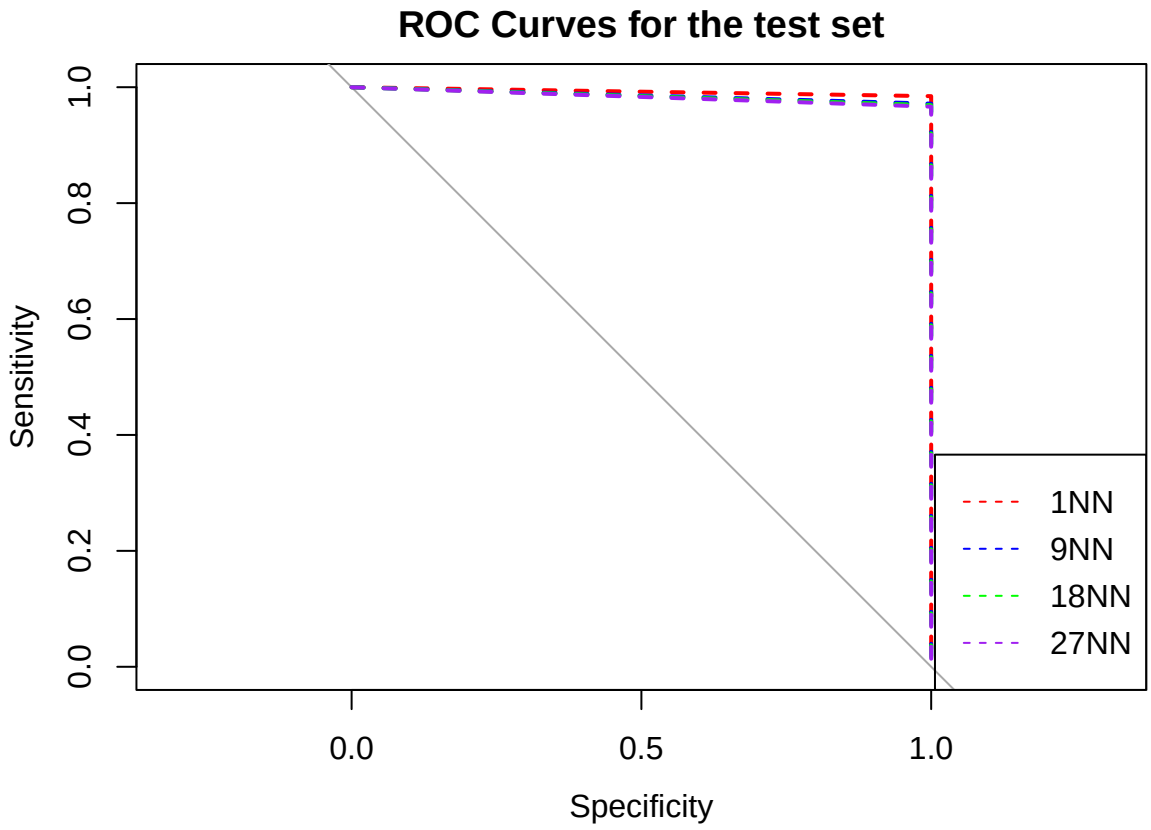
```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

```
roc.te27nn <- roc(yte17,as.numeric(as.vector(yte.27nn)))
```

```
## Setting levels: control = 1, case = 7
## Setting direction: controls < cases
```

```
plot.roc(roc.te1nn,main="ROC Curves for the test set",
         col = "red", lty = 2, xlim = c(0, 1), ylim = c(0, 1))
lines.roc(roc.te9nn, col = "blue", lty = 2)
lines.roc(roc.te18nn, col = "green", lty = 2)
lines.roc(roc.te27nn, col = "purple", lty = 2)
```

```
legend("bottomright", legend = c("1NN", "9NN", "18NN", "27NN"),
       col = c("red", "blue", "green", "purple"), lty = 2)
```



Question 4 Let find a False Positive and False Negative.

N B:

For my machines , all of them don't have a False Negative

and normally this is good and explain that the machine

perform well. This lead in fact that for the plotting i won't have False negative displayed. Intead it will be a blank window.

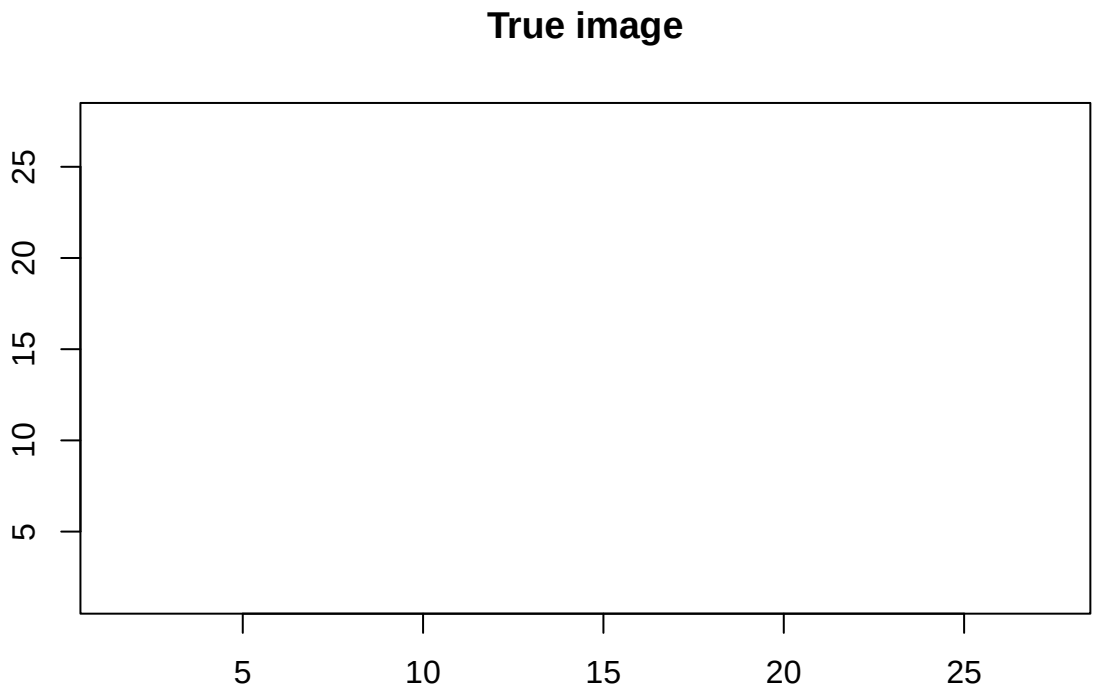
#####For 1NN

```
#par(mfrow=c(4,2))
falseNegative <- which(yte17==1&yte.1nn==7)
falsePositive <- which(yte17==7&yte.1nn==1)

#### 1 wrong predicted
image(1:28, 1:28, matrix(xte[falseNegative[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

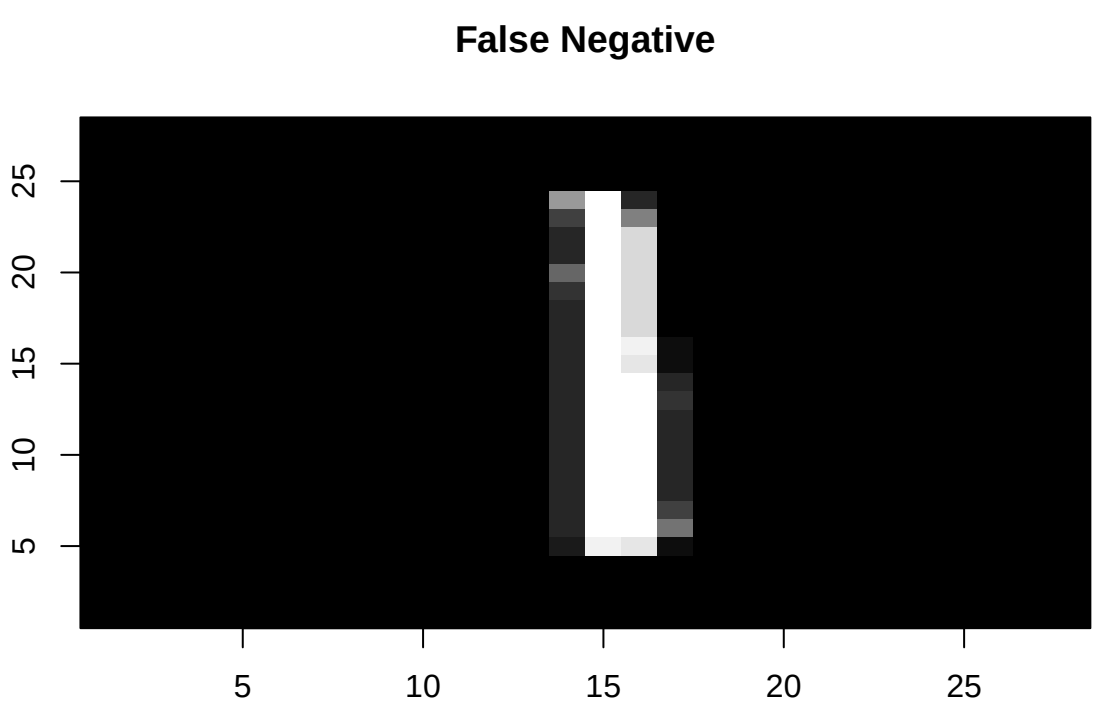
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in max(x): aucun argument pour max ; -Inf est renvoyé
```

```
 title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```

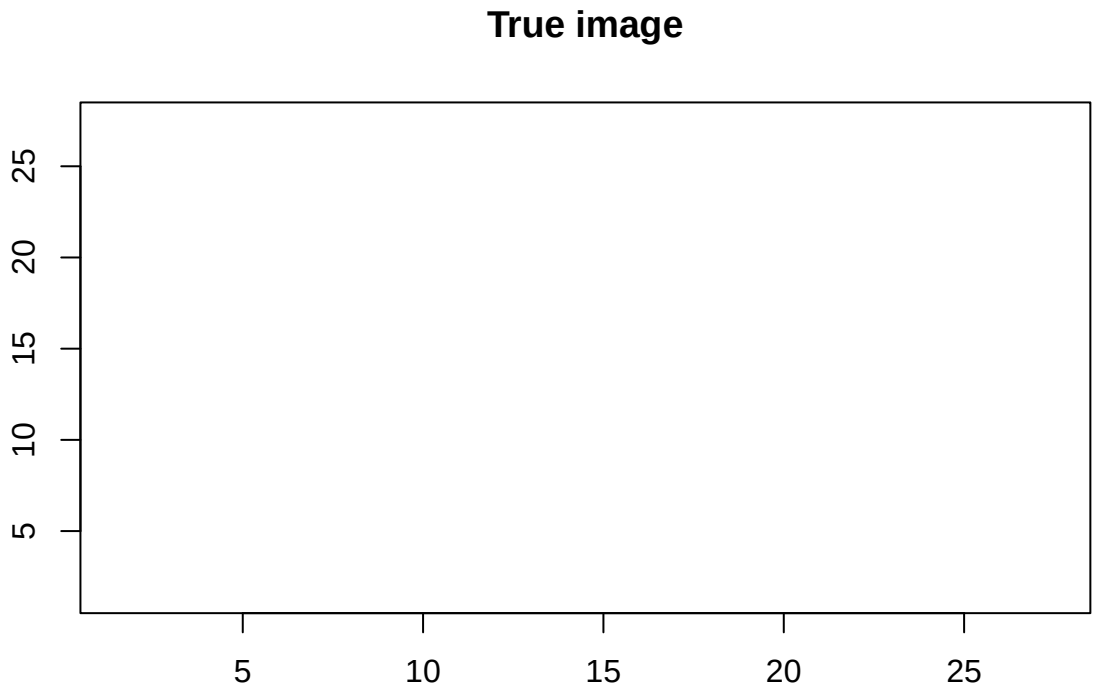



```
image(1:28, 1:28, matrix(xte[falseNegative[2],], nrow=28)[ , 28:1],
      col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

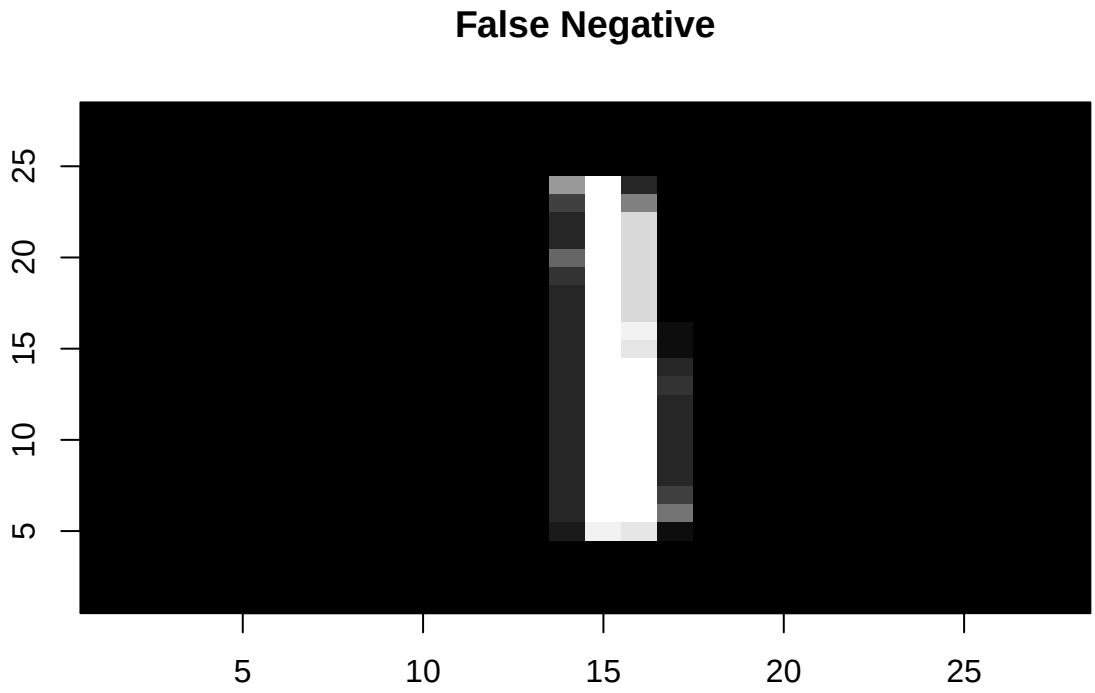
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in min(x): aucun argument pour max ; -Inf est renvoyé
```

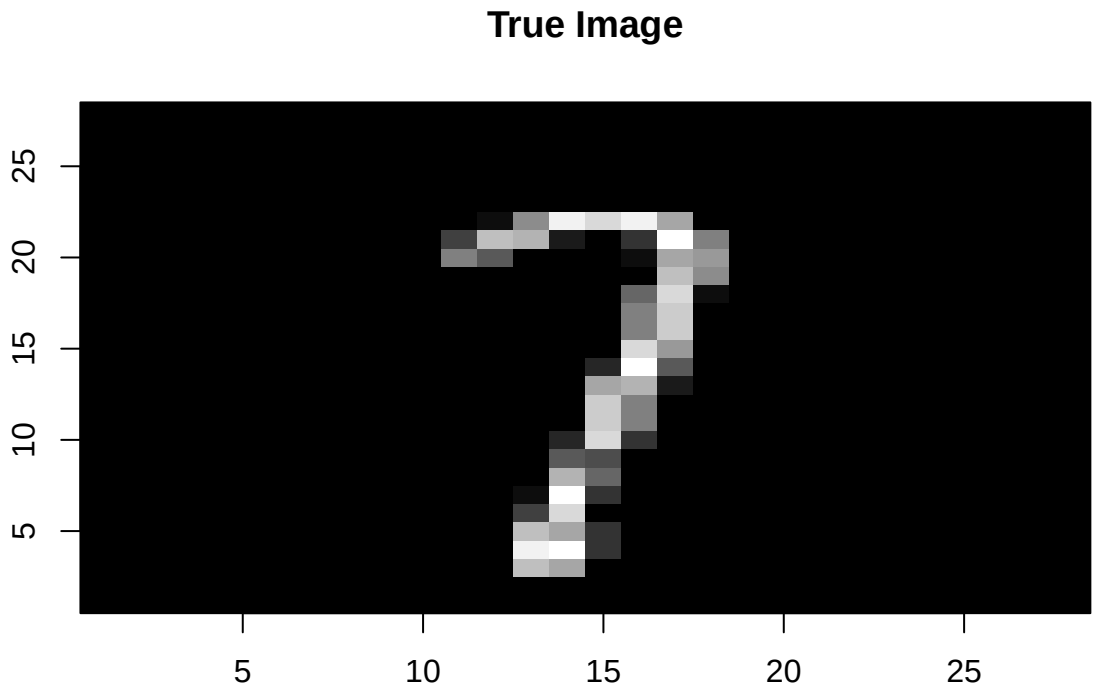
```
      title(main = "True image")
```



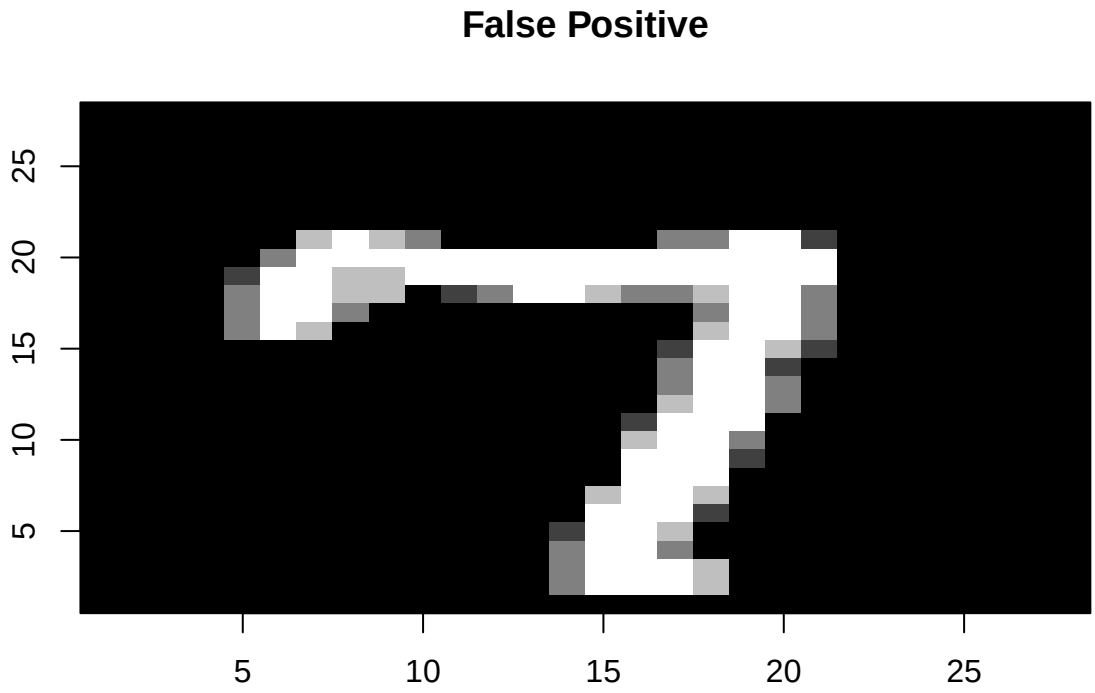

```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```



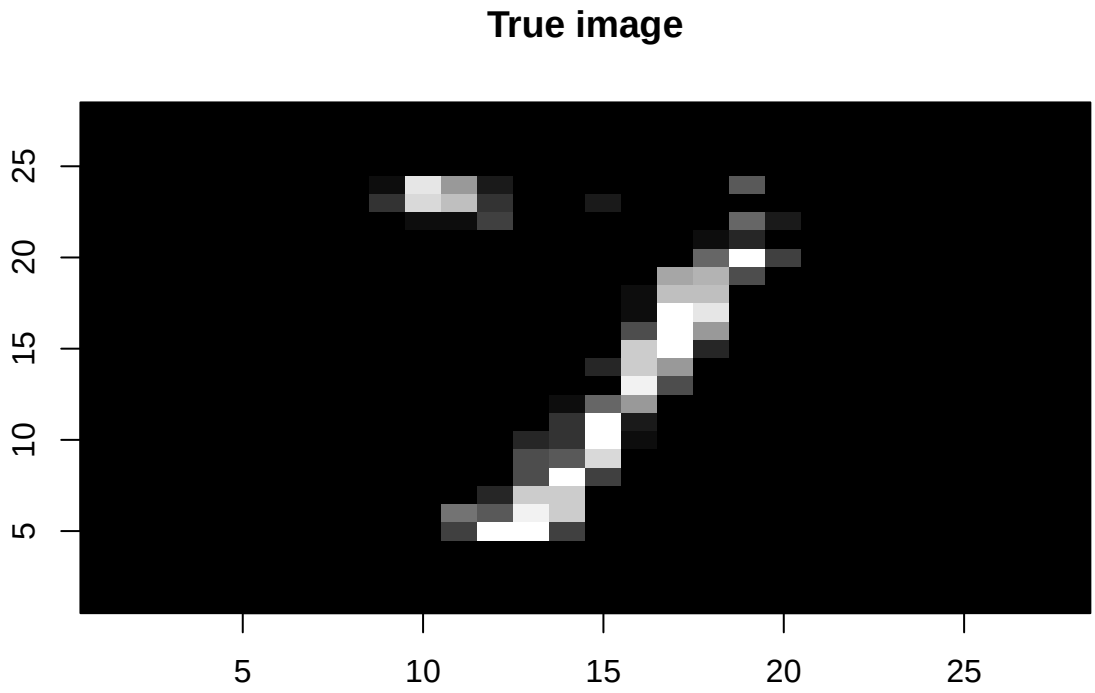

```
##### 7 wrong predicted
image(1:28, 1:28, matrix(xte[falsePositive[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True Image")
```



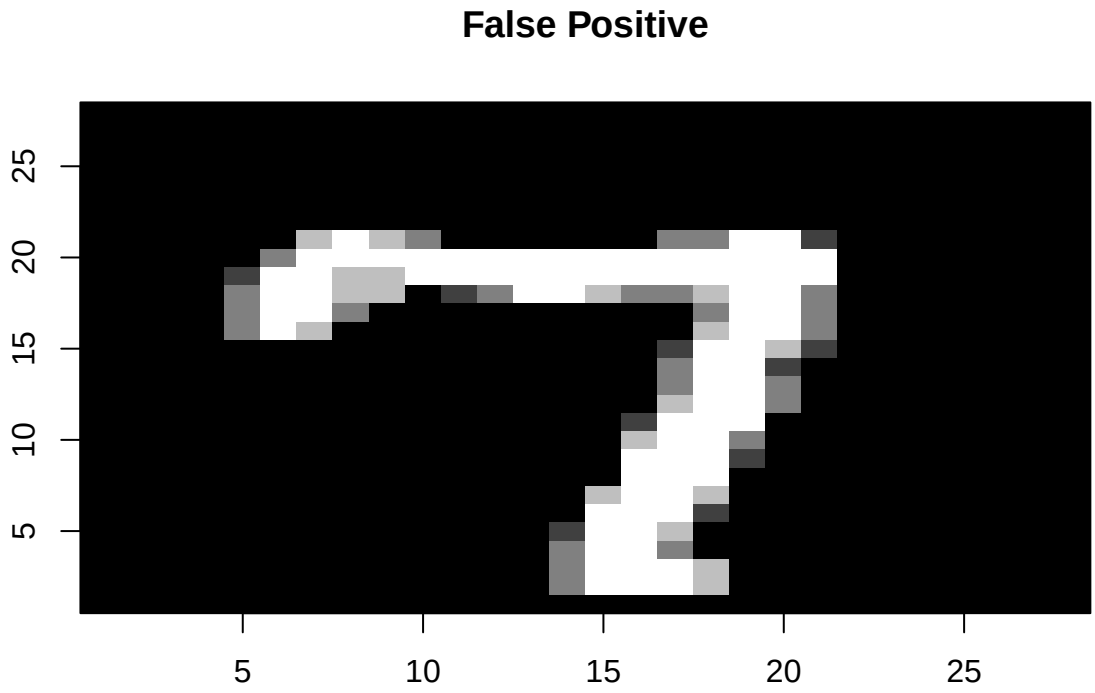

```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```




```
image(1:28, 1:28, matrix(xte[falsePositive[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```



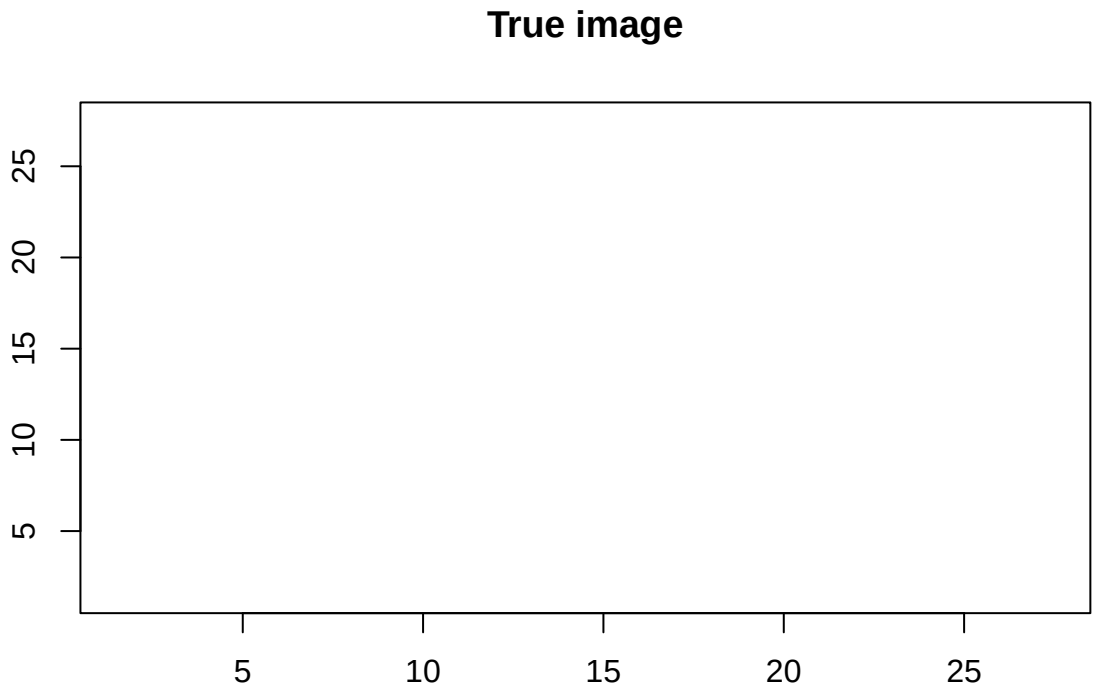

```
falseNegative <- which(yte17==1&yte.9nn==7)
falsePositive <- which(yte17==7&yte.9nn==1)

#### 1 wrong predicted
image(1:28, 1:28, matrix(xte[falseNegative[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

For 9NN

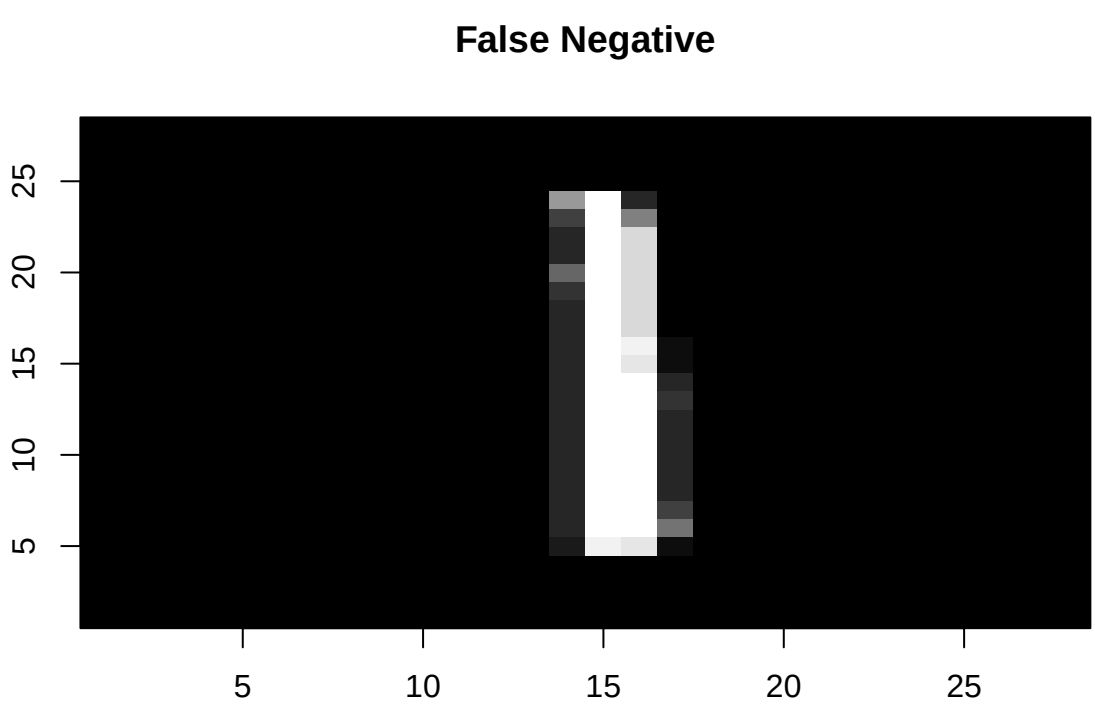
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in max(x): aucun argument pour max ; -Inf est renvoyé
```

```
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```

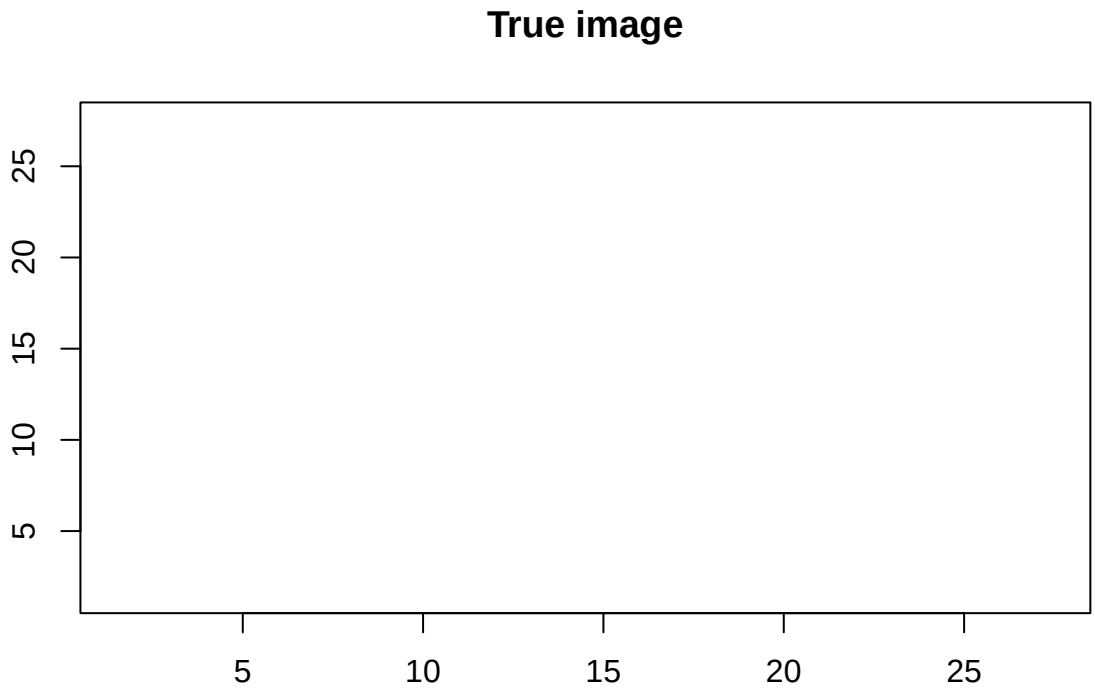



```
image(1:28, 1:28, matrix(xte[falseNegative[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

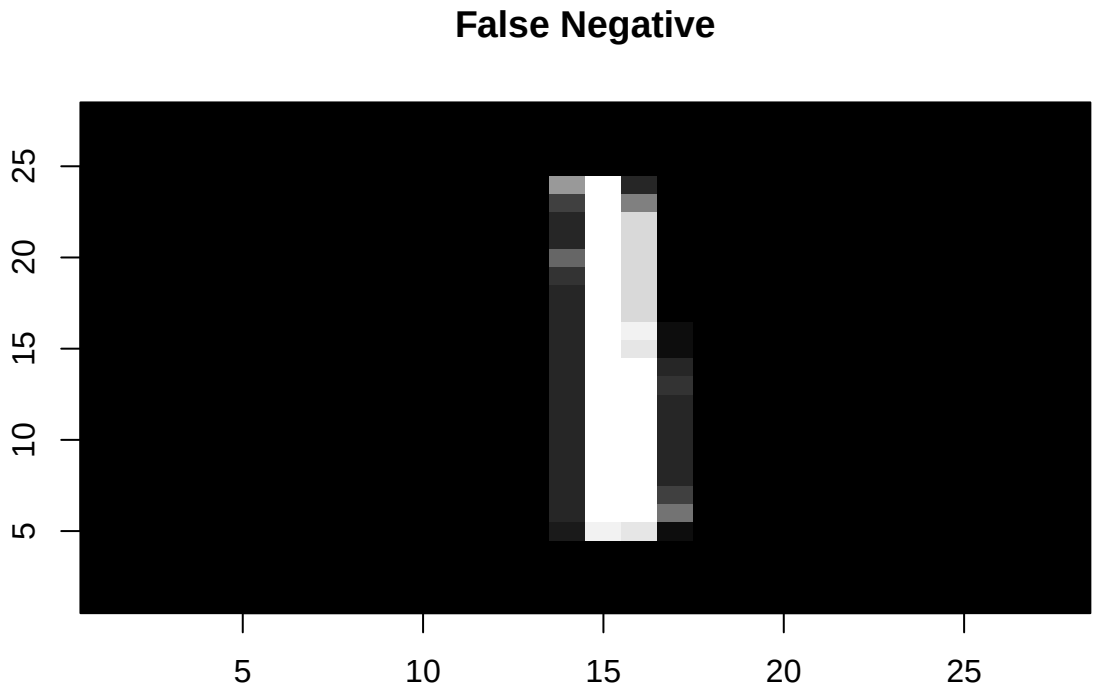
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in min(x): aucun argument pour max ; -Inf est renvoyé
```

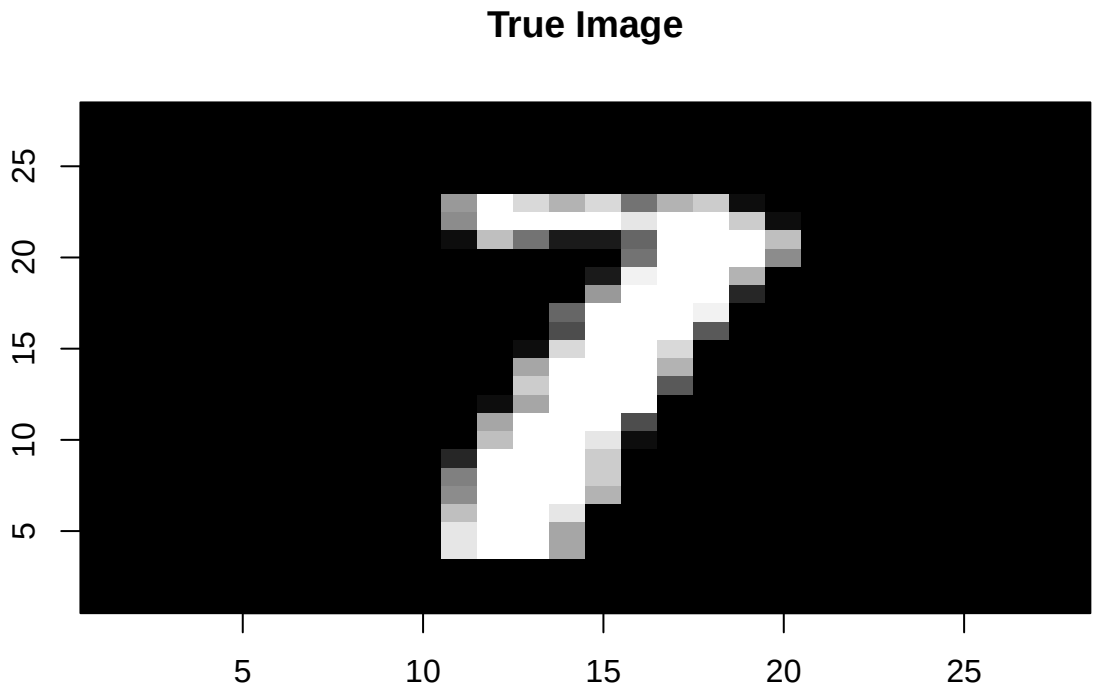
```
     title(main = "True image")
```



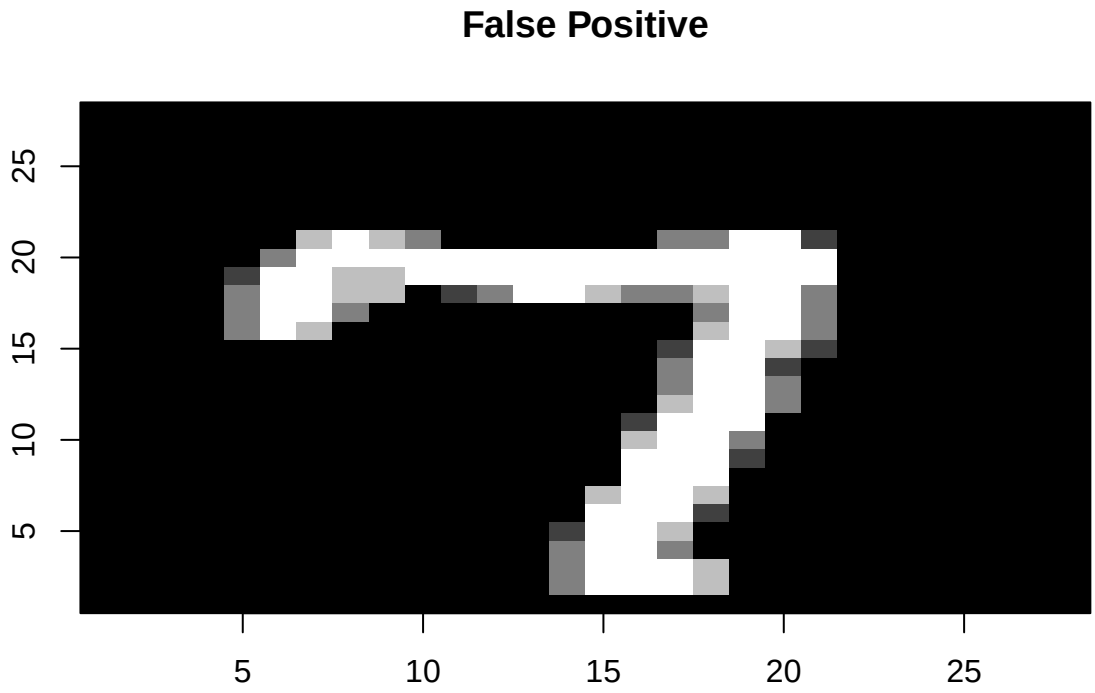

```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```



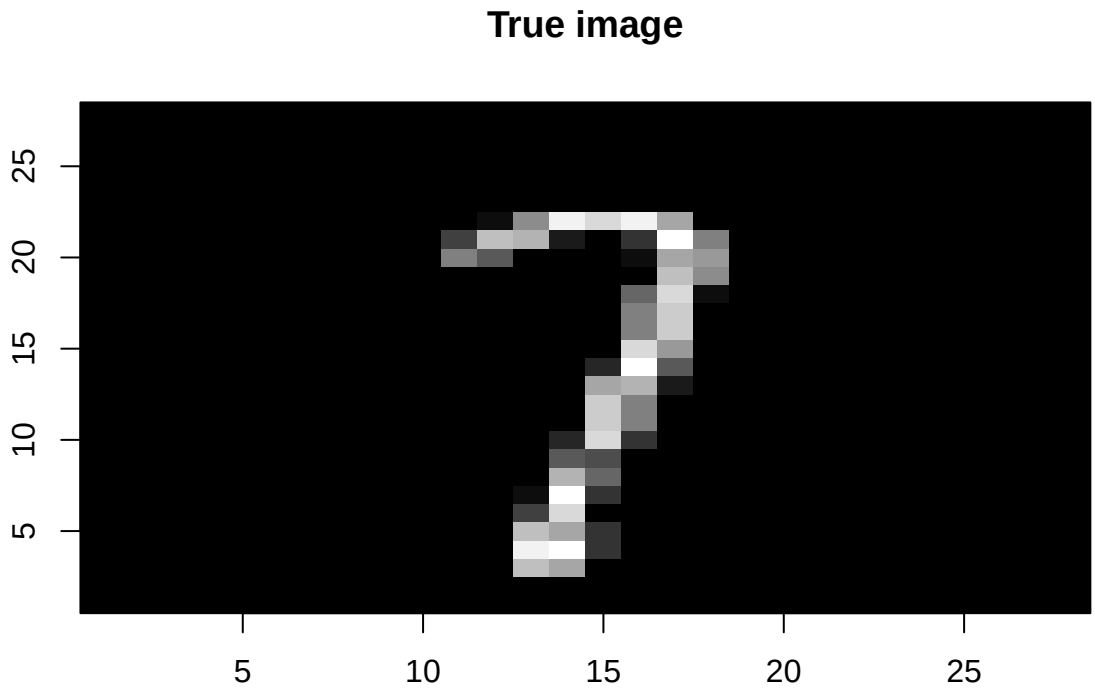

```
##### 7 wrong predicted
image(1:28, 1:28, matrix(xte[falsePositive[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True Image")
```



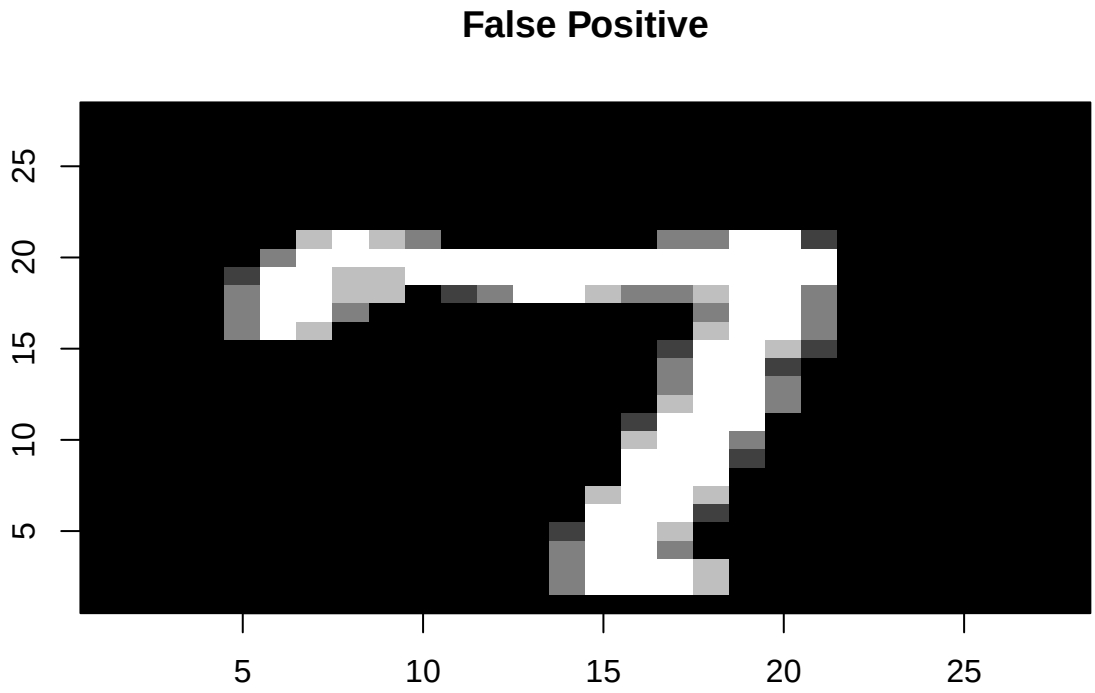

```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```




```
image(1:28, 1:28, matrix(xte[falsePositive[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```



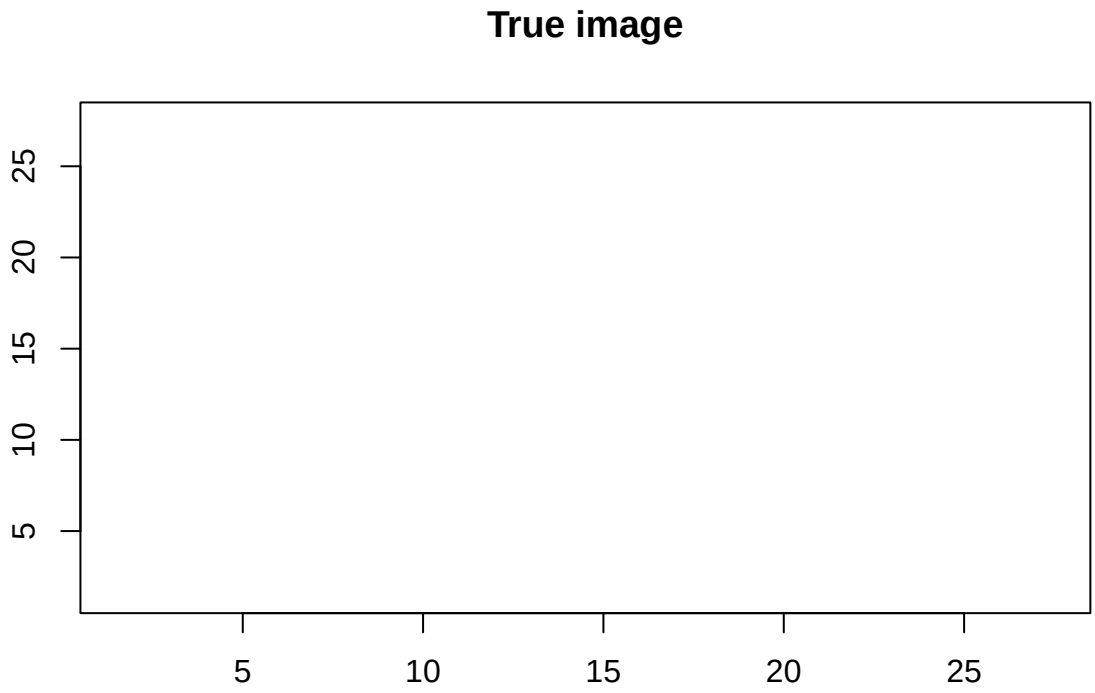
For 18NN

```
falseNegative <- which(yte17==1&yte.18nn==7)
falsePositive <- which(yte17==7&yte.18nn==1)

#### 1 wrong predicted
image(1:28, 1:28, matrix(xte[falseNegative[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

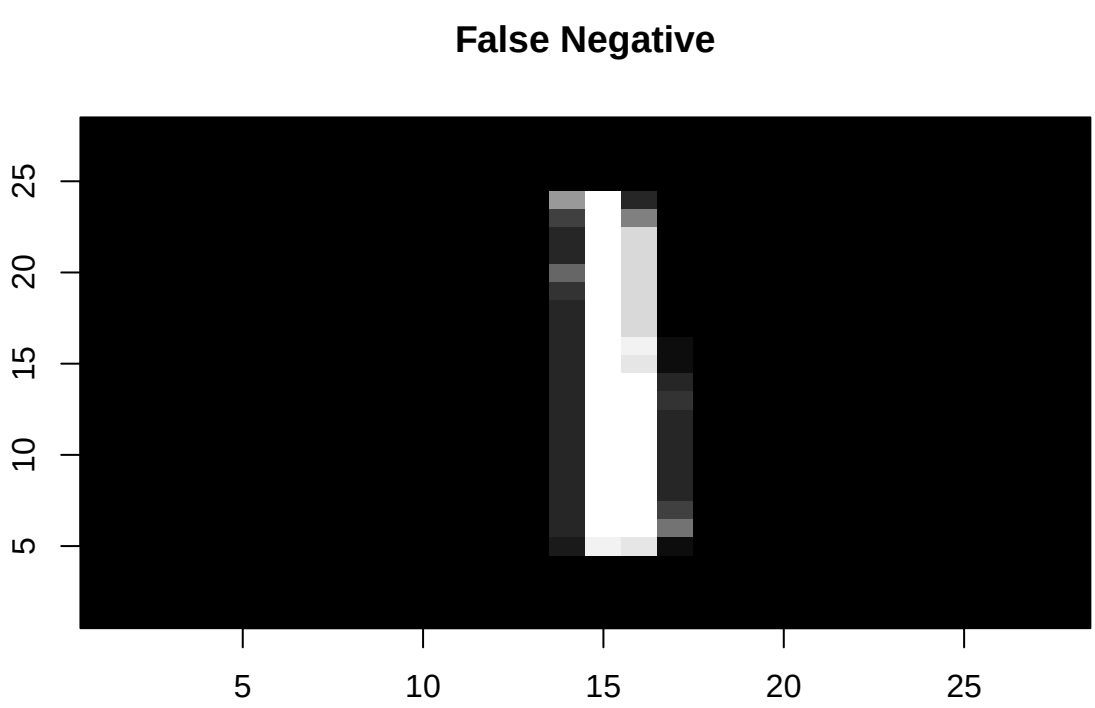
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in max(x): aucun argument pour max ; -Inf est renvoyé
```

```
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```

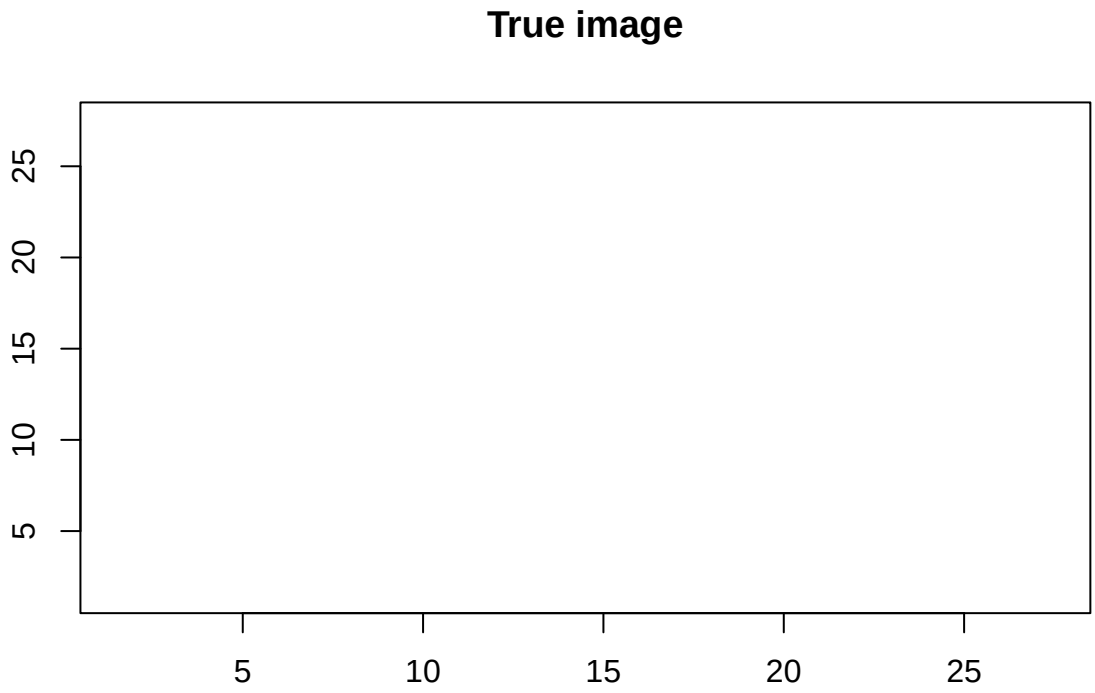



```
image(1:28, 1:28, matrix(xte[falseNegative[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

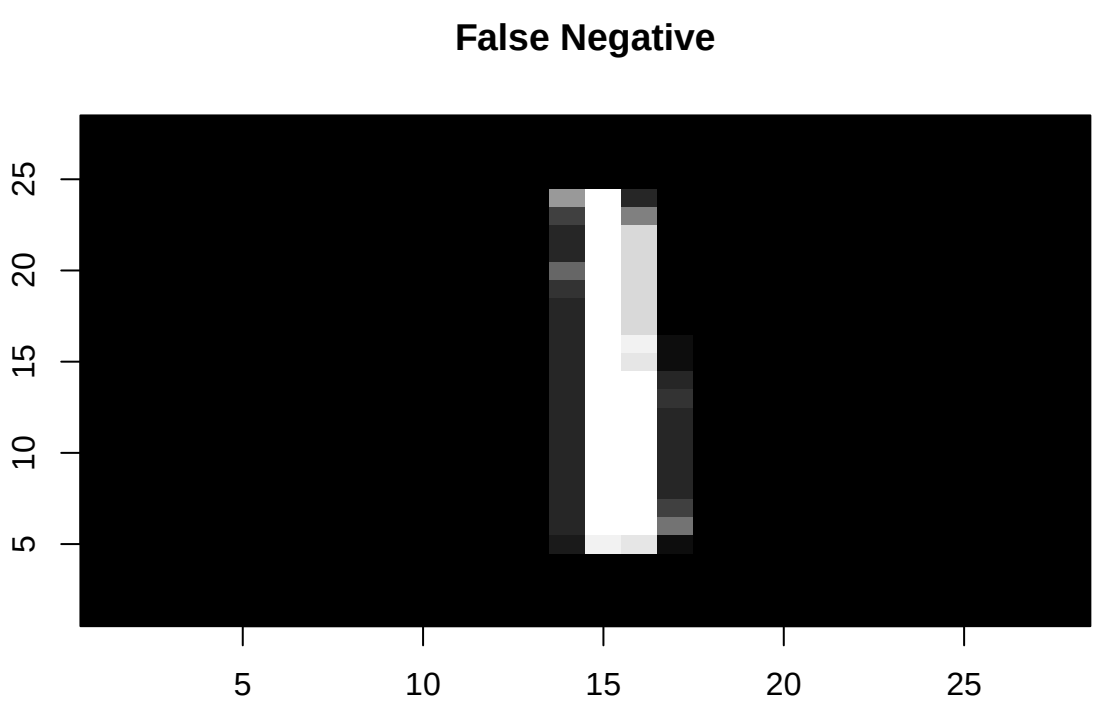
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in min(x): aucun argument pour max ; -Inf est renvoyé
```

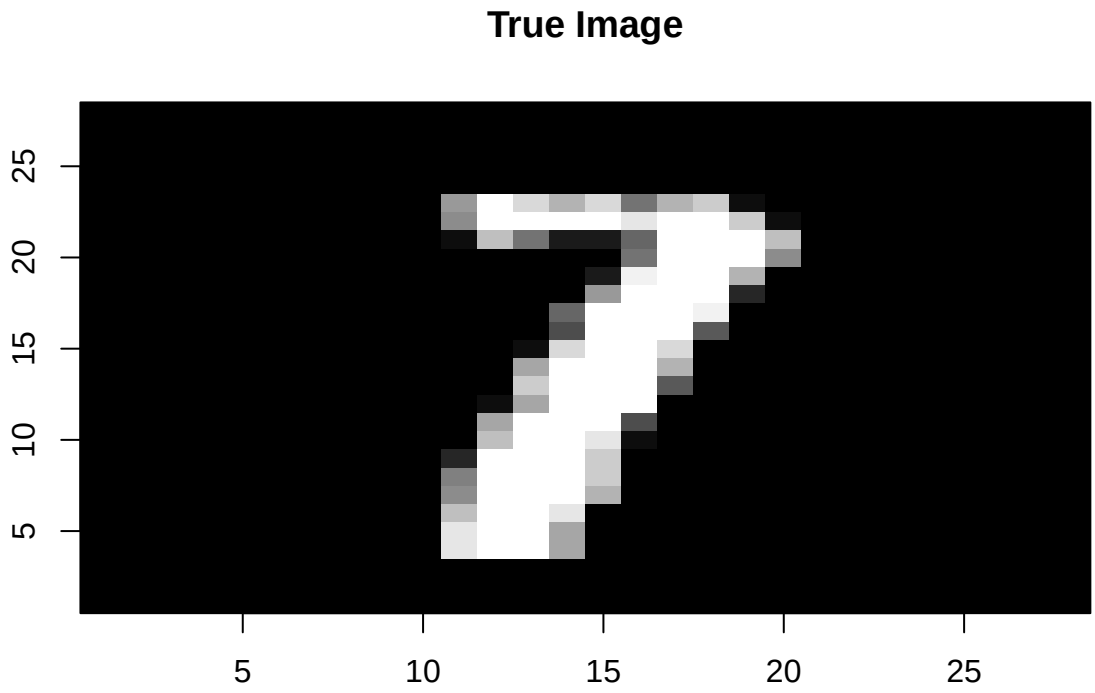
```
     title(main = "True image")
```



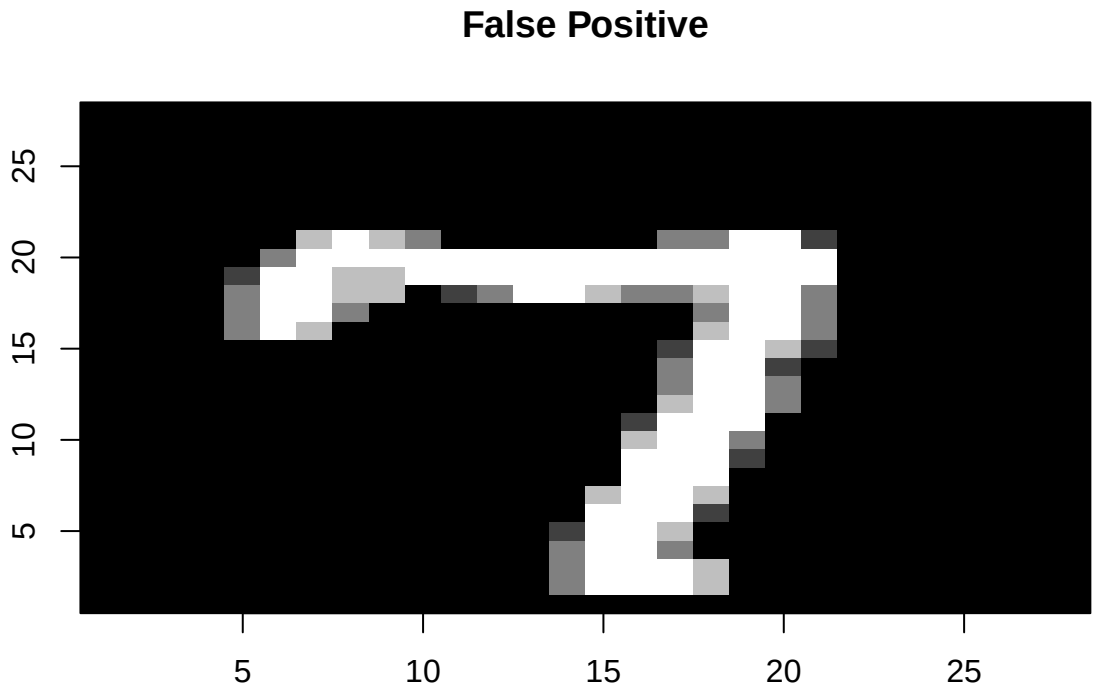

```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```



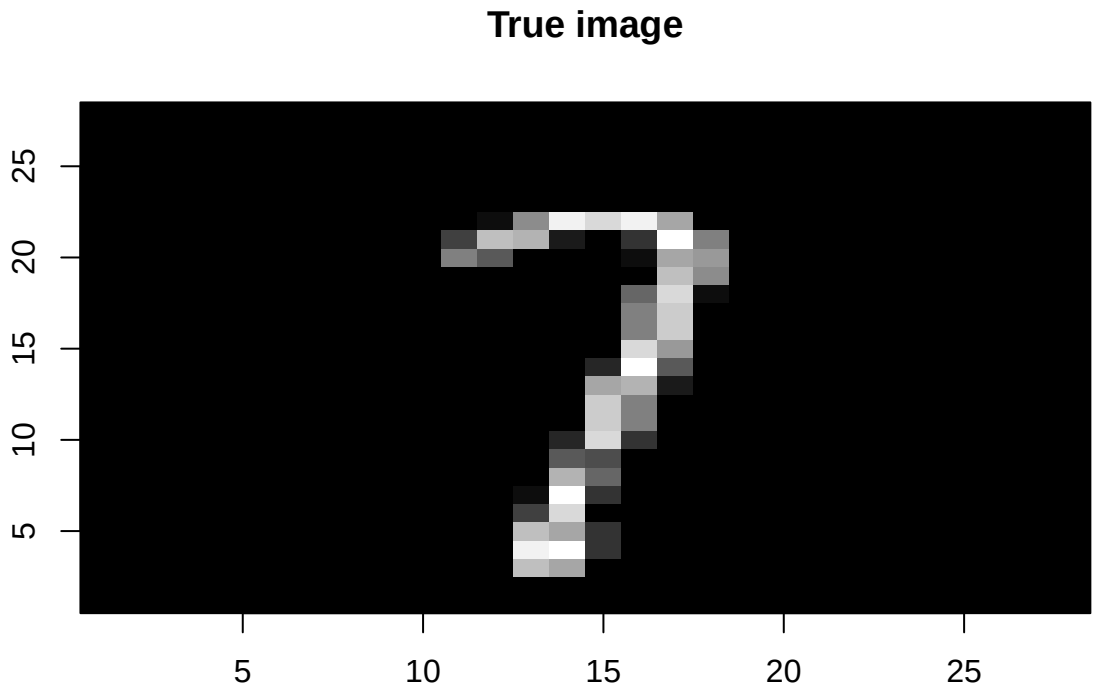

```
##### 7 wrong predicted
image(1:28, 1:28, matrix(xte[falsePositive[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True Image")
```



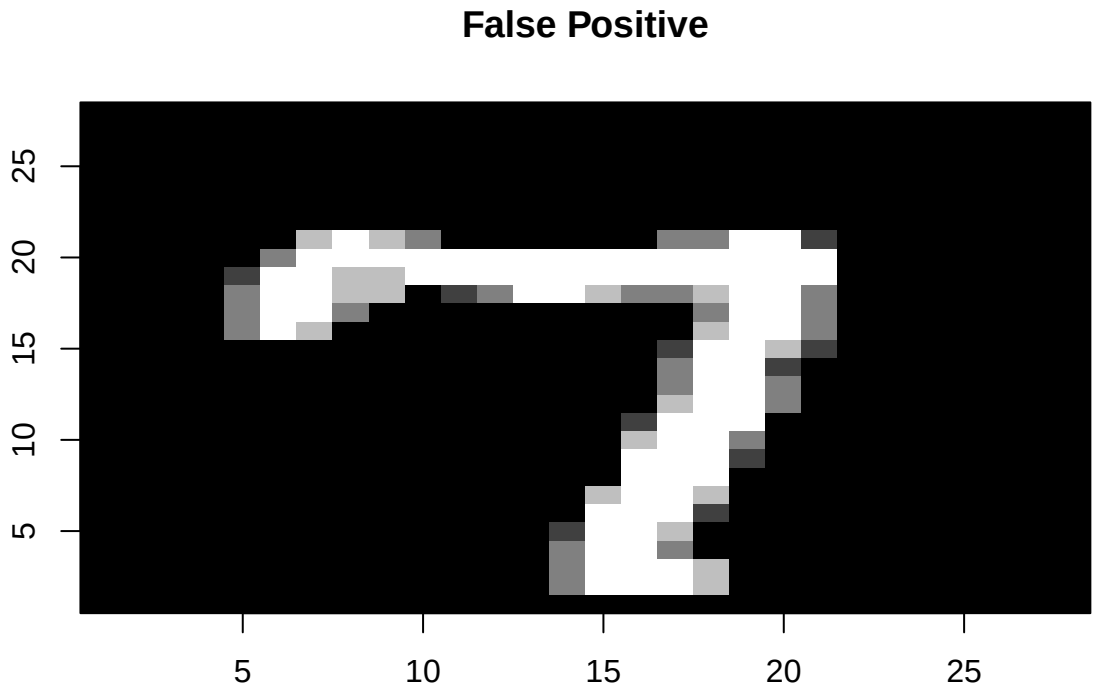

```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```




```
image(1:28, 1:28, matrix(xte[falsePositive[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True image")
```



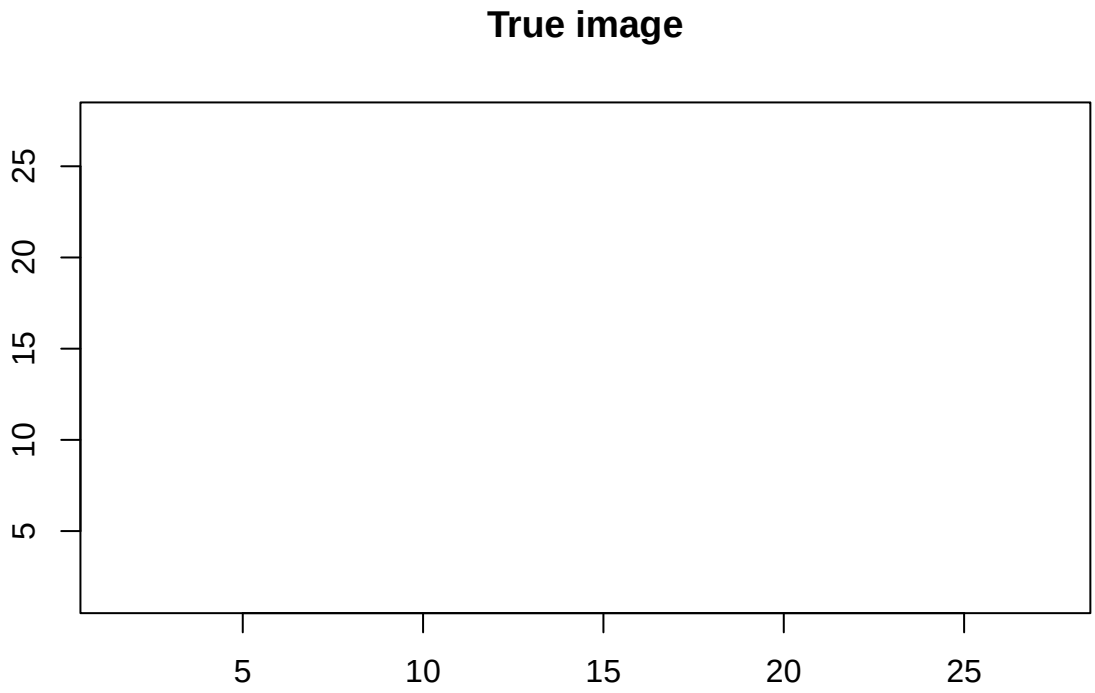

```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```



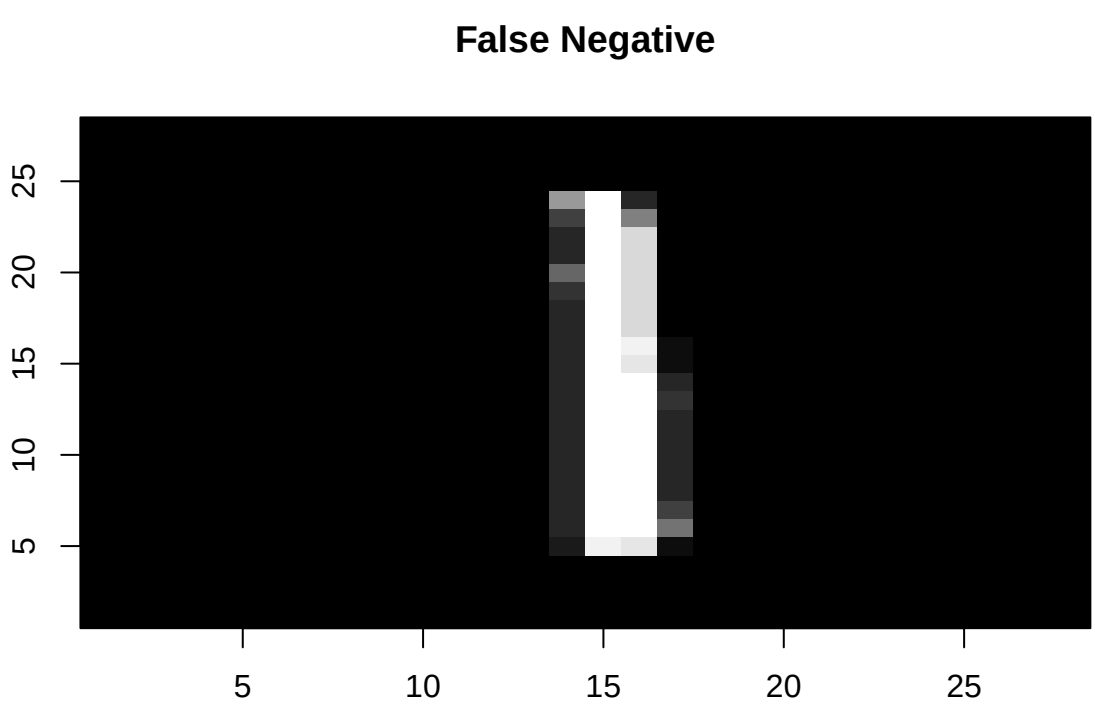

```
falseNegative <- which(yte17==1&yte.27nn==7)
falsePositive <- which(yte17==7&yte.27nn==1)

#### 1 wrong predicted
image(1:28, 1:28, matrix(xte[falseNegative[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

For 27NN

```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
## Warning in max(x): aucun argument pour max ; -Inf est renvoyé
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```

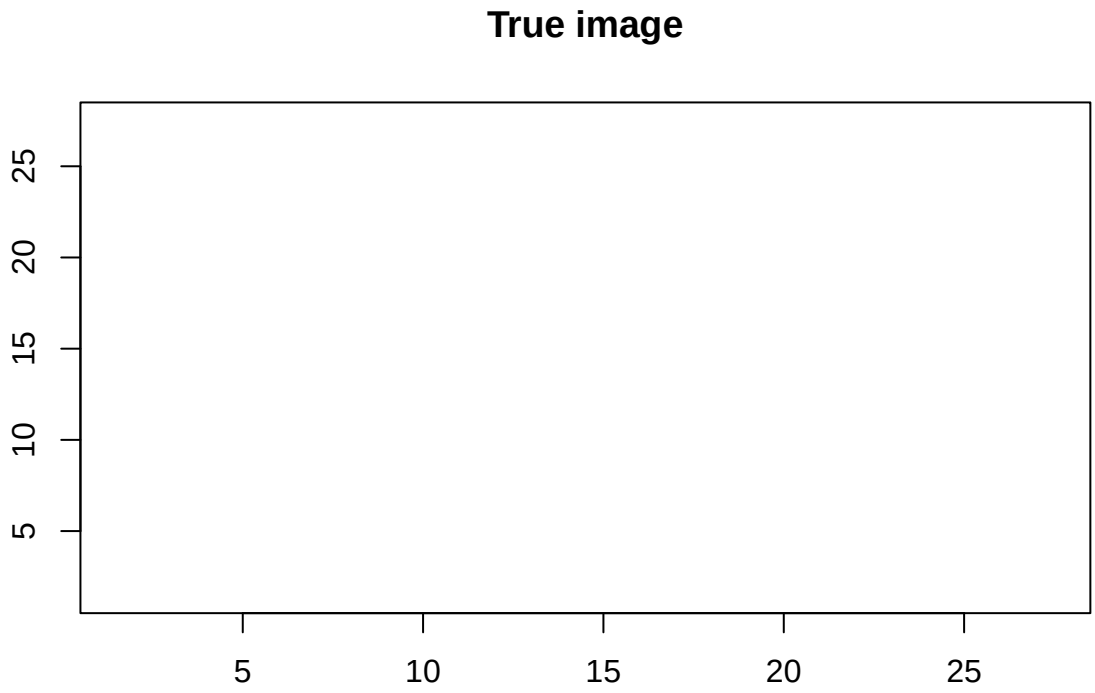



```
image(1:28, 1:28, matrix(xte[falseNegative[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
```

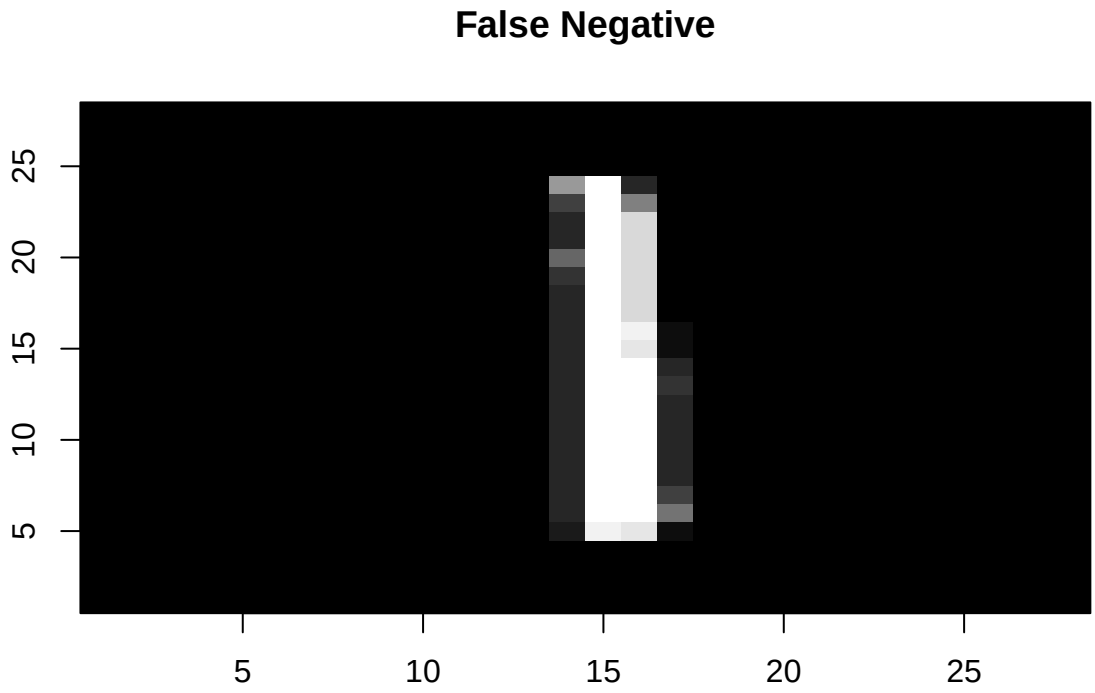
```
## Warning in min(x): aucun argument trouvé pour min ; Inf est renvoyé
```

```
## Warning in min(x): aucun argument pour max ; -Inf est renvoyé
```

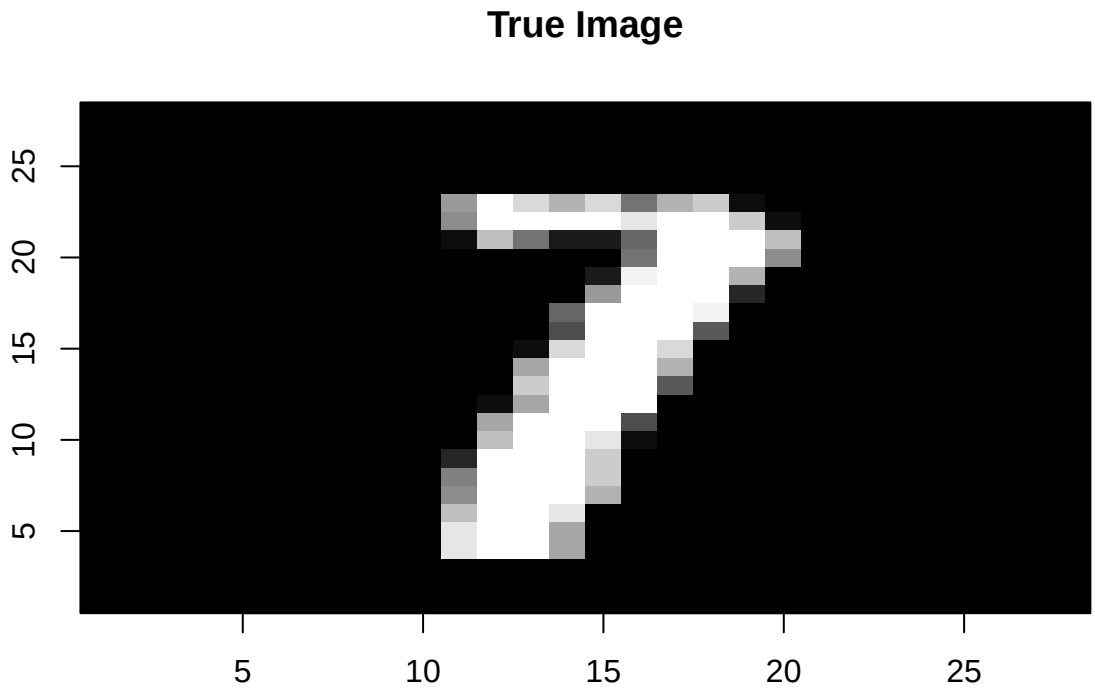
```
     title(main = "True image")
```



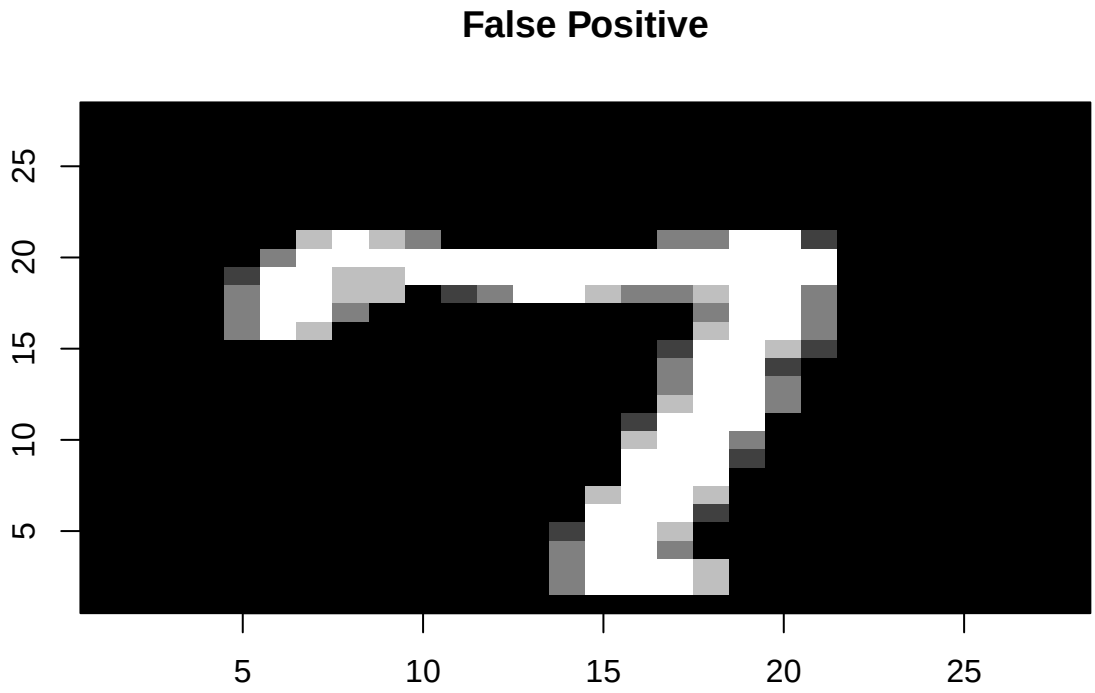

```
image(1:28, 1:28, matrix(xte[2,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Negative")
```



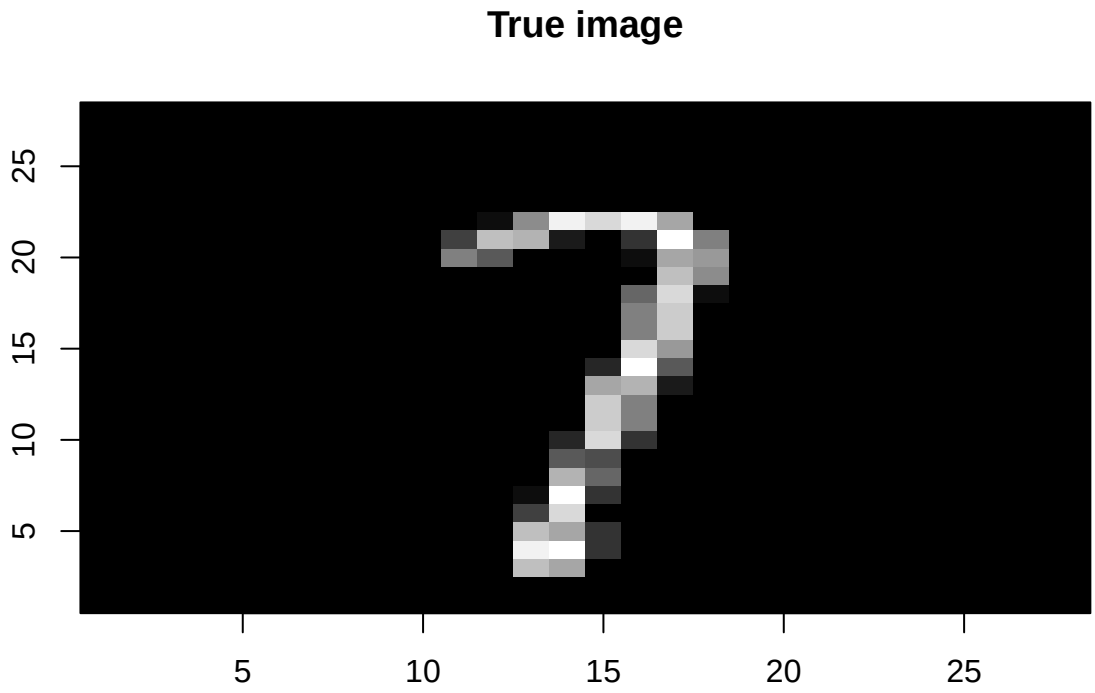

```
##### 7 wrong predicted
image(1:28, 1:28, matrix(xte[falsePositive[1],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True Image")
```



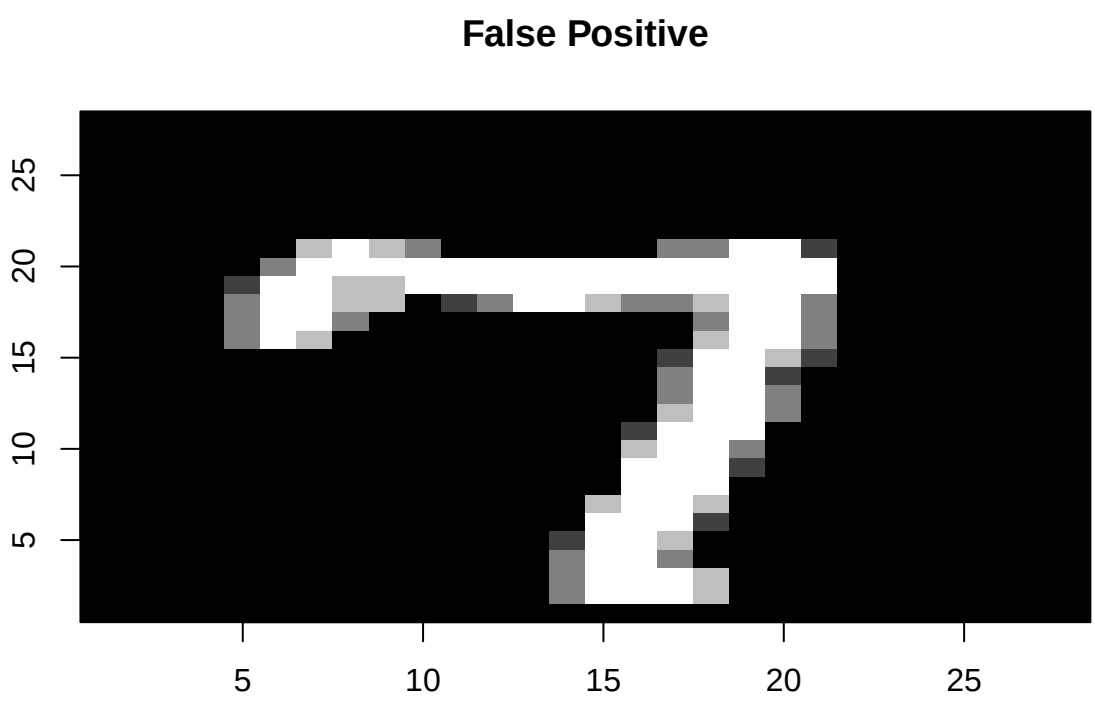

```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```




```
image(1:28, 1:28, matrix(xte[falsePositive[2],], nrow=28)[ , 28:1],
     col = gray(seq(0, 1, 0.05)), xlab = "", ylab="")
     title(main = "True image")
```




```
image(1:28, 1:28, matrix(xte[1,], nrow=28)[ , 28:1],
 col = gray(seq(0, 1, 0.05)), xlab = "", ylab="",)
title(main = "False Positive")
```



Question 5 COMMENT

We can noticed that for each machine the false positives and false negatives seem to be the same. If we can go back to the matrices of confusion , i'm expecting the rate of error decrease when the K is increasing but that's not realy the case . There are not a real partern to deduce. Making an extra reseach in google , the best K can be deduced by doing a cross validation. Let remark also that my machines made a lot of errors on the train data what is surprising.

Exercice 2

1- Let find and write $E(Y|X)$.

We have

$$p_1(y|x) = \frac{1}{\sqrt{(2\pi\frac{9}{(\pi^2)})}} \exp\left(-\frac{\pi^2}{18}\left(y - \frac{\pi}{2}x - \frac{3\pi}{4}\cos\left(\frac{\pi}{2}(1+x)\right)\right)^2\right)$$

It is a gaussian distribution with parameter

$$\mu = \frac{\pi}{2}x + \frac{3\pi}{4}\cos\left(\frac{\pi}{2}(1+x)\right)$$

and

$$\sigma^2 = \frac{9}{\pi^2}$$

Then we can conclude that

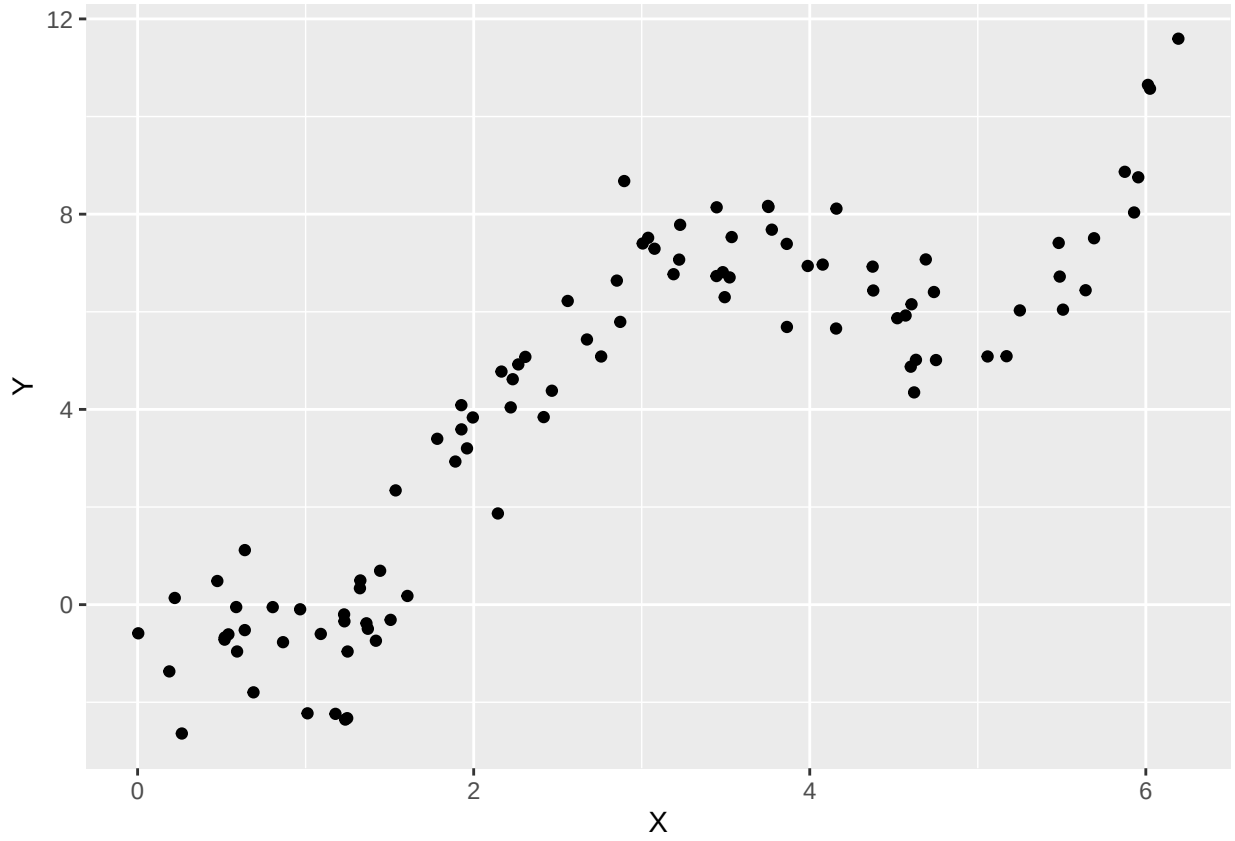
$$E(Y|X) = \frac{\pi}{2}x + \frac{3\pi}{4}\cos\left(\frac{\pi}{2}(1+x)\right)$$

2- Generate a join distribution sampling.

```
set.seed(19671210)
n=99
X <- runif(n ,min = 0,max = 2*pi)
mu=(pi/2)*X+(0.75*pi*cos((pi/2)*(1+X)))
sigma=3/pi
Y=rnorm(n,mu,sigma)
```

3- Display the scarter plot

```
#scatterplot(X,Y)
data <- data.frame(X,Y)
ggplot(data,aes(X,Y))+
  geom_point()
```



4- 1) Let find

$$f^*(X) = \arg\min_f R(f) = \arg\min_f E[l(Y, f(X))]$$

We have

$$\begin{aligned}
R(f) =& E(l(Y, f(X))) \\
=& \int\int (y - f(x))^2 P_{X,Y}(x, y) dxdy \\
=& \int\int (y - f(x))^2 P_X(x) P_{Y|X}(y|x) dxdy \qquad (\text{ Bayes}) \\
=& \int P_X(x) \left(\int (y - f(x))^2 P_{Y|X}(y|x) dy \right) dx \\
=& \int P_X(x) E((Y - f(x))^2 | X = x) dx
\end{aligned}$$

With the expression obtained, we can deduce that the f that minimize $R(f)$ is the same that minimize $P_X(x)E((Y - f(x))^2|X = x)$ with x fixed.

Now let denote $Q(f(x)) = P_X(x)E((Y - f(x))^2|X = x)$

$$\begin{aligned}
Q(f(x)) =& P_X(x) E((Y - f(x))^2 | X = x) \\
=& P_X(x) \left(E((Y^2 - 2f(x)Y + f(x)^2) | X = x) \right) \\
=& P_X(x) \left(E(Y^2 | X = x) - 2f(x) E(Y | X = x) + f(x)^2) \right)
\end{aligned}$$

Let differenciate $Q(f(x))$ with respect to $f(x)$.

We have $Q'(f(x)) = P_X(x)(-2E(Y|X = x) + 2f(x))$.

When we equate to zero we will have $f(x) = E(Y|X = x)$.

We can deduce that $f^*(x) = E(Y|X = x)$ because $Q''(f(x)) = 2 \geq 0$

Conclusion : $f^*(x) = E(Y|X = x)$

2) Let find

$$R^* = R(f^*) = \min_f R(f)$$

We have ,

$$\begin{aligned}
R^* =& R(f^*) \\
=& \int_{X \times Y} l(y, f(x)) p_{XY}(x, y) \, dx \, dy \\
=& \int_{X \times Y} (y - E(Y|X = x))^2 P_{X,Y}(x, y) dxdy \\
=& \int_{X \times Y} (y - E(Y|X = x))^2 \frac{1}{2\pi \sqrt{(2\pi \frac{9}{(\pi^2)})}} \exp\left(-\frac{\pi^2}{18} \left(y - \frac{\pi}{2} x - \frac{3\pi}{4} \cos\left(\frac{\pi}{2}(1 + x) \right) \right)^2 \right) dxdy \\
=& \int_{X \times Y} (y - E(Y|X = x))^2 \frac{1}{2\pi \sqrt{(2\pi \frac{9}{(\pi^2)})}} \exp\left(-\frac{\pi^2}{18} \left(y - E(Y|X = x) \right)^2 \right) dxdy
\end{aligned}$$

We can integrate in first time by integration by part choosing

$u(x) = (y - E(Y|X = x))$ and

$v'(x) = (y - E(Y|X = x))) \exp\left(-\frac{\pi^2}{18}(y - E(Y|X = x))^2\right)$

We will get the integral with respect to dy that will be equal to $\frac{9}{\pi^2} \times \frac{1}{2\pi}$.

Now we will integrate with respect to dx on $[0; 2\pi[$.

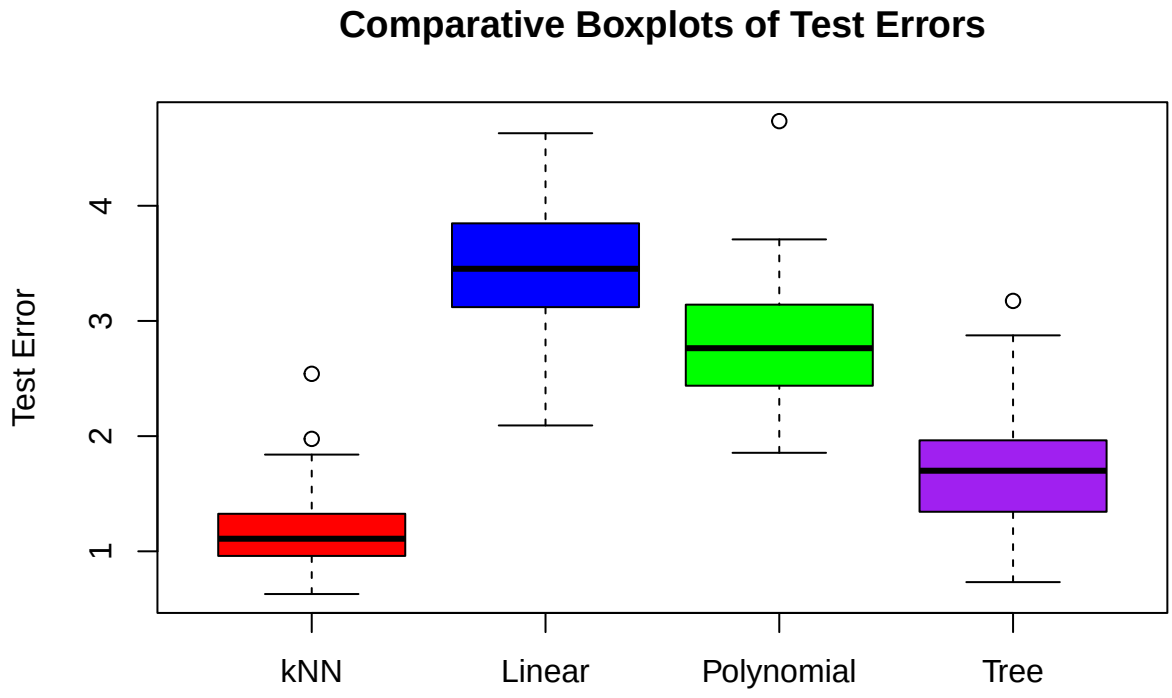
We will get

$$R(f^*) = \frac{9}{\pi^2}$$

3) Extrinsinc comparison between 4 machines for regression.

```
set.seed(19671210)
replications <- 100

# vectors to store test errors
knn_errors <- numeric(replications)
linear_errors <- numeric(replications)
poly_errors <- numeric(replications)
tree_errors <- numeric(replications)

# Loop through replications
for (i in 1:replications) {

  # Split the data into training and test sets (60%-40%)
  idx <- createDataPartition(data$Y, p = 0.6, list = FALSE)
  train_data <- data[idx, ]
  test_data <- data[-idx, ]

  # Model training and prediction for kNN regression

  knn_model <- train(Y ~ X, train_data, method="knn")
  knn_errors[i] <- mean((test_data$Y - predict(knn_model, test_data))^2)



  # Model training and prediction for Linear regression
  linear_model <- lm(Y ~ X, data = train_data)
  linear_predictions <- predict(linear_model, newdata = test_data)
  linear_errors[i] <- mean((test_data$Y - linear_predictions)^2)

  # Model training and prediction for Polynomial regression (degree 2)
  poly_model <- lm(Y ~ poly(X, degree = 2), data = train_data)
  poly_predictions <- predict(poly_model, newdata = test_data)
  poly_errors[i] <- mean((test_data$Y - poly_predictions)^2)



  # Model training and prediction for Regression Tree Learner
  tree_model <- rpart(Y ~ X, data = train_data, method = "anova")
  tree_predictions <- predict(tree_model, newdata = test_data)
  tree_errors[i] <- mean((test_data$Y - tree_predictions)^2)
}

## data set of error
error_data <- data.frame(
```

```
  kNN = knn_errors,
  Linear = linear_errors,
  Polynomial = poly_errors,
  Tree = tree_errors
)

# Plotting boxplots
boxplot(error_data, col = c("red", "blue", "green", "purple"),
        main = "Comparative Boxplots of Test Errors",
        ylab = "Test Error",
        names = c("kNN", "Linear", "Polynomial", "Tree"))
```




```
cat("We know that R*=9/pi^2 =0.91189 .
    \n The mean error test of each method is given by\n")
```

```
## We know that R*=9/pi^2 =0.91189 .
##
##  The mean error test of each method is given by
```

```
colMeans(error_data)
```

```
##        kNN     Linear Polynomial       Tree
##   1.168306   3.486412   2.800838   1.716065
```

```
cat("We can see that all of them are greater that R*
    but the 'knn'and the 'Tree' are the more close.
    \n The linear machine is the less better and
```

```
    it is expected because looking at the scarter plot
    the relation between X and Y is not linear. ")
```

```
## We can see that all of them are greater that R*
##     but the 'knn'and the 'Tree' are the more close.
##
##  The linear machine is the less better and
##     it is expected because looking at the scarter plot
##     the relation between X and Y is not linear.
```

Exercice 3

```
library(mlbench)
library(kernlab)
```

```
##
## Attachement du package : 'kernlab'
```

```
## L'objet suivant est masqué depuis 'package:purrr':
##
##     cross
```

```
## L'objet suivant est masqué depuis 'package:ggplot2':
##
##     alpha
```

```
data(DNA)  ### Binary predictor variables
data(BreastCancer)
data(spam) # Spam detection data set
leukemia<-read.csv('leukemia-data-1.csv') # DNA Microarray Gene Expression
prostate <- read.csv('prostate-cancer-1.csv') # DNA Microarray Gene Expression
colon <- read.csv('colon-cancer-1.csv')
```

```
#### dataset DNA
## First intruction done in the second t=chunk of the exercice

###

head(DNA,2)
```

```
##   V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20 V21
## 1  0  1  0  0  0  0  1  0  0   0   0   1   0   0   1   0   1   0   0   0   0
## 2  0  0  1  0  0  1  0  0  0   0   0   1   0   0   0   0   0   0   0   0   1
##   V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32 V33 V34 V35 V36 V37 V38 V39 V40
## 1   0   1   0   0   1   0   1   0   0   0   0   1   1   0   0   0   0   0   1
## 2   0   1   0   0   0   0   0   1   0   0   0   0   0   0   0   1   0   0   0
##   V41 V42 V43 V44 V45 V46 V47 V48 V49 V50 V51 V52 V53 V54 V55 V56 V57 V58 V59
## 1   0   0   0   0   1   0   1   0   0   1   0   1   0   0   0   0   0   1   0
## 2   0   1   0   0   1   1   0   0   0   0   0   0   0   1   0   0   0   1   0
##   V60 V61 V62 V63 V64 V65 V66 V67 V68 V69 V70 V71 V72 V73 V74 V75 V76 V77 V78
## 1   0   0   0   1   1   0   0   1   0   0   0   0   1   1   0   0   1   0   0
## 2   0   0   0   0   0   1   0   0   1   0   0   1   0   0   1   0   0   0   0
##   V79 V80 V81 V82 V83 V84 V85 V86 V87 V88 V89 V90 V91 V92 V93 V94 V95 V96 V97
## 1   0   1   0   0   1   0   1   0   0   1   0   0   1   0   0   0   1   0   1
## 2   0   1   0   1   0   0   1   0   0   1   0   0   0   1   0   0   1   0   0
```

```
##   V98 V99 V100 V101 V102 V103 V104 V105 V106 V107 V108 V109 V110 V111 V112 V113
## 1   0   0    0    1    0    0    0    0    0    0    0    0    0    0    0    1
## 2   0   0    1    0    0    0    1    0    0    1    0    0    0    0    0    0
##   V114 V115 V116 V117 V118 V119 V120 V121 V122 V123 V124 V125 V126 V127 V128
## 1    0    0    0    0    0    0    1    0    1    0    0    0    1    0    0
## 2    1    0    0    1    0    0    0    0    0    1    0    0    1    0    0
##   V129 V130 V131 V132 V133 V134 V135 V136 V137 V138 V139 V140 V141 V142 V143
## 1    0    0    0    1    0    0    0    0    0    1    0    0    0    0    0
## 2    0    0    0    0    0    1    0    0    0    0    0    0    1    0    0
##   V144 V145 V146 V147 V148 V149 V150 V151 V152 V153 V154 V155 V156 V157 V158
## 1    1    1    0    0    0    0    1    1    0    0    1    0    0    0    0
## 2    0    0    0    1    0    1    0    0    1    0    0    0    0    0    0
##   V159 V160 V161 V162 V163 V164 V165 V166 V167 V168 V169 V170 V171 V172 V173
## 1    0    1    0    0    1    0    0    0    0    0    0    1    0    1    0
## 2    0    0    1    0    0    1    0    0    1    0    0    1    0    0    0
##   V174 V175 V176 V177 V178 V179 V180 Class
## 1    0    0    0    1    1    0    0     n
## 2    0    1    0    0    0    1    0     n
```

```
cat("In the DNA dataset we have :",ncol(DNA),
    "colunm and ",nrow(DNA),"observations\n")
```

```
## In the DNA dataset we have : 181 colunm and  3186 observations
```

```
cat("The dimension of the output space is ",ncol(DNA)-1,
    "and the response is the variable class that
    is categorical with 3 level : ei,ie,neither(n)\n")
```

```
## The dimension of the output space is  180 and the response is the variable class that
##     is categorical with 3 level : ei,ie,neither(n)
```

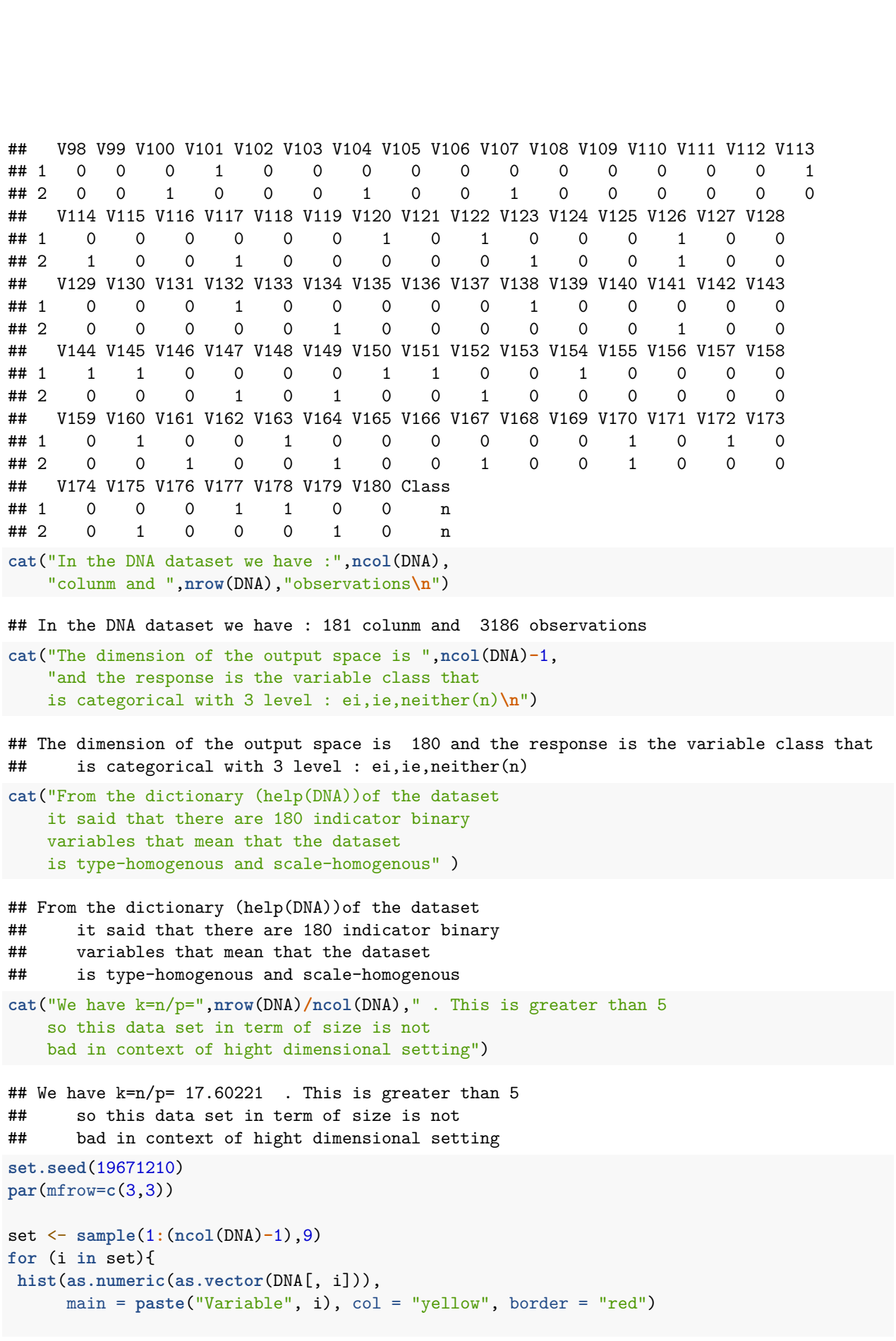
```
cat("From the dictionary (help(DNA))of the dataset
    it said that there are 180 indicator binary
    variables that mean that the dataset
    is type-homogenous and scale-homogenous" )
```

```
## From the dictionary (help(DNA))of the dataset
##     it said that there are 180 indicator binary
##     variables that mean that the dataset
##     is type-homogenous and scale-homogenous
```

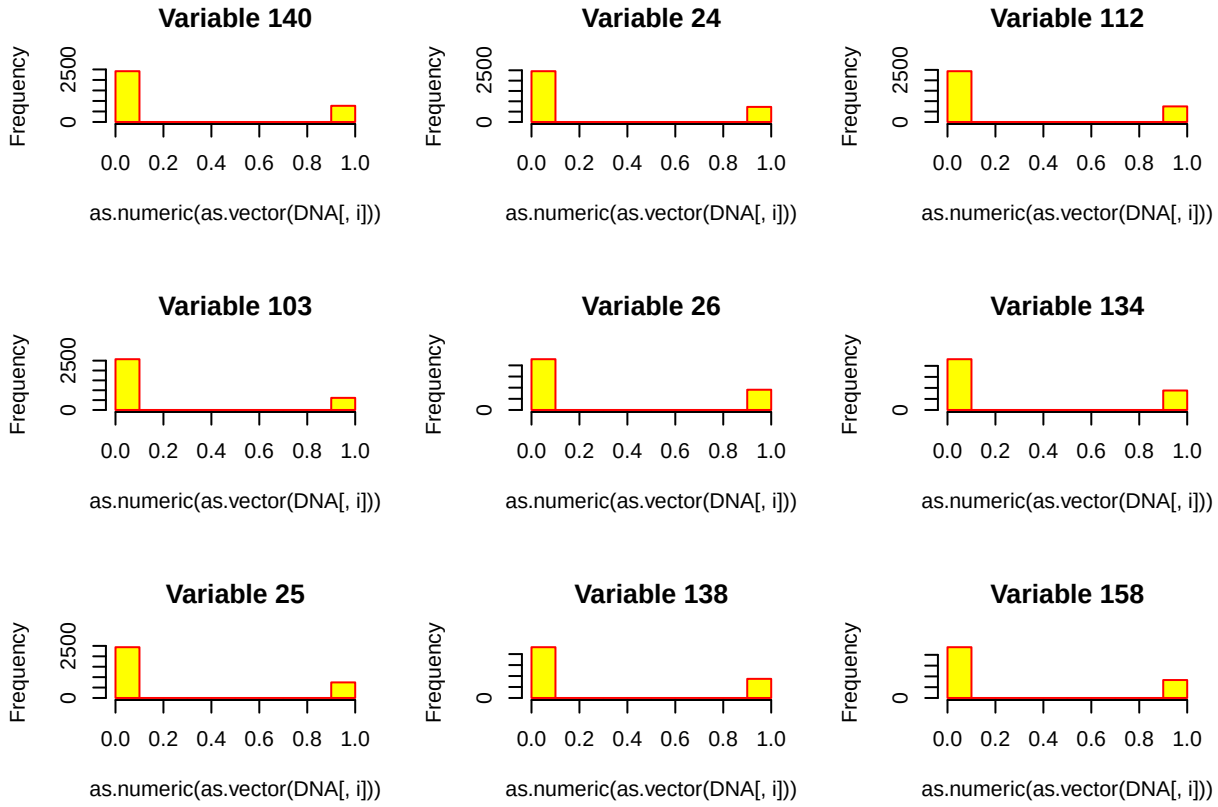
```
cat("We have k=n/p=",nrow(DNA)/ncol(DNA)," . This is greater than 5
    so this data set in term of size is not
    bad in context of hight dimensional setting")
```

```
## We have k=n/p= 17.60221  . This is greater than 5
##     so this data set in term of size is not
##     bad in context of hight dimensional setting
```

```
set.seed(19671210)
par(mfrow=c(3,3))

set <- sample(1:(ncol(DNA)-1),9)
for (i in set){
 hist(as.numeric(as.vector(DNA[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")
```



```
}
```




```
cat("The dataset contain only categorical variable ,
    so that's not very useful to investigate about
    correlation and muticolinerarity")
```

```
## The dataset contain only categorical variable ,
##     so that's not very useful to investigate about
##     correlation and muticolinerarity
```

```
head(BreastCancer,1)
```

```
##        Id Cl.thickness Cell.size Cell.shape Marg.adhesion Epith.c.size
## 1 1000025            5         1          1             1            2
##   Bare.nuclei Bl.cromatin Normal.nucleoli Mitoses  Class
## 1           1           3               1       1 benign
```

```
cat("In the BreastCancer dataset we have :",ncol(BreastCancer),"colunm and ",nrow(BreastCancer),"observa
```

```
## In the BreastCancer dataset we have : 11 colunm and  699 observations
```

```
cat("The dimension of the output space is ",ncol(DNA)-2,
"and the response is the variable class that
is categorical with 2 level : 'benign' and 'malignant'\n")
```

```
## The dimension of the output space is  179 and the response is the variable class that
## is categorical with 2 level : 'benign' and 'malignant'
```

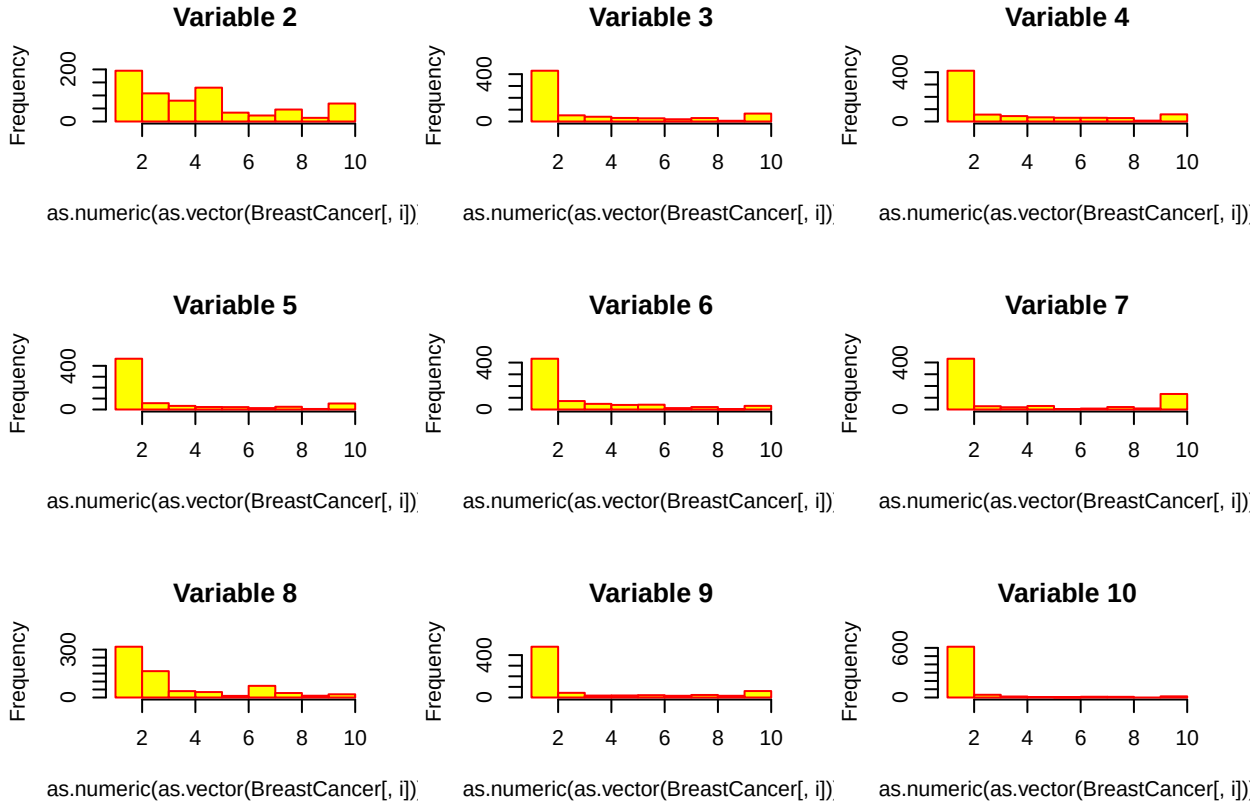
```
cat("From the dictionary (help(BrestCancer))
of the dataset it said that the 9 predictor
have a value in range 0-10,
that mean that the dataset is type-homogenous and scale-homogenous" )
```

```
## From the dictionary (help(BrestCancer))
## of the dataset it said that the 9 predictor
## have a value in range 0-10,
## that mean that the dataset is type-homogenous and scale-homogenous
```

```
cat("We have k=n/p=",nrow(BreastCancer)/ncol(BreastCancer)," .
This is greater than 5 so this data set
in term of size is not bad in context of hight dimensional setting")
```

```
## We have k=n/p= 63.54545  .
## This is greater than 5 so this data set
## in term of size is not bad in context of hight dimensional setting
```

```
par(mfrow=c(3,3))

#set <- sample(1:(ncol(BreastCancer)-1),9)
for (i in 2:10){
 hist(as.numeric(as.vector(BreastCancer[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")


}
```



```
cat("The dataset contain only categorical variables ,
    so that's not very useful to investigate about
    correlation and muticolinerarity")
```

```
## The dataset contain only categorical variables ,
##     so that's not very useful to investigate about
##     correlation and muticolinerarity
```

```
head(spam,2)
```

```
##   make address  all num3d  our over remove internet order mail receive will
## 1 0.00    0.64 0.64     0 0.32 0.00   0.00     0.00     0 0.00    0.00 0.64
## 2 0.21    0.28 0.50     0 0.14 0.28   0.21     0.07     0 0.94    0.21 0.79
##   people report addresses free business email  you credit your font num000
## 1   0.00   0.00      0.00 0.32     0.00  1.29 1.93      0 0.96    0   0.00
## 2   0.65   0.21      0.14 0.14     0.07  0.28 3.47      0 1.59    0   0.43
##   money hp hpl george num650 lab labs telnet num857 data num415 num85
## 1  0.00  0   0      0      0   0    0      0      0    0      0     0
## 2  0.43  0   0      0      0   0    0      0      0    0      0     0
##   technology num1999 parts pm direct cs meeting original project re edu table
## 1          0    0.00     0  0      0  0       0        0       0  0   0     0
## 2          0    0.07     0  0      0  0       0        0       0  0   0     0
##   conference charSemicolon charRoundbracket charSquarebracket charExclamation
## 1          0             0            0.000                 0           0.778
## 2          0             0            0.132                 0           0.372
##   charDollar charHash capitalAve capitalLong capitalTotal type
## 1       0.00    0.000      3.756          61          278 spam
## 2       0.18    0.048      5.114         101         1028 spam
```

```
cat("In the Spam dataset we have :",ncol(spam),
    "colunm and ",nrow(spam),"observations\n")
```

```
## In the Spam dataset we have : 58 colunm and  4601 observations
```

```
cat("The dimension of the output space is ",ncol(spam)-1,
    "and the response is the variable type that
    is categorical with 2 level : 'nonspam' and 'spam'\n\n")
```

```
## The dimension of the output space is  57 and the response is the variable type that
##     is categorical with 2 level : 'nonspam' and 'spam'
```

```
cat("From the dictionary (help(Spam))of the dataset
    we can deduce that all the predictors are numeric
    then it type-homogenous but in term of scale that's not
    the case because looking at the variable num415
    it range is 0-5 whereas
    for the variable capitalTotal it range is 1-15841  \n\n" )
```

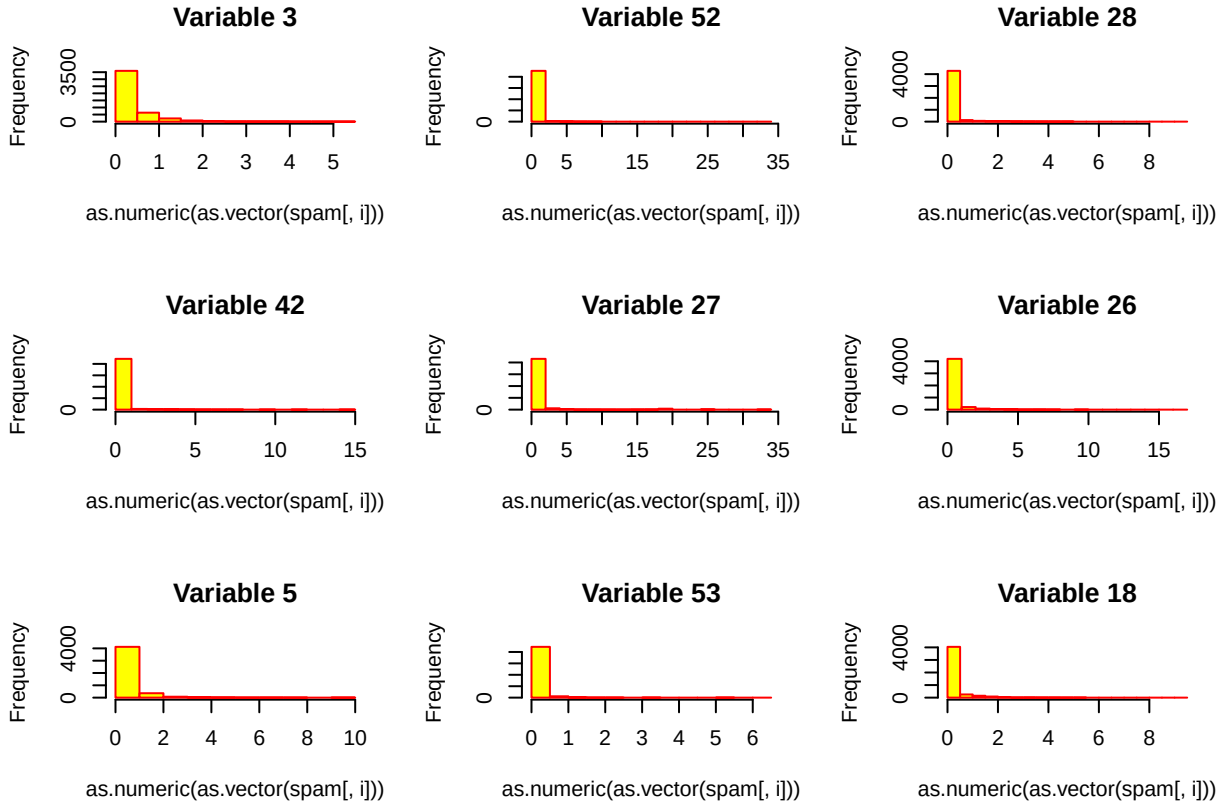
```
## From the dictionary (help(Spam))of the dataset
##     we can deduce that all the predictors are numeric
##     then it type-homogenous but in term of scale that's not
##     the case because looking at the variable num415
##     it range is 0-5 whereas
##     for the variable capitalTotal it range is 1-15841
```

```
cat("We have k=n/p=",nrow(spam)/ncol(spam)," .
    This is greater than 5
```

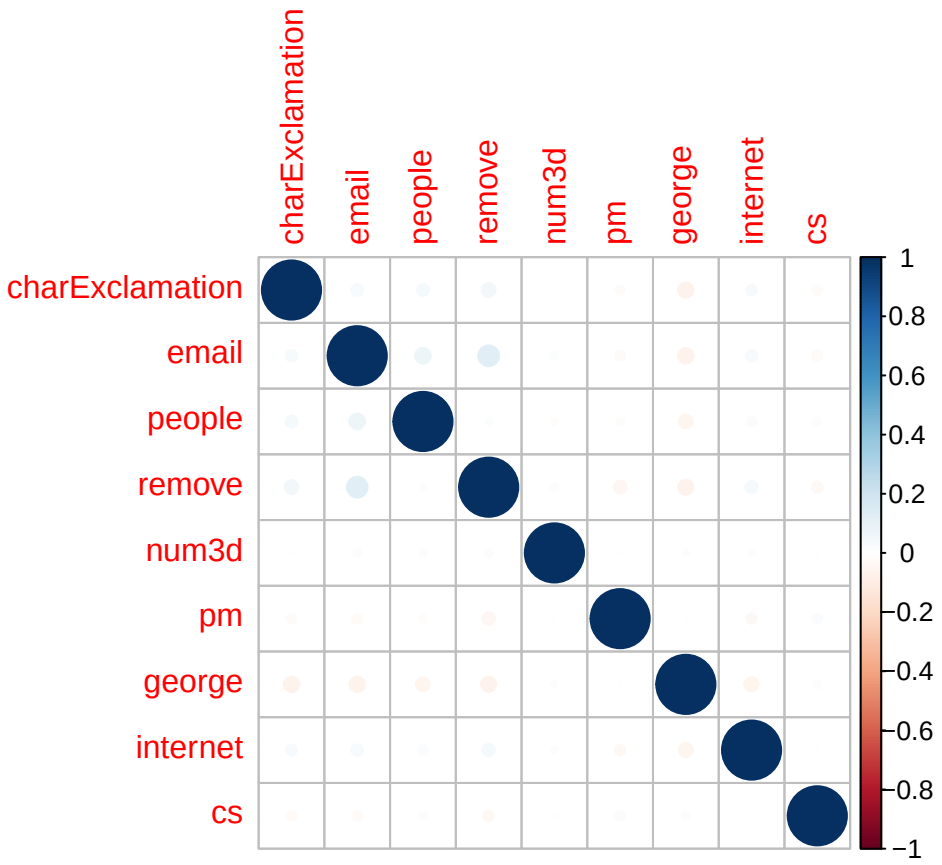
```
    so this data set in term of size is not bad
    in context of hight dimensional setting")
```

```
## We have k=n/p= 79.32759  .
##     This is greater than 5
##     so this data set in term of size is not bad
##     in context of hight dimensional setting
```

```
par(mfrow=c(3,3))

set <- sample(1:(ncol(spam)-1),9)
for (i in set){
 hist(as.numeric(as.vector(spam[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")


}
```




```
par(mfrow=c(1,1))
##### Correlation between some variables
corrplot(cor(spam[,sample(1:57,9)]))
```




```
cat("More is level more is the relation of corelation")
```

```
## More is level more is the relation of corelation
```

```
head(leukemia,1)
```

```
##   Y        x.1       x.2       x.3        x.4       x.5      x.6      x.7
## 1 0 -0.7883499 -0.756913 -1.414095 -0.7180281 0.4733983 3.113805 2.749407
##        x.8      x.9     x.10    x.11    x.12       x.13      x.14       x.15
## 1 2.628862 3.146849 2.870575 3.20094 3.20094 -0.5313315 -1.414095 -0.4211706
##       x.16    x.17      x.18     x.19      x.20      x.21       x.22      x.23
## 1 2.416142 2.39004 0.8178209 1.673262 -1.161635 0.1294552 -0.3120343 -1.039349
##         x.24      x.25      x.26      x.27     x.28      x.29       x.30
## 1 -0.4745839 -1.414095 -1.414095 0.4802184 -0.20493 -1.414095 -0.2620148
##        x.31       x.32      x.33      x.34      x.35      x.36      x.37
## 1 0.8060265 -0.9981425 0.7530722 0.1410393 0.4289747 0.1377446 0.1968442
##       x.38      x.39       x.40       x.41      x.42     x.43       x.44
## 1 -1.18254 0.7892531 -0.1557647 -0.5075344 -1.069969 1.411459 -0.2442587
##         x.45       x.46        x.47     x.48       x.49       x.50       x.51
## 1 -0.7525094 -0.9369409 -0.03234793 0.681544 -0.8795999 -0.2170385 0.01984931
##          x.52      x.53     x.54       x.55       x.56      x.57       x.58
## 1 -0.04436575 0.6292474 0.837909 -0.2243817 -0.5452147 -1.218487 -0.3039512
##         x.59     x.60      x.61      x.62       x.63      x.64        x.65
## 1 -0.4522089 0.70837 -1.414095 -1.414095 -0.3621021 0.8598036 0.004693363
##        x.66      x.67      x.68     x.69       x.70      x.71       x.72
## 1 0.5788531 0.3383435 -1.414095 1.214222 -0.8114895 -1.414095 -0.4975233
##        x.73      x.74     x.75      x.76      x.77      x.78      x.79
```

```
## 1 0.4132648 0.2866009 0.280979 0.9349389 -1.414095 -1.414095 -1.414095
##         x.80       x.81      x.82       x.83    x.84      x.85      x.86
## 1 -0.1603343 -0.1200123 -1.414095 -0.2749134 1.04661 -1.414095 -1.414095
##        x.87     x.88       x.89      x.90      x.91     x.92      x.93
## 1 0.3018842 1.322673 -0.1377128 -1.414095 0.2152153 -1.18254 0.3114779
##        x.94     x.95      x.96      x.97      x.98      x.99    x.100     x.101
## 1 -1.414095 2.088334 0.2963563 -0.394114 -1.414095 -1.414095 1.488614 0.1475931
##      x.102    x.103     x.104     x.105     x.106       x.107      x.108
## 1 1.126239 1.212706 0.8146907 0.5686357 0.8709248 -0.07304087 0.03475678
##         x.109     x.110      x.111      x.112    x.113     x.114    x.115
## 1 -0.07096239 -1.414095 -0.3852711 -0.2671523 1.091642 -0.854685 1.777176
##       x.116    x.117     x.118     x.119     x.120     x.121     x.122
## 1 -1.335731 1.644765 -1.414095 -1.414095 -0.969812 0.2795681 0.3060082
##       x.123      x.124     x.125      x.126     x.127     x.128    x.129
## 1 0.2347071 -0.3066376 0.5572624 -0.2442587 0.5899612 -1.414095 1.495314
##       x.130     x.131      x.132     x.133     x.134     x.135     x.136
## 1 0.6349967 -1.414095 -0.7657846 -1.057597 0.1475931 0.7835924 0.6416585
##        x.137     x.138     x.139    x.140     x.141      x.142     x.143
## 1 -0.9262427 -1.414095 0.9856932 2.549827 -1.233273 -0.4030437 0.1426821
##      x.144   x.145     x.146      x.147      x.148       x.149     x.150
## 1 1.184961 1.84881 0.7004049 -0.4522089 -0.3367236 -0.02639806 0.8052348
##          x.151     x.152     x.153     x.154    x.155      x.156     x.157
## 1 -0.008778519 -1.414095 -1.414095 0.4733983 1.780434 -0.4303714 -1.414095
##       x.158     x.159      x.160     x.161    x.162    x.163       x.164
## 1 0.5047965 0.6078503 -0.6449172 0.8650104 1.163849 1.133445 -0.09836043
##        x.165     x.166    x.167     x.168      x.169    x.170    x.171
## 1 -0.6766876 0.8217186 0.116033 -1.233273 -0.5347825 1.450854 1.129572
##       x.172       x.173      x.174      x.175      x.176       x.177     x.178
## 1 0.4937069 -0.09409124 0.01419539 0.03290665 -0.5700324 -0.07096239 0.2639018
##       x.179     x.180     x.181      x.182    x.183      x.184      x.185
## 1 -1.405047 0.8447605 0.6492127 0.07099008 1.686281 -0.6332837 -0.4303714
##      x.186      x.187     x.188     x.189     x.190    x.191    x.192
## 1 1.149317 -0.8400574 -1.414095 0.3670069 0.2935797 1.733434 0.063858
##         x.193     x.194     x.195      x.196     x.197     x.198     x.199
## 1 -0.05859028 0.3759408 0.1669757 -0.6217972 0.2921882 0.5572624 0.7074884
##      x.200     x.201    x.202     x.203    x.204     x.205      x.206     x.207
## 1 1.066438 -1.414095 1.359148 0.7266881 0.903495 -1.414095 -0.2853656 -1.414095
##        x.208      x.209     x.210     x.211     x.212      x.213      x.214
## 1 -0.4778257 -0.4272941 0.4277758 0.5036936 0.3501788 -0.4553719 0.07806665
##        x.215      x.216     x.217     x.218    x.219      x.220      x.221
## 1 -0.9315761 -0.3066376 -1.414095 0.5036936 1.384214 -0.2001314 -0.8209127
##        x.222     x.223      x.224     x.225     x.226      x.227    x.228
## 1 -0.3284191 -0.449057 -0.6294387 0.8927674 -1.211183 -0.9423376 1.561457
##        x.229     x.230      x.231     x.232     x.233     x.234      x.235
## 1 0.06921229 -1.414095 -0.3621021 0.5624498 0.3797429 0.2624641 -0.8846659
##      x.236     x.237     x.238     x.239     x.240     x.241     x.242
## 1 1.374948 -1.414095 0.2014719 -1.414095 -1.414095 0.1041239 0.6977343
##       x.243     x.244     x.245     x.246    x.247     x.248     x.249
## 1 -1.414095 0.6454435 -1.414095 -1.414095 1.947354 -1.414095 -1.414095
##       x.250      x.251     x.252      x.253     x.254     x.255     x.256
## 1 0.1968442 -0.8795999 -1.114648 -0.9810385 -1.414095 -1.414095 -1.414095
##       x.257      x.258      x.259     x.260     x.261      x.262      x.263
## 1 0.4665268 -0.4181242 -0.1026498 -1.414095 -1.414095 -0.6449172 -0.5075344
##     x.264      x.265      x.266      x.267     x.268      x.269     x.270
```

```
## 1 0.72236 -0.9924054 -0.3395087 -0.6029697 -1.414095 0.07099008 0.4688231
##       x.271     x.272     x.273     x.274       x.275      x.276     x.277
## 1 0.7614224 0.8271475 0.6482719 -1.414095 -0.09409124 -0.6256099 0.6650601
##       x.278    x.279      x.280     x.281      x.282     x.283     x.284
## 1 0.9830914 0.430172 -0.9642503 0.6147133 -0.2243817 0.6244285 0.1701664
##        x.285       x.286     x.287     x.288    x.289      x.290     x.291
## 1 -0.7308059 -0.06475529 -1.196749 0.1344379 1.975342 -0.5736338 0.1194072
##       x.292     x.293      x.294    x.295    x.296      x.297     x.298
## 1 0.4156995 0.7039536 -0.5244685 0.145959 0.280979 -0.4459159 -1.009727
##        x.299    x.300       x.301     x.302    x.303      x.304     x.305
## 1 -0.3852711 2.170478 -0.06681962 -1.108129 1.581915 -0.6888936 -1.369729
##      x.306      x.307     x.308    x.309      x.310      x.311     x.312
## 1 1.083513 -0.3311789 -1.414095 2.762663 -0.4303714 -0.3229246 0.8694498
##       x.313     x.314       x.315        x.316     x.317     x.318     x.319
## 1 -0.151218 0.3972788 -0.01071947 0.0008645768 -1.141199 0.3501788 0.8162571
##       x.320    x.321      x.322      x.323      x.324     x.325       x.326
## 1 -1.335731 1.157957 -0.5772494 -0.3621021 -0.1534885 0.1765143 -0.03833699
##        x.327     x.328     x.329      x.330      x.331      x.332     x.333
## 1 -0.6410228 -0.849783 -1.414095 0.04395135 -0.2417502 -0.1649269 -1.414095
##       x.334     x.335     x.336       x.337      x.338     x.339     x.340
## 1 -1.263587 0.1194072 0.0494238 -0.09836043 -0.3311789 0.1812463 0.8642684
##        x.341     x.342      x.343     x.344      x.345     x.346     x.347
## 1 -0.6067042 -1.414095 -0.6217972 -1.414095 -0.1156405 -1.414095 0.2182413
##     x.348     x.349     x.350     x.351       x.352     x.353     x.354
## 1 1.71469 0.0620662 -1.414095 -0.146694 -0.04034214 0.1952964 -1.414095
##        x.355      x.356      x.357      x.358     x.359     x.360     x.361
## 1 -0.3284191 -0.9423376 -0.6888936 0.02546829 0.1194072 0.4420589 0.0494238
##       x.362     x.363     x.364     x.365     x.366     x.367     x.368
## 1 0.5135718 0.1906371 0.5298007 0.7437975 -1.414095 0.9732678 -0.449057
##        x.369     x.370    x.371     x.372      x.373     x.374     x.375
## 1 -0.6848067 -1.414095 0.294969 0.1765143 0.03844577 0.3923029 0.4229645
##      x.376     x.377     x.378     x.379     x.380     x.381     x.382
## 1 2.015774 0.4455948 -1.414095 -0.517657 -1.101657 0.9726091 0.2167296
##       x.383     x.384    x.385     x.386     x.387      x.388     x.389
## 1 0.4083759 0.8060265 1.773632 -1.414095 0.1557194 -0.1534885 -1.414095
##        x.390     x.391     x.392      x.393     x.394     x.395     x.396
## 1 -0.3311789 -1.414095 -0.610454 -0.6410228 0.2435643 -0.359247 -1.414095
##       x.397     x.398     x.399     x.400      x.401     x.402     x.403
## 1 -1.414095 0.3797429 -1.414095 -1.414095 -0.6646432 0.4992686 -1.027384
##       x.404     x.405     x.406     x.407     x.408      x.409      x.410
## 1 0.4925905 0.6520295 0.8447605 -1.414095 -1.134488 -0.4000574 -0.6449172
##       x.411      x.412     x.413     x.414      x.415      x.416      x.417
## 1 -1.414095 -0.6029697 -1.248304 0.8209404 -0.6971229 -0.3120343 -0.1557647
##        x.418     x.419     x.420     x.421     x.422      x.423      x.424
## 1 -0.6567014 0.7039536 0.3923029 -1.414095 0.2907946 -0.1091219 -0.4810792
##        x.425      x.426    x.427      x.428      x.429     x.430     x.431
## 1 -0.4553719 -0.6449172 0.680636 0.05486351 -0.5772494 -1.414095 0.6349967
##        x.432     x.433     x.434    x.435      x.436     x.437     x.438
## 1 -0.3736128 0.3423057 -0.272319 1.293976 -0.9810385 0.3898048 0.7404013
##        x.439     x.440     x.441     x.442     x.443     x.444     x.445
## 1 -0.7138085 -1.414095 0.8977894 -1.414095 0.1277882 0.6349967 0.7622533
##       x.446     x.447    x.448      x.449    x.450      x.451     x.452
## 1 -1.414095 0.4903535 1.619562 -0.2671523 1.045395 0.08508858 0.6941613
##      x.453      x.454     x.455   x.456    x.457    x.458     x.459     x.460
```

```
## 1 1.388395 -0.5736338 0.6117783 1.88576 1.270538 1.312754 0.4502882 -1.414095
##       x.461    x.462     x.463    x.464      x.465       x.466      x.467
## 1 0.7835924 2.103849 0.5665784 1.721367 -0.1534885 -0.01071947 -0.5522367
##       x.468      x.469      x.470     x.471      x.472    x.473   x.474
## 1 0.7980777 -0.0343399 -0.7351053 0.1589498 -0.3174631 1.805034 1.11504
##       x.475     x.476     x.477     x.478    x.479      x.480      x.481
## 1 0.3223195 -1.414095 0.8949231 0.7395502 -1.02146 -0.6766876 0.04577916
##        x.482       x.483   x.484     x.485     x.486      x.487     x.488
## 1 -0.2879976 -0.07512411 1.51621 -1.414095 -1.414095 -0.5772494 0.8701876
##       x.489     x.490      x.491      x.492     x.493      x.494     x.495
## 1 -1.414095 0.8568148 -0.4365573 -0.2342659 0.9259662 -0.2219274 -1.414095
##      x.496     x.497    x.498      x.499     x.500      x.501      x.502
## 1 1.230743 -1.414095 2.519075 -0.1091219 0.4071496 -0.2827413 -0.5664453
##        x.503      x.504     x.505      x.506    x.507      x.508    x.509
## 1 -0.3564009 0.01984931 -1.414095 -0.1977415 1.439884 -0.1695428 1.488614
##        x.510     x.511    x.512    x.513     x.514    x.515     x.516
## 1 -0.6848067 -1.414095 2.002071 0.510291 -1.414095 1.562146 -1.414095
##        x.517     x.518      x.519     x.520       x.521     x.522     x.523
## 1 0.01040648 0.2479608 -0.2417502 0.5351466 -0.04840725 -1.414095 -1.414095
##       x.524      x.525     x.526     x.527   x.528      x.529    x.530
## 1 -1.414095 -0.4909099 -1.414095 0.6492127 1.09222 0.07276439 1.415517
##       x.531      x.532     x.533       x.534     x.535     x.536     x.537
## 1 -0.272319 -0.1649269 0.3087471 -0.05246679 0.3276923 -1.271326 0.2420941
##        x.538      x.539      x.540     x.541     x.542     x.543     x.544
## 1 -0.6766876 -0.3707214 -0.4585458 -1.414095 0.6195838 0.6117783 0.7597585
##       x.545     x.546     x.547      x.548      x.549     x.550      x.551
## 1 0.1177217 -1.240757 0.2739024 -0.6029697 0.03290665 -1.414095 0.07982722
##       x.552      x.553     x.554      x.555     x.556     x.557     x.558
## 1 -1.414095 -0.7657846 -1.414095 -0.5452147 -1.414095 -1.414095 0.5603784
##      x.559     x.560     x.561      x.562     x.563     x.564     x.565
## 1 2.099852 0.5583023 0.4642246 -0.4522089 -1.414095 -1.414095 0.1210896
##       x.566     x.567      x.568     x.569      x.570      x.571    x.572
## 1 -0.756913 0.2257628 0.02359915 0.4607605 -0.9315761 0.03660314 1.493458
##       x.573    x.574     x.575     x.576    x.577      x.578     x.579    x.580
## 1 0.6388094 1.147688 -1.414095 -1.414095 1.253281 -0.2317848 0.5168409 2.279306
##       x.581     x.582    x.583      x.584    x.585    x.586     x.587     x.588
## 1 0.1859538 0.5308724 1.318178 -0.8068142 2.738415 1.397526 0.8538162 0.1024098
##      x.589      x.590      x.591      x.592      x.593     x.594     x.595
## 1 2.360593 -0.7837919 0.01796857 -0.1977415 -0.4181242 0.4768148 -1.414095
##         x.596     x.597     x.598     x.599     x.600      x.601      x.602
## 1 -0.03633625 -1.121213 0.1685724 -1.196749 -0.692999 -0.7657846 -0.1858856
##       x.603     x.604    x.605      x.606     x.607      x.608     x.609
## 1 -0.5772494 0.8131215 1.475064 0.09897184 -1.414095 -0.7308059 -1.414095
##       x.610      x.611     x.612      x.613     x.614    x.615     x.616
## 1 -0.9477665 -0.7883499 0.9445037 -0.4617309 0.6585681 1.361729 -1.414095
##      x.617     x.618    x.619     x.620     x.621    x.622     x.623      x.624
## 1 0.792472 0.3488714 1.371555 0.1906371 0.3501788 2.043996 0.0920567 -0.9532279
##       x.625     x.626      x.627     x.628      x.629      x.630    x.631
## 1 -0.9104278 0.2302459 0.06921229 0.9084583 -0.7394252 -0.8695519 1.534864
##       x.632      x.633      x.634   x.635     x.636    x.637     x.638
## 1 -1.189617 -0.1580466 -0.9981425 1.72943 -1.414095 1.341313 -1.396088
##       x.639     x.640     x.641     x.642     x.643     x.644      x.645
## 1 -0.2293104 -1.101657 0.1875176 0.1701664 0.5859376 0.9190035 -0.6686403
##       x.646     x.647     x.648     x.649     x.650     x.651    x.652
```

```
## 1 0.1508523 -1.414095 -1.414095 0.5014838 -1.414095 -1.414095 1.153647
##       x.653     x.654      x.655      x.656     x.657     x.658     x.659
## 1 0.2851987 -1.414095 -0.2243817 -0.1112896 0.1277882 -1.414095 -1.414095
##        x.660      x.661     x.662     x.663     x.664     x.665     x.666
## 1 -0.3012728 -0.4272941 0.5319429 -1.414095 -1.414095 -1.414095 -1.414095
##        x.667     x.668     x.669      x.670     x.671    x.672      x.673
## 1 -0.3882092 -1.414095 -1.414095 -0.7180281 -1.414095 1.840982 0.01419539
##        x.674      x.675     x.676     x.677     x.678     x.679     x.680
## 1 -0.1603343 -0.8846659 0.9600022 0.6650601 0.1244451 0.6678282 0.2537899
##      x.681     x.682   x.683     x.684     x.685    x.686    x.687      x.688
## 1 1.063462 -1.414095 1.24355 -1.414095 0.1126463 0.636905 1.614046 -0.1026498
##       x.689     x.690     x.691     x.692     x.693     x.694     x.695
## 1 -1.414095 0.5415205 -1.414095 -1.414095 0.9356254 0.9973102 0.3847877
##        x.696      x.697     x.698     x.699     x.700       x.701     x.702
## 1 -0.4000574 -0.2853656 0.7284136 -1.414095 -1.414095 0.008506096 -0.394114
##       x.703    x.704      x.705      x.706       x.707    x.708      x.709
## 1 0.2566905 -1.37843 -0.4334591 -0.9156689 -0.04436575 1.294901 -0.2775152
##        x.710      x.711     x.712     x.713       x.714     x.715      x.716
## 1 -0.1288195 -0.7351053 0.6914723 0.3985185 -0.04034214 -1.088849 0.09897184
##      x.717      x.718     x.719    x.720      x.721     x.722      x.723
## 1 1.171824 -0.3678392 0.1669757 1.207631 -0.6807381 -1.027384 -0.2932844
##      x.724     x.725     x.726     x.727    x.728     x.729      x.730
## 1 2.106315 -1.414095 0.7284136 0.1393934 1.747032 0.5879516 -0.4030437
##        x.731     x.732      x.733    x.734    x.735     x.736     x.737
## 1 -0.8596137 0.9424626 -0.4060399 0.670588 1.209156 0.4596029 -1.414095
##      x.738     x.739     x.740    x.741     x.742    x.743     x.744    x.745
## 1 2.079208 -1.414095 -1.414095 1.116166 0.9112823 1.026962 -1.414095 1.268637
##         x.746  x.747      x.748      x.749     x.750     x.751    x.752
## 1 -0.06269564 1.5673 -0.3823425 -0.1603343 0.1393934 0.8248248 1.792817
##       x.753      x.754     x.755     x.756     x.757     x.758      x.759
## 1 -1.161635 -0.1741823 0.9417812 -1.414095 0.9640022 -1.414095 0.03660314
##      x.760    x.761    x.762     x.763     x.764      x.765      x.766
## 1 0.670588 2.557009 1.240611 0.4869877 -1.414095 -0.3451047 -0.2442587
##       x.767    x.768     x.769     x.770      x.771      x.772       x.773
## 1 0.1410393 2.001646 0.3784773 -1.414095 0.02359915 -0.4242272 -0.06888864
##       x.774     x.775     x.776     x.777     x.778     x.779       x.780
## 1 0.4790853 -1.414095 -1.414095 -1.088849 0.2991244 0.2406215 0.004693363
##       x.781     x.782     x.783      x.784     x.785     x.786     x.787
## 1 0.7275513 -1.414095 -1.414095 -0.5278935 0.6416585 0.2167296 0.8340802
##        x.788     x.789      x.790     x.791      x.792     x.793     x.794
## 1 -0.5700324 0.5255013 -0.3120343 0.4711136 -0.5808795 -1.414095 0.1006924
##        x.795     x.796     x.797   x.798     x.799     x.800      x.801
## 1 -0.5244685 0.7811556 -1.082512 1.21926 -1.414095 0.2963563 -0.1069594
##       x.802     x.803     x.804      x.805     x.806      x.807     x.808
## 1 -1.414095 0.4108237 0.5949658 0.02172616 0.6107979 -0.5244685 0.8348473
##       x.809    x.810     x.811     x.812     x.813     x.814     x.815
## 1 -1.414095 1.137851 0.3784773 -1.414095 -0.146694 0.1126463 -1.414095
##        x.816     x.817     x.818     x.819      x.820      x.821      x.822
## 1 -0.3423024 0.3972788 0.1765143 -1.414095 -0.5278935 -0.4843443 -0.5557681
##       x.823     x.824     x.825     x.826       x.827     x.828     x.829
## 1 -1.414095 0.3947943 0.7868314 0.4009929 -0.06064065 0.8201616 0.1812463
##        x.830     x.831     x.832     x.833     x.834     x.835     x.836
## 1 -0.1134624 0.1092469 -1.405047 -1.414095 0.3579843 -1.414095 0.1261182
##         x.837      x.838     x.839      x.840      x.841     x.842     x.843
```

```
## 1 -0.02837703 -0.4459159 -1.414095 -0.2801245 -0.2959394 0.3046356 -1.414095
##       x.844        x.845      x.846        x.847     x.848     x.849      x.850
## 1 0.3566881 0.0008645768 -0.3649661 -0.002980399 0.5614147 0.5222633 -0.2749134
##       x.851      x.852     x.853       x.854    x.855    x.856     x.857
## 1 0.1701664 -0.4427857 0.4071496 -0.08561253 1.172882 1.112784 0.6896752
##        x.858     x.859      x.860      x.861     x.862     x.863     x.864
## 1 -0.6488283 -1.279132 -0.1672319 -0.1156405 0.1344379 -0.209754 -1.414095
##       x.865     x.866     x.867     x.868     x.869    x.870    x.871     x.872
## 1 -1.414095 0.7876393 0.2406215 0.3644381 0.3423057 1.197911 2.216256 -1.414095
##        x.873   x.874      x.875     x.876     x.877     x.878      x.879
## 1 -0.4427857 1.76043 -0.1788456 0.3682885 0.7497105 0.3847877 0.02733359
##       x.880     x.881    x.882     x.883    x.884      x.885    x.886
## 1 -1.414095 -1.414095 1.375371 0.7956795 1.743369 -0.2932844 3.086503
##        x.887      x.888     x.889       x.890     x.891     x.892     x.893
## 1 -0.4060399 -0.3039512 0.2347071 -0.07930497 0.3356924 -1.063762 -1.414095
##       x.894     x.895    x.896     x.897     x.898     x.899    x.900    x.901
## 1 -1.414095 -1.414095 1.245993 0.1765143 -1.414095 0.5113859 1.042958 0.669669
##       x.902      x.903      x.904     x.905      x.906      x.907   x.908
## 1 0.6098164 0.01040648 -0.2442587 -1.414095 -0.1718596 -0.2367538 1.70237
##        x.909     x.910      x.911      x.912      x.913     x.914     x.915
## 1 -0.1310347 0.4688231 -0.1222061 -0.5700324 -0.2219274 -1.414095 0.2376691
##       x.916    x.917     x.918      x.919    x.920     x.921     x.922
## 1 0.9301185 1.619238 -1.414095 0.08508858 1.085843 0.7827809 -0.761338
##       x.923     x.924     x.925      x.926     x.927     x.928      x.929
## 1 0.6397601 -1.414095 -1.414095 0.06027087 -1.063762 -1.057597 -0.4681347
##      x.930    x.931      x.932     x.933      x.934     x.935    x.936
## 1 2.355135 1.170765 -0.8897602 -1.414095 -0.5041851 0.5768188 1.024475
##       x.937      x.938     x.939    x.940      x.941     x.942     x.943
## 1 -1.414095 -0.1288195 -1.141199 1.153107 -0.1156405 -1.361109 0.8716614
##       x.944     x.945     x.946     x.947      x.948        x.949      x.950
## 1 0.3605713 -1.414095 0.1393934 0.2523361 -0.4942106 0.0008645768 -0.3229246
##        x.951      x.952      x.953      x.954        x.955     x.956     x.957
## 1 -0.3284191 -0.2268427 -0.1005026 -0.4876212 -0.004909001 -0.541724 0.4479445
##       x.958      x.959    x.960     x.961      x.962       x.963       x.964
## 1 -0.975408 -0.5041851 2.722974 0.9224915 -0.9532279 -0.05859028 -0.06475529
##       x.965     x.966     x.967     x.968     x.969      x.970     x.971
## 1 -1.414095 -1.414095 -1.414095 -0.209754 0.3155587 -0.4975233 -1.414095
##       x.972     x.973      x.974    x.975      x.976     x.977     x.978
## 1 0.3847877 -1.414095 -0.1649269 2.394879 -0.1741823 -1.414095 -1.414095
##        x.979        x.980     x.981     x.982     x.983     x.984    x.985
## 1 -0.4060399 -0.002980399 0.6068657 0.1410393 -1.414095 -1.414095 1.056278
##        x.986   x.987     x.988     x.989    x.990    x.991     x.992      x.993
## 1 -0.5881835 1.39131 0.5383392 0.4046919 1.908643 1.674785 -1.414095 -0.4272941
##       x.994      x.995    x.996      x.997     x.998    x.999    x.1000
## 1 -1.108129 -0.7792565 0.193746 -0.8352333 0.9445037 1.574807 -1.414095
##     x.1001   x.1002   x.1003   x.1004    x.1005     x.1006      x.1007
## 1 1.900367 0.571713 1.164917 2.137957 0.6788173 -0.3039512 -0.09196414
##      x.1008    x.1009    x.1010    x.1011   x.1012     x.1013    x.1014
## 1 0.2907946 -1.414095 0.3276923 0.4205493 0.675169 -0.6332837 -1.414095
##      x.1015   x.1016    x.1017   x.1018    x.1019   x.1020   x.1021    x.1022
## 1 0.4802184 1.214727 0.1443221 1.058079 0.2667703 2.240599 1.363016 -1.414095
##       x.1023    x.1024     x.1025   x.1026      x.1027     x.1028    x.1029
## 1 -0.7012657 0.7892531 -0.5881835 1.656955 -0.09409124 -0.4778257 -0.272319
##     x.1030    x.1031    x.1032    x.1033     x.1034     x.1035     x.1036
```

```
## 1 1.163849 0.1410393 -1.414095 0.3383435 -0.6332837 -0.6029697 0.09724798
##        x.1037    x.1038    x.1039   x.1040    x.1041     x.1042     x.1043
## 1 -0.03833699 -0.637145 0.4479445 2.323323 0.3708464 -0.4334591 0.01230291
##       x.1044   x.1045    x.1046    x.1047    x.1048     x.1049     x.1050
## 1 -0.6646432 1.323569 0.3592788 0.4444177 0.1765143 -0.1421923 -0.1718596
##      x.1051    x.1052    x.1053     x.1054    x.1055      x.1056    x.1057
## 1 -1.414095 0.2030092 0.2935797 0.06921229 0.9633368 -0.07930497 0.6068657
##      x.1058    x.1059   x.1060     x.1061    x.1062     x.1063   x.1064
## 1 -1.414095 -0.272319 0.318269 -0.8161889 -1.414095 -0.3564009 1.494572
##     x.1065    x.1066   x.1067     x.1068    x.1069   x.1070    x.1071    x.1072
## 1 1.271488 0.2907946 1.427982 0.05486351 0.4768148 1.340873 0.6349967 -1.387216
##      x.1073    x.1074     x.1075    x.1076    x.1077    x.1078    x.1079
## 1 -1.076219 -0.756913 -0.9000353 0.1605606 0.0476033 -0.792931 -1.414095
##      x.1080     x.1081     x.1082    x.1083    x.1084     x.1085    x.1086
## 1 -0.637145 -0.2417502 -0.2317848 -1.414095 -1.414095 0.06027087 0.4120451
##      x.1087    x.1088     x.1089     x.1090     x.1091    x.1092    x.1093
## 1 -1.127827 -1.414095 -0.7437657 -0.9867042 -0.1788456 -1.414095 0.5157525
##        x.1094    x.1095   x.1096    x.1097     x.1098    x.1099    x.1100
## 1 -0.04034214 -1.414095 1.689282 -1.414095 -0.4090459 0.9921654 0.5014838
##      x.1101    x.1102    x.1103      x.1104    x.1105    x.1106    x.1107
## 1 0.2977414 0.2121791 0.9231875 -0.07721214 0.5939671 -1.414095 0.6302082
##      x.1108    x.1109    x.1110    x.1111      x.1112   x.1113    x.1114
## 1 -1.414095 -1.414095 0.2991244 0.3810067 -0.01071947 0.347562 -1.414095
##      x.1115    x.1116    x.1117     x.1118      x.1119     x.1120    x.1121
## 1 0.1410393 0.1968442 0.3462508 -0.8304347 -0.06888864 -0.5772494 0.9091651
##      x.1122    x.1123    x.1124     x.1125     x.1126     x.1127    x.1128
## 1 -1.294947 -1.414095 0.6029163 -0.7394252 -0.3012728 -0.4876212 -0.269732
##      x.1129    x.1130     x.1131     x.1132     x.1133    x.1134   x.1135
## 1 0.1669757 0.3514844 -0.1718596 -0.9369409 -0.3229246 -0.146694 1.041738
##     x.1136    x.1137    x.1138    x.1139     x.1140   x.1141    x.1142
## 1 2.418295 -1.319197 -1.414095 0.4502882 -0.4843443 0.853065 -1.414095
##       x.1143   x.1144    x.1145   x.1146    x.1147    x.1148    x.1149
## 1 -0.3147447 1.221769 0.5394009 2.221944 0.5069983 0.1749315 -1.294947
##        x.1150     x.1151     x.1152    x.1153    x.1154    x.1155    x.1156
## 1 -0.08561253 -0.2569061 -0.4272941 -1.414095 0.3670069 0.3128402 -1.414095
##      x.1157    x.1158      x.1159    x.1160   x.1161      x.1162    x.1163
## 1 -1.414095 0.5686357 -0.09409124 -1.414095 1.054473 0.006601728 -1.414095
##     x.1164     x.1165    x.1166   x.1167    x.1168    x.1169    x.1170
## 1 0.228754 -0.1310347 -1.414095 1.028202 -1.414095 -1.414095 0.4665268
##      x.1171     x.1172    x.1173     x.1174     x.1175    x.1176    x.1177
## 1 0.4408771 -0.4810792 0.2136984 -0.4303714 -0.3765134 0.6968424 0.4549574
##      x.1178    x.1179    x.1180    x.1181    x.1182   x.1183     x.1184
## 1 0.4217577 -1.414095 0.1426821 -1.414095 -1.414095 1.122335 -0.6888936
##      x.1185    x.1186   x.1187    x.1188   x.1189    x.1190    x.1191
## 1 0.2935797 0.3935495 2.386567 0.6416585 1.430375 -0.672655 0.3960374
##       x.1192    x.1193     x.1194    x.1195   x.1196    x.1197   x.1198  x.1199
## 1 -0.4334591 -1.414095 -0.3911568 0.4836093 1.117853 -1.414095 1.304558 1.10655
##      x.1200     x.1201    x.1202   x.1203    x.1204   x.1205    x.1206
## 1 -1.414095 -0.9104278 0.1426821 1.550355 0.1426821 1.375794 0.4253733
##       x.1207     x.1208    x.1209     x.1210    x.1211     x.1212    x.1213
## 1 -0.4810792 -0.6217972 -0.849783 0.02172616 -1.414095 0.02359915 -1.414095
##      x.1214     x.1215    x.1216    x.1217     x.1218   x.1219    x.1220
## 1 0.4385091 -0.9587224 0.0620662 0.3566881 0.02172616 2.101948 0.2030092
##      x.1221     x.1222     x.1223   x.1224    x.1225    x.1226    x.1227
```

```
## 1 -1.161635 -0.9000353 -0.3093319 1.173939 -1.414095 0.5415205 -1.414095
##      x.1228    x.1229    x.1230    x.1231      x.1232    x.1233   x.1234
## 1 0.5747799 0.7171389 -1.039349 -1.255913 -0.07930497 0.7188826 1.566615
##      x.1235    x.1236    x.1237  x.1238     x.1239     x.1240     x.1241
## 1 -1.033347 0.6321266 0.4925905 1.78287 -0.4553719 -0.2417502 -0.5664453
##      x.1242     x.1243      x.1244    x.1245    x.1246    x.1247    x.1248
## 1 0.3101135 -0.8695519 -0.08140263 0.9006467 0.5541358 -1.319197 -1.414095
##     x.1249    x.1250   x.1251     x.1252     x.1253   x.1254    x.1255   x.1256
## 1 0.456121 0.6869728 1.216745 0.03105276 -0.9867042 1.199966 0.7844033 0.280979
##      x.1257    x.1258    x.1259     x.1260   x.1261    x.1262      x.1263
## 1 0.8255997 0.4688231 -1.414095 0.03660314 0.278155 0.5634837 -0.02048686
##       x.1264    x.1265    x.1266     x.1267    x.1268    x.1269    x.1270
## 1 0.05666954 0.9882876 0.3579843 0.01230291 -0.517657 0.4502882 -0.412062
##       x.1271     x.1272     x.1273    x.1274     x.1275    x.1276     x.1277
## 1 -0.5210564 -0.9810385 0.01796857 0.3005054 -0.4522089 -0.517657 0.08683562
##      x.1278    x.1279    x.1280      x.1281     x.1282   x.1283     x.1284
## 1 -0.756913 0.9532962 0.5706884 -0.01656731 -0.1534885 1.089327 -0.1580466
##      x.1285   x.1286    x.1287    x.1288     x.1289    x.1290     x.1291
## 1 0.8731328 2.733012 -1.414095 -1.414095 -0.1332553 0.3566881 0.06564627
##      x.1292    x.1293     x.1294    x.1295    x.1296     x.1297    x.1298
## 1 0.7680479 -1.414095 -0.7883499 0.5036936 0.9699695 -0.3093319 -1.196749
##       x.1299    x.1300     x.1301     x.1302    x.1303      x.1304    x.1305
## 1 0.02919508 0.4813501 -0.2749134 -0.1489532 0.0494238 -0.05450338 -1.175518
##      x.1306    x.1307    x.1308     x.1309    x.1310   x.1311    x.1312
## 1 -1.114648 -1.414095 0.6977343 -0.6449172 -1.414095 1.323121 0.6407098
##     x.1313     x.1314     x.1315    x.1316    x.1317    x.1318   x.1319
## 1 -1.14796 -0.9156689 -0.2569061 0.2907946 -1.414095 -1.414095 1.138401
##       x.1320     x.1321    x.1322    x.1323    x.1324    x.1325     x.1326
## 1 -0.2219274 0.01608394 0.9314983 0.3579843 0.8934865 -1.015574 -0.2417502
##      x.1327    x.1328    x.1329   x.1330     x.1331    x.1332    x.1333
## 1 0.5014838 -1.414095 0.2866009 0.488111 -0.9000353 -1.414095 -1.414095
##      x.1334   x.1335    x.1336   x.1337     x.1338    x.1339    x.1340
## 1 0.0494238 2.441908 0.4824804 1.322224 -0.1929806 -1.414095 0.6959496
##      x.1341    x.1342     x.1343    x.1344    x.1345     x.1346     x.1347
## 1 -1.414095 0.1294552 -0.2569061 0.5899612 0.3810067 -0.2620148 -0.3678392
##      x.1348     x.1349     x.1350    x.1351     x.1352    x.1353    x.1354
## 1 0.8709248 -0.2879976 -0.1178238 -1.414095 -0.2620148 -1.414095 0.5135718
##      x.1355   x.1356    x.1357    x.1358    x.1359     x.1360     x.1361
## 1 0.6234616 2.710097 0.3972788 0.3032609 0.8992192 -0.3479156 -0.1332553
##       x.1362     x.1363     x.1364    x.1365     x.1366     x.1367    x.1368
## 1 -0.1534885 -0.6067042 -0.4975233 0.8131215 0.03290665 0.04211986 0.1092469
##      x.1369    x.1370     x.1371    x.1372    x.1373     x.1374    x.1375
## 1 0.1210896 0.3073787 -0.7054274 -1.414095 0.1875176 -0.2342659 0.9593338
##     x.1376   x.1377    x.1378    x.1379     x.1380    x.1381     x.1382
## 1 1.533443 1.747875 0.1109482 -1.414095 -0.2442587 -1.414095 -0.5210564
##       x.1383    x.1384   x.1385    x.1386   x.1387     x.1388    x.1389
## 1 -0.5557681 0.8333125 1.319978 -1.414095 0.347562 -0.9810385 0.2753221
##       x.1390      x.1391     x.1392    x.1393     x.1394     x.1395    x.1396
## 1 -0.2932844 -0.03234793 -0.3066376 -1.414095 0.05486351 -0.2146038 0.8716614
##     x.1397    x.1398    x.1399    x.1400    x.1401      x.1402   x.1403
## 1 1.288871 0.8004697 0.1508523 0.1812463 -1.414095 -0.04840725 1.741674
##      x.1404    x.1405   x.1406     x.1407     x.1408    x.1409    x.1410
## 1 -1.414095 -1.414095 1.305015 -0.3201898 0.01608394 0.5135718 0.4903535
##      x.1411     x.1412    x.1413    x.1414    x.1415    x.1416      x.1417
```

```
## 1 -1.414095 -0.5452147 0.4479445 -1.414095 -0.089842 -1.414095 -0.05859028
##      x.1418    x.1419   x.1420     x.1421    x.1422    x.1423     x.1424
## 1 -1.414095 0.0476033 1.900842 -0.9867042 0.6454435 0.3810067 -0.3649661
##       x.1425     x.1426     x.1427    x.1428    x.1429     x.1430    x.1431
## 1 -0.1835329 0.08857932 -0.9423376 0.2739024 0.4722567 -0.5278935 0.6669065
##        x.1432    x.1433   x.1434    x.1435   x.1436   x.1437    x.1438   x.1439
## 1 -0.09622333 0.5372762 1.258589 -1.414095 2.950113 2.461214 -0.104802 1.759043
##      x.1440    x.1441     x.1442    x.1443     x.1444    x.1445    x.1446
## 1 -1.294947 0.5047965 -0.1222061 0.6492127 -0.1399498 0.1749315 -1.414095
##      x.1447    x.1448     x.1449    x.1450  x.1451    x.1452    x.1453
## 1 0.3436227 -0.849783 -0.8021629 0.1492241 0.35409 -1.414095 0.6029163
##       x.1454    x.1455    x.1456    x.1457    x.1458     x.1459    x.1460
## 1 -0.1557647 0.2302459 -1.414095 -1.414095 0.0620662 -0.6180004 0.8906066
##      x.1461     x.1462    x.1463     x.1464     x.1465     x.1466    x.1467
## 1 0.0494238 0.05486351 0.6349967 0.07806665 -0.2146038 0.04028467 0.4408771
##       x.1468    x.1469    x.1470     x.1471    x.1472     x.1473    x.1474
## 1 -0.2317848 0.6224937 0.5614147 -0.2025275 0.2450322 -0.1672319 0.8620387
##      x.1475    x.1476    x.1477     x.1478     x.1479      x.1480    x.1481
## 1 0.1210896 0.1921929 0.1075424 -0.1444404 -0.9262427 -0.04638426 0.2710563
##       x.1482   x.1483    x.1484     x.1485    x.1486      x.1487    x.1488
## 1 0.02172616 1.190163 -1.009727 -0.6180004 -1.108129 -0.09836043 0.3772099
##     x.1489    x.1490   x.1491      x.1492    x.1493     x.1494    x.1495
## 1 1.132893 -0.637145 0.748025 -0.02639806 -1.414095 -0.1649269 0.2837943
##      x.1496   x.1497    x.1498   x.1499    x.1500    x.1501    x.1502
## 1 0.1605606 1.726846 0.6378577 1.444994 -1.414095 -1.255913 -1.414095
##        x.1503     x.1504     x.1505      x.1506    x.1507    x.1508     x.1509
## 1 -0.02048686 -0.5772494 -0.2543625 -0.01656731 -1.009727 0.3810067 0.06564627
##      x.1510     x.1511    x.1512    x.1513     x.1514    x.1515    x.1516
## 1 0.3396662 -0.2827413 -1.414095 0.4396939 -0.1557647 0.4745386 0.2880009
##      x.1517    x.1518    x.1519     x.1520    x.1521     x.1522     x.1523
## 1 -1.414095 0.2435643 0.5909643 -0.1005026 0.8363794 -0.2392486 -0.7180281
##      x.1524    x.1525    x.1526    x.1527   x.1528    x.1529     x.1530
## 1 0.6292474 -1.414095 0.6156895 -1.414095 2.458518 -1.414095 -0.2879976
##      x.1531    x.1532     x.1533     x.1534   x.1535   x.1536    x.1537
## 1 -1.203937 0.6321266 -0.5075344 -0.5008481 1.392972 1.669595 -0.209754
##      x.1538    x.1539    x.1540    x.1541    x.1542     x.1543    x.1544
## 1 0.2227616 -1.414095 -1.414095 -1.414095 0.2317354 0.08158439 -0.854685
##       x.1545    x.1546      x.1547    x.1548    x.1549   x.1550    x.1551
## 1 -0.1649269 0.7614224 0.008506096 0.4653764 0.3223195 1.341313 -1.414095
##     x.1552    x.1553     x.1554   x.1555   x.1556    x.1557    x.1558
## 1 0.278155 -1.063762 -0.7054274 0.204544 1.778806 0.2302459 0.1828182
##       x.1559    x.1560    x.1561   x.1562    x.1563     x.1564     x.1565
## 1 -0.4778257 -1.414095 0.1733459 1.213717 -1.414095 -0.1026498 -0.4030437
##       x.1566    x.1567     x.1568     x.1569     x.1570    x.1571     x.1572
## 1 -0.5628723 0.9785202 -0.5210564 -0.5075344 -0.3882092 0.2977414 0.01419539
##      x.1573     x.1574    x.1575    x.1576   x.1577    x.1578   x.1579
## 1 -1.414095 -0.1354813 0.2667703 0.7012934 0.145959 0.7118877 1.263866
##      x.1580   x.1581     x.1582    x.1583    x.1584     x.1585     x.1586
## 1 0.1210896 1.749279 -0.2442587 0.9133946 -1.414095 -0.2194797 -0.3823425
##        x.1587    x.1588    x.1589     x.1590   x.1591   x.1592    x.1593
## 1 0.004693363 -1.387216 0.3356924 -0.6646432 0.571713 1.042348 0.2332225
##      x.1594     x.1595    x.1596   x.1597     x.1598    x.1599   x.1600
## 1 -1.414095 -0.1788456 -1.414095 1.384214 -0.6971229 -1.414095 1.338233
##      x.1601    x.1602    x.1603     x.1604    x.1605      x.1606   x.1607
```

```
## 1 0.8848192 0.7852134 0.5829081 -0.1695428 -1.063762 -0.09409124 0.634041
##      x.1608     x.1609   x.1610    x.1611    x.1612     x.1613     x.1614
## 1 0.5979554 -0.2194797 1.323569 -1.414095 0.5415205 0.04028467 -0.1534885
##      x.1615    x.1616    x.1617     x.1618     x.1619   x.1620     x.1621
## 1 0.4733983 0.4572831 -1.414095 -0.7138085 -0.9587224 1.329819 -0.5041851
##      x.1622     x.1623    x.1624   x.1625    x.1626    x.1627     x.1628
## 1 -1.414095 -0.3229246 -1.414095 0.676995 0.5979554 0.8255997 -0.3201898
##     x.1629     x.1630   x.1631    x.1632   x.1633    x.1634    x.1635    x.1636
## 1 1.028202 -0.1156405 0.157336 -0.359247 1.235196 0.5467982 -1.414095 -1.414095
##      x.1637     x.1638    x.1639   x.1640   x.1641  x.1642    x.1643    x.1644
## 1 0.7197532 0.07276439 -0.792931 2.109718 1.130126 1.07531 -1.414095 0.5859376
##      x.1645   x.1646     x.1647    x.1648   x.1649     x.1650     x.1651
## 1 0.8840932 1.396286 -0.4876212 0.8060265 1.581578 -0.9209405 -0.3229246
##      x.1652    x.1653       x.1654    x.1655    x.1656    x.1657    x.1658
## 1 -1.414095 0.0920567 -0.002980399 0.3046356 0.9169042 -1.248304 0.1875176
##       x.1659     x.1660     x.1661    x.1662    x.1663     x.1664   x.1665
## 1 -0.1765109 -0.1580466 -0.1112896 -1.414095 0.5233439 -0.2827413 1.181825
##       x.1666    x.1667    x.1668      x.1669     x.1670      x.1671    x.1672
## 1 -0.1026498 0.8224962 0.3236657 0.008506096 0.06743103 -0.05450338 0.9204003
##      x.1673    x.1674    x.1675    x.1676    x.1677   x.1678    x.1679
## 1 0.4802184 -1.414095 0.6760825 -1.414095 0.3514844 0.681544 0.1360927
##       x.1680     x.1681    x.1682     x.1683    x.1684     x.1685    x.1686
## 1 -0.4272941 -0.1200123 0.0620662 -0.2121757 0.4205493 -0.4000574 0.8884407
##     x.1687    x.1688     x.1689    x.1690     x.1691    x.1692    x.1693
## 1 0.494822 -1.414095 -0.5992506 0.7964796 -0.2268427 -0.692999 0.7860227
##       x.1694   x.1695    x.1696     x.1697    x.1698    x.1699     x.1700
## 1 -0.6256099 1.536992 0.7369923 -0.4713536 0.6742547 -1.414095 -0.1091219
##       x.1701     x.1702   x.1703    x.1704    x.1705   x.1706     x.1707
## 1 -0.2853656 -0.1421923 1.525226 0.9224915 -1.319197 2.683683 0.04395135
##      x.1708   x.1709    x.1710    x.1711 x.1712     x.1713    x.1714    x.1715
## 1 0.4824804 1.161176 -0.969812 0.2552414 1.8831 -0.1672319 -1.344112 0.6557716
##       x.1716    x.1717     x.1718   x.1719   x.1720    x.1721   x.1722   x.1723
## 1 -0.2749134 -0.272319 -0.3423024 2.270653 1.107686 0.9259662 0.430172 0.945862
##         x.1724    x.1725    x.1726    x.1727    x.1728    x.1729   x.1730
## 1 -0.004909001 -1.414095 0.4361348 -1.414095 0.3708464 -1.396088 1.479603
##      x.1731     x.1732     x.1733   x.1734    x.1735     x.1736    x.1737
## 1 0.5706884 -0.2317848 -0.4649271 1.293976 -1.414095 -0.7308059 0.7647412
##      x.1738   x.1739    x.1740    x.1741    x.1742     x.1743    x.1744
## 1 0.5989497 2.053681 0.1968442 0.4265754 -1.414095 -0.8795999 0.1621686
##     x.1745    x.1746    x.1747   x.1748    x.1749    x.1750    x.1751    x.1752
## 1 1.381696 0.2991244 -1.255913 1.289802 -1.057597 0.7404013 -1.414095 0.5788531
##      x.1753    x.1754     x.1755    x.1756    x.1757   x.1758    x.1759
## 1 0.4217577 0.2420941 0.09897184 0.4408771 0.3935495 2.918725 0.3462508
##      x.1760      x.1761      x.1762     x.1763   x.1764    x.1765     x.1766
## 1 0.7940771 -0.09622333 -0.06064065 -0.2594569 1.456677 0.1859538 -0.2317848
##       x.1767   x.1768    x.1769    x.1770     x.1771    x.1772    x.1773
## 1 -0.8021629 1.500491 0.2710563 0.3263521 -0.9104278 -1.414095 -1.414095
##        x.1774     x.1775     x.1776     x.1777      x.1778     x.1779
## 1 -0.02048686 -0.4060399 -0.2492966 -0.1953579 -0.04436575 -0.8304347
##       x.1780    x.1781     x.1782     x.1783   x.1784     x.1785    x.1786
## 1 -0.3367236 -1.414095 -0.7308059 0.07099008 1.822021 -0.2543625 0.2136984
##       x.1787     x.1788     x.1789    x.1790   x.1791    x.1792   x.1793
## 1 -0.2417502 -0.9423376 -0.5881835 0.4325618 1.363016 -1.414095 0.675169
##      x.1794     x.1795    x.1796     x.1797    x.1798    x.1799    x.1800
```

```
## 1 -1.414095 -0.5593132 -1.414095 -0.5955465 0.7597585 -1.414095 -1.414095
##     x.1801    x.1802    x.1803     x.1804    x.1805    x.1806    x.1807
## 1 1.376217 -1.414095 0.6263591 -0.2268427 0.8302353 0.0620662 0.3046356
##      x.1808    x.1809       x.1810    x.1811      x.1812     x.1813    x.1814
## 1 0.2464977 -0.394114 0.0008645768 -1.414095 -0.07096239 -0.3311789 0.7153919
##      x.1815    x.1816    x.1817    x.1818   x.1819     x.1820   x.1821
## 1 0.3797429 0.6029163 0.7980777 -1.414095 1.028822 0.07982722 0.204544
##      x.1822     x.1823    x.1824    x.1825    x.1826     x.1827    x.1828
## 1 0.1443221 -0.1718596 -1.414095 0.9424626 0.5146628 -0.2543625 0.7030677
##       x.1829   x.1830    x.1831       x.1832    x.1833   x.1834    x.1835
## 1 -0.5845241 1.161711 0.3682885 -0.004909001 0.7240937 0.193746 -1.414095
##     x.1836       x.1837    x.1838    x.1839   x.1840     x.1841    x.1842
## 1 1.062865 -0.008778519 0.4059216 0.3046356 1.070589 -0.2025275 -1.414095
##      x.1843    x.1844    x.1845   x.1846    x.1847    x.1848    x.1849
## 1 0.8028553 -1.414095 0.8985045 0.430172 0.1621686 -1.414095 -1.414095
##      x.1850   x.1851     x.1852    x.1853    x.1854     x.1855  x.1856  x.1857
## 1 0.5200982 1.353531 -0.4843443 0.6594984 -1.414095 -0.1178238 1.29721 1.26243
##      x.1858   x.1859    x.1860    x.1861    x.1862    x.1863      x.1864
## 1 -1.414095 1.177101 -1.414095 -1.414095 -1.414095 -1.414095 -0.03036031
##      x.1865  x.1866    x.1867     x.1868     x.1869    x.1870   x.1871
## 1 -1.294947 1.12401 -1.414095 -0.6646432 -0.5522367 -1.414095 1.826155
##      x.1872      x.1873   x.1874    x.1875      x.1876  x.1877    x.1878
## 1 -1.414095 -0.06064065 0.193746 -1.319197 -0.02245299 1.04661 0.8317752
##       x.1879    x.1880     x.1881   x.1882     x.1883    x.1884      x.1885
## 1 -0.3311789 -1.414095 -0.1788456 0.876801 -0.3229246 -1.414095 -0.02442339
##      x.1886    x.1887     x.1888    x.1889    x.1890    x.1891   x.1892
## 1 -1.414095 0.3935495 -0.3507352 0.0920567 0.7778964 -1.414095 1.306842
##      x.1893    x.1894   x.1895    x.1896    x.1897      x.1898    x.1899
## 1 0.6186118 -1.414095 1.627934 -0.209754 0.1075424 -0.01071947 0.3721227
##      x.1900    x.1901    x.1902    x.1903    x.1904    x.1905      x.1906
## 1 0.8523131 0.3488714 0.1194072 -1.414095 0.4733983 0.1426821 -0.09196414
##      x.1907    x.1908    x.1909     x.1910    x.1911    x.1912     x.1913
## 1 0.2197506 0.5747799 0.6914723 -0.6294387 0.2420941 -1.414095 0.06921229
##      x.1914      x.1915    x.1916    x.1917     x.1918     x.1919    x.1920
## 1 0.2420941 -0.01656731 -0.104802 0.4241697 -0.1266097 -0.8795999 0.8263739
##       x.1921    x.1922   x.1923      x.1924     x.1925     x.1926    x.1927
## 1 -0.1929806 0.9791747 0.294969 -0.07304087 -0.8352333 -0.5845241 0.3501788
##      x.1928    x.1929      x.1930     x.1931     x.1932     x.1933   x.1934
## 1 0.1311191 -1.335731 -0.02639806 -0.1906094 0.05305388 -0.7481271 1.109955
##       x.1935    x.1936     x.1937     x.1938    x.1939     x.1940    x.1941
## 1 -0.4553719 0.7240937 -0.0877248 0.06564627 0.5372762 -0.2442587 0.6107979
##       x.1942  x.1943    x.1944     x.1945     x.1946    x.1947    x.1948
## 1 -0.2645799 1.07118 -1.361109 -0.6646432 -0.1695428 0.7048386 -0.104802
##     x.1949    x.1950    x.1951     x.1952    x.1953    x.1954    x.1955
## 1 1.778263 -1.414095 -0.761338 -0.5142703 0.2197506 0.6585681 -1.414095
##      x.1956     x.1957    x.1958     x.1959     x.1960      x.1961    x.1962
## 1 0.1244451 0.04577916 -1.414095 -0.9052167 -0.7351053 -0.02442339 0.3276923
##       x.1963    x.1964  x.1965    x.1966    x.1967   x.1968     x.1969
## 1 -0.2392486 -0.849783 0.53408 -1.414095 -1.414095 0.636905 -0.9532279
##      x.1970   x.1971    x.1972   x.1973    x.1974    x.1975     x.1976
## 1 0.6048931 1.745907 0.8797249 1.529165 0.3985185 0.7564215 -0.8795999
##       x.1977    x.1978    x.1979    x.1980     x.1981    x.1982    x.1983
## 1 -0.5142703 -0.251826 0.6088339 0.2391465 -0.2073388 0.7762623 0.3682885
##     x.1984     x.1985    x.1986    x.1987     x.1988    x.1989     x.1990
```

```
## 1 1.011941 -0.3707214 0.5509983 0.3784773 -0.5664453 0.4903535 -0.2317848
##      x.1991    x.1992    x.1993     x.1994    x.1995   x.1996    x.1997
## 1 0.1843874 -1.414095 0.4768148 -0.2219274 -1.414095 1.933488 -1.414095
##      x.1998    x.1999    x.2000    x.2001    x.2002    x.2003    x.2004
## 1 -1.414095 -1.414095 -0.209754 0.3263521 -1.414095 0.5798686 -1.414095
##      x.2005     x.2006      x.2007     x.2008   x.2009    x.2010    x.2011
## 1 0.1024098 -0.2879976 -0.07930497 -0.4181242 2.412362 0.5080972 0.3383435
##     x.2012   x.2013   x.2014     x.2015   x.2016    x.2017  x.2018    x.2019
## 1 1.021358 1.118975 1.681458 0.09031967 1.890094 -1.414095 1.98902 -1.154772
##       x.2020    x.2021     x.2022     x.2023     x.2024      x.2025    x.2026
## 1 -0.2959394 -1.414095 -0.2671523 -0.1069594 -0.1091219 -0.03036031 0.2753221
##     x.2027   x.2028   x.2029    x.2030  x.2031    x.2032    x.2033    x.2034
## 1 1.615672 1.669289 1.658196 0.9745837 3.20094 -0.269732 0.5593409 -1.287005
##       x.2035   x.2036   x.2037    x.2038    x.2039    x.2040   x.2041    x.2042
## 1 -0.1444404 1.623758 1.105981 -1.414095 0.1605606 0.1261182 -1.09523 -1.414095
##      x.2043   x.2044    x.2045    x.2046    x.2047    x.2048    x.2049
## 1 0.3005054 2.688788 -1.414095 0.7232273 -1.414095 -1.414095 0.2494216
##      x.2050    x.2051   x.2052    x.2053    x.2054    x.2055   x.2056    x.2057
## 1 0.7232273 0.7301358 1.754035 -1.414095 0.4337544 -1.127827 0.494822 -0.209754
##      x.2058    x.2059   x.2060     x.2061    x.2062    x.2063    x.2064
## 1 0.9169042 0.4169143 1.214727 -0.3882092 0.9342518 0.3657234 -1.414095
##      x.2065    x.2066     x.2067     x.2068    x.2069    x.2070     x.2071
## 1 -1.414095 -1.414095 -0.4681347 -0.6410228 -1.414095 -1.414095 -0.9532279
##      x.2072     x.2073    x.2074  x.2075    x.2076    x.2077     x.2078
## 1 -1.414095 -0.1906094 0.2977414 1.97381 0.2106572 0.3383435 -0.4060399
##       x.2079    x.2080    x.2081     x.2082   x.2083     x.2084   x.2085
## 1 -0.9867042 0.1637738 -1.414095 -0.2749134 1.340873 -0.1534885 1.277633
##      x.2086   x.2087    x.2088    x.2089     x.2090   x.2091     x.2092
## 1 -1.051474 0.347562 0.6995156 0.1344379 -0.5108961 1.416326 -0.5382466
##      x.2093   x.2094    x.2095   x.2096   x.2097    x.2098     x.2099    x.2100
## 1 -1.414095 1.182872 0.3835291 1.827957 1.542642 -1.414095 -0.3678392 0.1277882
##       x.2101   x.2102    x.2103   x.2104    x.2105    x.2106    x.2107
## 1 0.01230291 1.620209 0.2696299 1.085843 0.2893988 -1.414095 0.2136984
##      x.2108    x.2109     x.2110   x.2111    x.2112  x.2113    x.2114    x.2115
## 1 -1.414095 0.4193392 -0.9000353 1.993963 0.3759408 2.00398 0.3746699 0.5603784
##     x.2116     x.2117    x.2118   x.2119     x.2120      x.2121     x.2122
## 1 1.309576 -0.1695428 -1.414095 1.352229 -0.3535636 -0.05859028 -0.6067042
##       x.2123   x.2124   x.2125    x.2126    x.2127  x.2128   x.2129    x.2130
## 1 -0.4876212 1.816307 1.374948 -1.414095 0.3657234 1.96456 1.020108 -1.154772
##      x.2131    x.2132    x.2133     x.2134    x.2135     x.2136    x.2137
## 1 -1.414095 -1.414095 0.8091867 -0.3229246 -1.015574 -0.8948832 -1.414095
##       x.2138    x.2139    x.2140  x.2141    x.2142    x.2143    x.2144
## 1 -0.3423024 0.4420589 0.1492241 1.93783 -1.414095 -1.414095 -1.414095
##      x.2145     x.2146   x.2147     x.2148     x.2149    x.2150    x.2151
## 1 -1.414095 -0.3174631 0.819382 -0.2392486 -0.3256677 -1.414095 -1.414095
##      x.2152    x.2153     x.2154    x.2155   x.2156     x.2157    x.2158
## 1 -1.414095 0.7884466 -0.4365573 -1.414095 2.667581 -0.5244685 -1.414095
##      x.2159     x.2160     x.2161    x.2162    x.2163    x.2164    x.2165
## 1 0.1006924 -0.1929806 -0.6488283 0.2435643 -1.414095 0.0920567 0.8028553
##       x.2166    x.2167     x.2168    x.2169    x.2170    x.2171   x.2172
## 1 -0.5522367 0.4313677 -0.4617309 0.2091327 0.2212574 0.2667703 0.157336
##         x.2173    x.2174    x.2175   x.2176    x.2177   x.2178     x.2179
## 1 -0.001055879 0.6833572 -1.027384 1.421167 0.4009929 0.748025 -0.5244685
##      x.2180   x.2181   x.2182     x.2183    x.2184     x.2185    x.2186
```

```
## 1 0.7852134 1.579214 1.560422 -0.1222061 -1.414095 -0.3284191 -1.414095
##       x.2187   x.2188    x.2189    x.2190    x.2191     x.2192    x.2193
## 1 -0.4396662 1.250373 0.1605606 0.9472182 0.4034606 -0.2194797 -1.414095
##    x.2194   x.2195   x.2196     x.2197   x.2198     x.2199     x.2200
## 1 0.54785 2.181356 1.111653 -0.7012657 1.683571 -0.1112896 -0.4090459
##       x.2201    x.2202     x.2203     x.2204   x.2205    x.2206   x.2207
## 1 -0.6294387 0.6407098 -0.3707214 -0.7747437 1.341752 0.7344272 1.365586
##       x.2208   x.2209   x.2210    x.2211    x.2212    x.2213     x.2214
## 1 -0.5108961 1.403289 2.499252 0.4537924 -1.069969 -1.414095 -0.2827413
##      x.2215    x.2216    x.2217    x.2218   x.2219    x.2220     x.2221
## 1 -1.189617 0.1261182 0.1685724 0.7589254 -1.02146 -0.610454 -0.6294387
##      x.2222    x.2223   x.2224    x.2225    x.2226   x.2227     x.2228
## 1 0.9084583 0.7197532 1.481111 -1.414095 0.0920567 2.330604 0.06564627
##      x.2229    x.2230   x.2231     x.2232    x.2233    x.2234      x.2235
## 1 0.2227616 0.2610241 1.977964 -0.8948832 -1.414095 0.3209714 -0.02639806
##      x.2236    x.2237    x.2238    x.2239    x.2240    x.2241    x.2242
## 1 0.1426821 0.5446908 0.3592788 0.1294552 -1.414095 0.7844033 -0.854685
##       x.2243     x.2244    x.2245    x.2246    x.2247    x.2248    x.2249
## 1 -0.2986022 0.03475678 0.6797271 0.0620662 -1.414095 -1.414095 -1.414095
##       x.2250    x.2251      x.2252    x.2253   x.2254     x.2255    x.2256
## 1 -0.2367538 0.1875176 -0.07304087 -1.414095 1.124568 -0.3794233 0.1843874
##      x.2257    x.2258    x.2259   x.2260    x.2261    x.2262     x.2263
## 1 0.6176387 0.6019263 0.1109482 1.180778 0.2317354 0.5562214 -0.0877248
##       x.2264    x.2265     x.2266     x.2267    x.2268    x.2269      x.2270
## 1 -0.5382466 -0.761338 -0.5347825 -0.8795999 0.2317354 0.3566881 -0.06681962
##       x.2271     x.2272    x.2273    x.2274     x.2275    x.2276   x.2277
## 1 -0.7437657 -0.7437657 -1.414095 -1.161635 -0.9369409 0.6724232 1.972494
##       x.2278   x.2279    x.2280     x.2281    x.2282    x.2283     x.2284
## 1 -0.7792565 1.937374 0.2739024 -0.5382466 0.1921929 0.1360927 -0.7883499
##    x.2285    x.2286     x.2287   x.2288   x.2289      x.2290    x.2291
## 1 1.20304 -0.104802 -0.4396662 1.244039 1.617295 -0.02048686 0.8424824
##       x.2292     x.2293     x.2294   x.2295     x.2296     x.2297    x.2298
## 1 -0.1377128 -0.2268427 -0.2121757 1.647593 -0.0343399 -0.6488283 0.6887753
##       x.2299   x.2300    x.2301    x.2302      x.2303    x.2304    x.2305
## 1 -0.8161889 1.281864 -0.394114 0.2257628 -0.08350514 -1.414095 0.7344272
##      x.2306     x.2307    x.2308   x.2309     x.2310  x.2311   x.2312    x.2313
## 1 -1.414095 0.07453525 -1.161635 2.073532 -0.2853656 1.22427 1.298592 -1.161635
##        x.2314     x.2315    x.2316    x.2317    x.2318    x.2319    x.2320
## 1 -0.03633625 -0.6488283 -1.414095 0.2332225 0.9063345 -1.414095 0.7605909
##      x.2321   x.2322    x.2323     x.2324   x.2325     x.2326    x.2327
## 1 0.9301185 0.958665 0.9673222 -0.3852711 0.488111 -0.2827413 -1.045391
##     x.2328    x.2329   x.2330    x.2331    x.2332     x.2333     x.2334
## 1 0.204544 0.7437975 1.613395 0.1765143 -1.414095 -0.1200123 0.05124065
##      x.2335    x.2336    x.2337     x.2338   x.2339  x.2340    x.2341   x.2342
## 1 0.8162571 0.1749315 -0.251826 -0.3649661 0.456121 1.22427 0.1041239 1.364731
##      x.2343     x.2344    x.2345    x.2346      x.2347    x.2348     x.2349
## 1 -1.414095 -0.8304347 -1.414095 -1.414095 -0.04034214 -1.414095 0.06564627
##      x.2350    x.2351    x.2352    x.2353   x.2354    x.2355   x.2356    x.2357
## 1 0.4083759 0.9863425 0.1557194 0.9600022 1.252797 -1.114648 1.080006 0.9659957
##       x.2358    x.2359     x.2360    x.2361    x.2362    x.2363   x.2364
## 1 0.03660314 0.8302353 -0.9981425 0.4479445 -1.414095 0.2060761 2.518955
##      x.2365   x.2366      x.2367    x.2368   x.2369    x.2370     x.2371
## 1 0.1637738 0.280979 -0.09409124 -1.414095 1.910289 0.1859538 -0.2025275
##     x.2372  x.2373    x.2374   x.2375   x.2376    x.2377    x.2378    x.2379
```

```
## 1 2.146333 0.35409 0.6078503 1.101989 1.111653 0.7327131 -1.414095 -0.151218
##        x.2380     x.2381     x.2382     x.2383     x.2384   x.2385  x.2386
## 1 -0.09622333 -0.5487189 0.09552084 -0.1906094 -0.5845241 1.192236 1.17341
##      x.2387     x.2388    x.2389      x.2390      x.2391    x.2392   x.2393
## 1 0.3005054 -0.3039512 -0.333947 -0.09622333 -0.01852497 0.5025894 2.581596
##        x.2394    x.2395      x.2396    x.2397    x.2398    x.2399   x.2400
## 1 -0.01656731 0.2667703 -0.02048686 0.2076057 0.3155587 -1.414095 1.814481
##      x.2401   x.2402     x.2403   x.2404   x.2405   x.2406    x.2407    x.2408
## 1 0.3423057 1.470121 -0.4909099 3.112115 1.279986 1.818909 -1.414095 -1.015574
##      x.2409    x.2410   x.2411    x.2412    x.2413     x.2414     x.2415
## 1 0.9953843 -0.449057 1.006879 -1.414095 0.3046356 -0.7747437 -0.2243817
##        x.2416    x.2417    x.2418    x.2419     x.2420    x.2421     x.2422
## 1 -0.01656731 0.2739024 0.1765143 -1.414095 -0.3736128 -1.414095 -0.3201898
##       x.2423     x.2424    x.2425    x.2426    x.2427      x.2428    x.2429
## 1 -0.2170385 -0.1134624 0.1589498 0.5091948 0.1024098 0.008506096 0.6349967
##      x.2430    x.2431    x.2432     x.2433    x.2434    x.2435    x.2436
## 1 0.7284136 -0.541724 0.8417217 -0.2001314 -1.414095 -1.082512 -1.414095
##     x.2437    x.2438   x.2439     x.2440    x.2441    x.2442    x.2443
## 1 1.174994 -1.414095 1.777447 -0.2293104 -1.414095 -1.414095 0.4083759
##      x.2444    x.2445    x.2446    x.2447    x.2448    x.2449     x.2450
## 1 0.5969599 0.1906371 0.3449377 -0.151218 -1.414095 -1.218487 -0.1134624
##       x.2451    x.2452    x.2453    x.2454  x.2455   x.2456      x.2457
## 1 -0.1178238 -1.414095 0.6078503 -1.414095 1.09568 1.075898 -0.04638426
##     x.2458     x.2459    x.2460    x.2461    x.2462      x.2463     x.2464
## 1 1.490853 -0.2932844 0.2406215 -0.610454 -1.414095 -0.04436575 -0.6606636
##      x.2465    x.2466     x.2467    x.2468    x.2469     x.2470     x.2471
## 1 0.3290305 -1.414095 -0.2243817 -1.127827 0.9998717 -0.3066376 -0.4396662
##     x.2472    x.2473      x.2474      x.2475    x.2476    x.2477    x.2478
## 1 1.380435 0.4337544 0.004693363 -0.06888864 0.8154743 0.4925905 -1.414095
##      x.2479    x.2480     x.2481   x.2482    x.2483    x.2484    x.2485
## 1 -1.063762 0.7795275 -0.4211706 0.280979 0.5036936 0.8992192 -1.414095
##       x.2486    x.2487    x.2488     x.2489     x.2490   x.2491    x.2492
## 1 0.07276439 -1.033347 -1.414095 -0.5487189 -0.5452147 1.350926 0.2696299
##       x.2493    x.2494     x.2495    x.2496    x.2497     x.2498    x.2499
## 1 -0.7837919 0.4630714 -0.1005026 0.2479608 0.4642246 -0.2932844 0.2566905
##       x.2500  x.2501     x.2502    x.2503     x.2504    x.2505     x.2506
## 1 -0.1649269 1.07531 -0.1069594 0.4903535 -0.1134624 0.6622835 -0.6646432
##      x.2507    x.2508    x.2509    x.2510    x.2511     x.2512     x.2513
## 1 0.4733983 -1.414095 0.6292474 0.9626709 -1.414095 -0.1811862 -0.5487189
##      x.2514    x.2515   x.2516    x.2517    x.2518    x.2519    x.2520
## 1 0.3797429 0.5747799 0.669669 -1.414095 0.4396939 -1.161635 0.6492127
##       x.2521   x.2522      x.2523     x.2524     x.2525    x.2526    x.2527
## 1 -0.3564009 1.315922 -0.05654453 -0.5008481 -0.2801245 -1.414095 0.7844033
##      x.2528   x.2529  x.2530    x.2531     x.2532   x.2533    x.2534    x.2535
## 1 0.9532962 1.033148 2.51751 0.1906371 -0.6488283 1.127907 0.4642246 -1.414095
##      x.2536    x.2537     x.2538    x.2539     x.2540       x.2541      x.2542
## 1 -1.414095 0.1426821 -0.2194797 0.1890787 -0.7054274 -0.006841702 -0.03036031
##      x.2543    x.2544    x.2545     x.2546    x.2547      x.2548    x.2549
## 1 0.4156995 -1.414095 0.6378577 0.07982722 0.6733394 -0.06681962 0.4813501
##     x.2550    x.2551    x.2552     x.2553   x.2554    x.2555     x.2556
## 1 1.298592 -1.414095 0.7811556 -0.5557681 1.276219 -1.414095 -0.7702531
##       x.2557   x.2558     x.2559    x.2560   x.2561    x.2562    x.2563
## 1 -0.4060399 -0.20493 -0.1266097 -1.414095 0.742101 0.7868314 -1.414095
##      x.2564     x.2565     x.2566    x.2567    x.2568    x.2569    x.2570
```

```
## 1 0.2212574 -0.5881835 -0.1603343 -0.975408 0.8131215 0.8620387 0.5265781
##      x.2571    x.2572     x.2573     x.2574   x.2575     x.2576   x.2577
## 1 0.2152153 -1.114648 -0.2073388 -0.6332837 0.676995 -0.8161889 1.111088
##      x.2578     x.2579   x.2580 x.2581   x.2582    x.2583    x.2584     x.2585
## 1 -1.211183 -0.6848067 1.300432 0.9148 1.137851 -1.414095 0.6594984 -0.2879976
##      x.2586     x.2587    x.2588    x.2589    x.2590  x.2591      x.2592
## 1 -1.414095 -0.9642503 -1.414095 -1.414095 0.4034606 1.22427 -0.09836043
##      x.2593     x.2594   x.2595   x.2596   x.2597   x.2598     x.2599    x.2600
## 1 -1.414095 -0.5918575 1.285141 1.179204 1.741674 0.414483 -0.7096083 -1.414095
##       x.2601   x.2602   x.2603     x.2604     x.2605    x.2606    x.2607
## 1 -0.7481271 0.485863 0.634041 -0.1626277 -0.6142194 -1.414095 0.3209714
##     x.2608     x.2609   x.2610     x.2611   x.2612      x.2613   x.2614
## 1 1.712941 -0.7837919 0.063858 0.02359915 0.669669 -0.01461385 1.303643
##      x.2615      x.2616    x.2617      x.2618    x.2619     x.2620    x.2621
## 1 -1.414095 0.006601728 0.1126463 -0.04436575 -1.414095 -0.8021629 -1.414095
##      x.2622    x.2623    x.2624   x.2625    x.2626    x.2627   x.2628
## 1 -1.057597 -1.414095 0.4156995 1.980577 -1.414095 -1.414095 1.327146
##       x.2629    x.2630   x.2631     x.2632    x.2633    x.2634     x.2635
## 1 0.07099008 0.2552414 1.087006 -0.3852711 0.1006924 0.2710563 -0.3479156
##       x.2636    x.2637   x.2638    x.2639     x.2640   x.2641    x.2642
## 1 -0.5628723 0.8811833 2.621798 0.9049159 -0.6410228 1.138401 0.7275513
##      x.2643    x.2644    x.2645     x.2646   x.2647      x.2648    x.2649
## 1 -1.414095 0.1749315 0.1828182 -0.5664453 1.630495 -0.08140263 0.3169149
##      x.2650  x.2651    x.2652    x.2653     x.2654   x.2655    x.2656
## 1 0.1669757 0.70837 -1.196749 -0.969812 -0.1718596 1.196882 0.2406215
##       x.2657    x.2658   x.2659    x.2660    x.2661    x.2662    x.2663
## 1 0.06027087 -1.414095 1.148774 0.4217577 -1.414095 -1.414095 -1.414095
##       x.2664   x.2665      x.2666     x.2667     x.2668  x.2669    x.2670
## 1 -0.4090459 2.642303 -0.07930497 -0.1580466 -0.8400574 2.16054 0.2347071
##      x.2671    x.2672   x.2673    x.2674    x.2675     x.2676    x.2677
## 1 -1.414095 -1.414095 1.453965 0.6641355 -1.414095 -0.4242272 0.7827809
##      x.2678    x.2679  x.2680   x.2681    x.2682    x.2683    x.2684    x.2685
## 1 0.6205548 0.2880009 1.75515 -1.02146 0.6742547 -1.369729 -1.414095 0.2435643
##      x.2686   x.2687    x.2688    x.2689     x.2690    x.2691 x.2692    x.2693
## 1 0.6914723 -1.18254 0.1828182 0.4813501 -0.4942106 0.5839191 0.9148 -1.387216
##       x.2694    x.2695    x.2696   x.2697    x.2698    x.2699  x.2700   x.2701
## 1 -0.5736338 0.5362121 -1.414095 0.228754 0.6426062 -1.414095 1.89894 1.273856
##      x.2702    x.2703    x.2704    x.2705    x.2706      x.2707   x.2708
## 1 0.8515607 0.3223195 0.2724805 0.2136984 -1.039349 -0.03036031 1.481111
##      x.2709     x.2710 x.2711    x.2712     x.2713    x.2714   x.2715    x.2716
## 1 -0.692999 -0.3852711 1.6039 0.1843874 0.07806665 0.2121791 1.004973 -1.218487
##      x.2717    x.2718     x.2719     x.2720     x.2721    x.2722    x.2723
## 1 0.1524776 0.6760825 -0.1266097 -0.7883499 -0.4810792 0.3155587 0.5551792
##       x.2724    x.2725      x.2726   x.2727   x.2728    x.2729    x.2730
## 1 -0.0877248 -1.414095 -0.03036031 1.472786 2.017237 -0.756913 0.1524776
##      x.2731    x.2732    x.2733    x.2734    x.2735     x.2736    x.2737
## 1 -1.414095 -0.975408 -1.414095 -1.414095 -1.414095 -0.5382466 -1.414095
##      x.2738    x.2739    x.2740    x.2741    x.2742    x.2743     x.2744
## 1 0.3128402 0.8028553 0.1194072 -1.414095 -1.414095 0.7522329 0.07276439
##      x.2745    x.2746    x.2747    x.2748    x.2749    x.2750      x.2751
## 1 0.2317354 0.2739024 0.5308724 0.1669757 -1.121213 0.2795681 -0.05043475
##      x.2752     x.2753   x.2754      x.2755    x.2756    x.2757   x.2758
## 1 0.2963563 -0.5772494 1.244039 -0.09196414 -1.203937 -1.414095 1.454353
##      x.2759     x.2760     x.2761   x.2762   x.2763      x.2764     x.2765
```

```
## 1 0.9798286 -0.0343399 -0.4522089 1.636547 1.603571 -0.06888864 -0.4778257
##     x.2766    x.2767    x.2768      x.2769     x.2770    x.2771       x.2772
## 1 1.780163 -1.414095 -1.414095 -0.08350514 -0.3564009 0.9659957 -0.008778519
##      x.2773    x.2774    x.2775    x.2776   x.2777   x.2778    x.2779    x.2780
## 1 -1.414095 -1.414095 -1.414095 0.8789948 1.241101 1.389229 0.2921882 0.6058799
##      x.2781    x.2782   x.2783     x.2784    x.2785      x.2786     x.2787
## 1 -1.414095 0.5551792 1.820466 -0.5593132 -1.414095 0.008506096 -0.3564009
##      x.2788   x.2789   x.2790    x.2791   x.2792    x.2793  x.2794   x.2795
## 1 -1.414095 2.619754 0.636905 -1.414095 1.220766 0.3657234 1.74478 1.526661
##      x.2796    x.2797     x.2798    x.2799    x.2800    x.2801    x.2802
## 1 0.5211814 0.6678282 -0.3707214 -1.271326 -1.414095 -1.414095 0.1796717
##      x.2803    x.2804   x.2805    x.2806    x.2807    x.2808     x.2809
## 1 0.6019263 0.3114779 1.261951 0.8913274 0.5624498 -1.414095 -0.3174631
##     x.2810     x.2811     x.2812     x.2813     x.2814    x.2815    x.2816
## 1 2.692176 -0.8795999 -0.1977415 0.04211986 -0.4617309 0.2724805 -1.414095
##      x.2817    x.2818     x.2819      x.2820     x.2821    x.2822    x.2823
## 1 0.5157525 -1.414095 0.08333818 -0.05246679 -0.3039512 -1.414095 -1.414095
##      x.2824    x.2825   x.2826    x.2827   x.2828    x.2829    x.2830    x.2831
## 1 -1.414095 0.6058799 1.402878 -1.335731 1.104272 -1.414095 0.3872997 -1.414095
##      x.2832       x.2833    x.2834      x.2835    x.2836     x.2837     x.2838
## 1 -1.414095 -0.008778519 -1.414095 -0.02245299 0.4722567 -0.1929806 -0.4060399
##       x.2839   x.2840   x.2841    x.2842    x.2843    x.2844    x.2845
## 1 0.03290665 1.693467 0.876801 0.8409605 0.1637738 0.1443221 0.6501526
##      x.2846   x.2847    x.2848    x.2849   x.2850    x.2851   x.2852     x.2853
## 1 -1.414095 1.082345 0.3527881 0.8162571 1.062865 0.9383665 2.397908 0.05486351
##    x.2854    x.2855   x.2856    x.2857     x.2858    x.2859    x.2860    x.2861
## 1 3.20094 -1.414095 1.118975 0.1177217 -0.4745839 0.6302082 -1.335731 0.2242634
##     x.2862     x.2863   x.2864     x.2865     x.2866    x.2867   x.2868
## 1 1.721078 0.08158439 1.996745 -0.2959394 -0.6567014 0.5372762 -1.18254
##      x.2869    x.2870    x.2871    x.2872    x.2873    x.2874   x.2875
## 1 -1.414095 -1.414095 -0.849783 0.9973102 0.2795681 0.1733459 2.177336
##      x.2876     x.2877       x.2878     x.2879   x.2880   x.2881   x.2882
## 1 -1.414095 -0.3066376 0.0008645768 -0.7883499 1.020733 1.160104 1.244528
##       x.2883   x.2884  x.2885  x.2886     x.2887    x.2888   x.2889  x.2890
## 1 -0.9262427 2.058884 3.20094 3.20094 0.02172616 -1.414095 1.504171 3.20094
##     x.2891    x.2892     x.2893      x.2894    x.2895  x.2896     x.2897
## 1 1.204062 0.1177217 -0.6449172 -0.02245299 0.1360927 3.20094 -0.9642503
##      x.2898     x.2899    x.2900    x.2901    x.2902   x.2903    x.2904
## 1 -1.414095 -0.5210564 -1.414095 -0.517657 -1.161635 1.353097 0.1410393
##      x.2905   x.2906    x.2907     x.2908    x.2909    x.2910   x.2911
## 1 -1.414095 1.176575 0.3317011 -0.8161889 0.8753355 -1.414095 1.710017
##      x.2912    x.2913   x.2914     x.2915    x.2916     x.2917    x.2918
## 1 0.3822688 0.3330335 0.936997 -0.1649269 -1.414095 0.06564627 0.3822688
##     x.2919   x.2920   x.2921    x.2922    x.2923    x.2924   x.2925    x.2926
## 1 1.875808 2.822839 1.349621 0.7327131 -1.414095 -1.414095 1.045395 -1.196749
##       x.2927    x.2928    x.2929   x.2930    x.2931     x.2932    x.2933
## 1 -0.5593132 0.2581373 -1.414095 1.961456 0.1968442 0.04395135 -1.414095
##      x.2934     x.2935    x.2936     x.2937    x.2938     x.2939     x.2940
## 1 -1.414095 -0.5244685 -1.414095 -0.1718596 -1.414095 -0.8645692 -0.4909099
##      x.2941    x.2942     x.2943    x.2944      x.2945     x.2946     x.2947
## 1 0.1968442 0.5768188 -0.5700324 0.3330335 -0.06475529 -0.1399498 -0.1244052
##      x.2948    x.2949    x.2950    x.2951    x.2952    x.2953 x.2954   x.2955
## 1 0.8731328 0.5362121 0.1669757 -1.414095 -1.414095 0.7614224 1.0037 1.473546
##      x.2956     x.2957     x.2958    x.2959    x.2960    x.2961     x.2962
```

```
## 1 0.5879516 0.08333818 -0.2594569 0.3935495 0.2420941 0.4869877 -0.7012657
##      x.2963   x.2964     x.2965    x.2966     x.2967     x.2968    x.2969
## 1 -1.414095 1.016976 -0.4365573 -1.414095 -0.4060399 -0.2367538 0.1859538
##     x.2970    x.2971     x.2972      x.2973   x.2974    x.2975    x.2976
## 1 1.185483 -1.414095 -0.3507352 -0.04436575 1.039904 -0.151218 -1.414095
##      x.2977    x.2978      x.2979     x.2980     x.2981    x.2982  x.2983
## 1 0.0476033 0.8855447 -0.07304087 -0.4617309 0.06564627 -1.414095 1.75012
##    x.2984   x.2985    x.2986    x.2987  x.2988   x.2989   x.2990    x.2991
## 1 1.77254 0.565548 -1.414095 0.7012934 3.20094 1.312754 2.272706 0.5146628
##       x.2992    x.2993    x.2994    x.2995    x.2996   x.2997    x.2998
## 1 -0.4617309 -1.039349 -1.414095 -1.414095 -0.672655 1.097979 0.8131215
##       x.2999    x.3000    x.3001    x.3002     x.3003    x.3004    x.3005
## 1 -0.3479156 0.5614147 -1.414095 -1.414095 -0.8948832 0.4479445 -1.414095
##      x.3006     x.3007     x.3008     x.3009    x.3010     x.3011    x.3012
## 1 0.2347071 -0.2906371 -0.5108961 0.04395135 0.6529664 -0.7222674 0.6215248
##     x.3013    x.3014     x.3015      x.3016   x.3017   x.3018   x.3019  x.3020
## 1 1.314566 0.7770797 -0.5593132 -0.06681962 1.736284 1.292587 1.141689 3.20094
##       x.3021    x.3022     x.3023   x.3024    x.3025     x.3026    x.3027
## 1 -0.8449072 -1.414095 -0.1580466 2.205959 -1.414095 -0.4617309 -1.302958
##         x.3028     x.3029     x.3030    x.3031     x.3032    x.3033      x.3034
## 1 -0.008778519 -0.3852711 -0.2906371 -1.414095 -0.6971229 0.7868314 -0.03633625
##      x.3035     x.3036   x.3037   x.3038     x.3039    x.3040   x.3041   x.3042
## 1 -1.414095 -0.1977415 1.736853 0.907043 -0.8209127 0.3746699 1.036225 1.324912
##     x.3043    x.3044    x.3045   x.3046   x.3047   x.3048     x.3049    x.3050
## 1 2.828934 0.1557194 -1.255913 1.260031 1.248429 0.443239 -0.3794233 0.7446446
##      x.3051     x.3052    x.3053     x.3054    x.3055    x.3056     x.3057
## 1 0.2724805 -0.3852711 0.3935495 -0.4365573 0.6292474 0.4491171 -0.5992506
##       x.3058    x.3059    x.3060     x.3061  x.3062    x.3063    x.3064
## 1 -0.06475529 -0.610454 0.6842625 -0.2569061 0.53408 0.8356137 -1.414095
##      x.3065      x.3066    x.3067     x.3068   x.3069    x.3070      x.3071
## 1 0.8826394 -0.07930497 0.1701664 -0.4303714 0.157336 -1.414095 -0.06269564
##       x.3072    x.3073    x.3074    x.3075    x.3076    x.3077     x.3078
## 1 -0.3311789 0.1143413 0.1875176 0.9785202 -1.414095 0.3169149 -0.1580466
##      x.3079     x.3080    x.3081    x.3082    x.3083    x.3084    x.3085
## 1 -1.414095 -0.7308059 0.2376691 0.6156895 -1.414095 0.8485446 0.4059216
##      x.3086     x.3087   x.3088    x.3089     x.3090    x.3091   x.3092
## 1 0.1701664 -0.4459159 0.318269 0.2682012 -0.2392486 -1.414095 1.542642
##       x.3093     x.3094    x.3095    x.3096   x.3097     x.3098   x.3099
## 1 -0.5992506 -0.5244685 0.4217577 0.9673222 3.168897 -0.3765134 1.042958
##        x.3100    x.3101    x.3102   x.3103    x.3104  x.3105    x.3106
## 1 -0.06888864 -1.069969 -1.414095 1.582926 -1.414095 3.20094 -1.414095
##      x.3107     x.3108    x.3109      x.3110   x.3111    x.3112     x.3113
## 1 -1.414095 -0.8021629 0.6941613 -0.03833699 1.147144 -1.414095 -0.3649661
##      x.3114     x.3115     x.3116     x.3117    x.3118      x.3119       x.3120
## 1 0.3847877 0.05124065 -0.4396662 -0.3201898 -1.414095 -0.06064065 0.0008645768
##     x.3121   x.3122    x.3123    x.3124    x.3125    x.3126    x.3127    x.3128
## 1 1.039904 3.142799 0.9666592 -1.414095 0.4711136 -1.414095 -1.414095 0.3155587
##      x.3129   x.3130   x.3131    x.3132   x.3133     x.3134   x.3135   x.3136
## 1 -1.414095 1.651349 2.889422 -1.414095 1.148774 0.09379042 1.361729 2.355567
##     x.3137   x.3138   x.3139     x.3140    x.3141    x.3142   x.3143    x.3144
## 1 2.023483 1.568328 1.298592 0.05124065 -1.414095 -1.414095 1.056879 -1.414095
##      x.3145    x.3146     x.3147    x.3148    x.3149    x.3150      x.3151
## 1 0.2667703 0.4584437 -0.3423024 0.6995156 -1.414095 -0.692999 -0.07512411
##      x.3152   x.3153     x.3154     x.3155   x.3156   x.3157    x.3158
```

```
## 1 0.5509983 0.809975 0.07276439 -0.9000353 1.584609 1.499753 -1.414095
##       x.3159    x.3160     x.3161    x.3162   x.3163     x.3164    x.3165
## 1 -0.4649271 -1.414095 -0.8352333 0.2167296 1.240611 -0.3678392 0.9183042
##        x.3166    x.3167    x.3168    x.3169    x.3170    x.3171    x.3172
## 1 -0.06475529 -1.414095 0.5265781 -1.414095 -1.414095 0.5383392 -0.637145
##     x.3173    x.3174     x.3175   x.3176    x.3177    x.3178    x.3179
## 1 1.067626 -1.414095 0.08857932 0.675169 0.1410393 -1.414095 -1.414095
##      x.3180   x.3181    x.3182    x.3183     x.3184  x.3185     x.3186  x.3187
## 1 0.7696967 1.061073 0.3759408 -0.209754 -0.2417502 2.17961 -0.7702531 0.70837
##       x.3188    x.3189    x.3190     x.3191    x.3192   x.3193       x.3194
## 1 0.02733359 -1.414095 0.9349389 -0.1765109 -1.414095 0.702181 -0.006841702
##      x.3195    x.3196   x.3197    x.3198   x.3199    x.3200   x.3201  x.3202
## 1 0.6176387 0.4733983 0.063858 -0.969812 2.253094 0.7249594 1.157419 0.66321
##      x.3203    x.3204    x.3205    x.3206     x.3207     x.3208    x.3209
## 1 -1.414095 -1.414095 0.5686357 -0.969812 -0.4030437 -0.7138085 -1.414095
##      x.3210    x.3211   x.3212     x.3213    x.3214    x.3215    x.3216
## 1 0.4009929 -1.082512 1.461694 -0.3507352 0.3488714 0.1024098 -1.414095
##     x.3217    x.3218    x.3219    x.3220   x.3221    x.3222    x.3223
## 1 1.155805 -1.414095 -1.161635 0.6117783 2.596522 0.1426821 0.6742547
##       x.3224     x.3225     x.3226    x.3227    x.3228    x.3229    x.3230
## 1 -0.2906371 -0.2569061 -0.1069594 0.4937069 0.5425785 0.2450322 -1.414095
##      x.3231   x.3232    x.3233    x.3234   x.3235     x.3236    x.3237
## 1 0.6397601 2.049658 0.3356924 0.3772099 1.133445 0.01796857 0.1890787
##      x.3238   x.3239     x.3240    x.3241      x.3242     x.3243     x.3244
## 1 0.4514578 1.279986 -0.2001314 0.6127577 -0.07721214 -0.5313315 -0.4060399
##      x.3245    x.3246     x.3247     x.3248      x.3249     x.3250      x.3251
## 1 -1.154772 0.5889569 -0.3229246 -0.4649271 -0.02048686 -0.2775152 -0.08140263
##      x.3252    x.3253    x.3254   x.3255    x.3256     x.3257   x.3258
## 1 -1.414095 -1.127827 0.5939671 2.517269 -1.414095 -0.6067042 1.078248
##       x.3259  x.3260    x.3261    x.3262    x.3263    x.3264     x.3265
## 1 -0.8645692 3.20094 -1.414095 0.4596029 -1.414095 0.2076057 -0.5992506
##      x.3266   x.3267     x.3268    x.3269     x.3270    x.3271    x.3272
## 1 0.5069983 1.117291 -0.7747437 0.2653372 -0.0877248 0.1508523 0.6613561
##       x.3273    x.3274    x.3275    x.3276    x.3277    x.3278    x.3279
## 1 -0.4553719 -0.151218 -1.414095 0.4596029 0.4373227 -0.269732 -0.449057
##     x.3280    x.3281     x.3282   x.3283    x.3284    x.3285    x.3286
## 1 0.063858 -1.414095 -0.1557647 1.086424 0.7835924 0.7232273 0.5788531
##      x.3287    x.3288    x.3289    x.3290   x.3291    x.3292     x.3293
## 1 -1.414095 -1.414095 -1.127827 -1.414095 1.388395 -0.975408 -0.6686403
##      x.3294    x.3295    x.3296     x.3297    x.3298    x.3299    x.3300
## 1 -1.263587 0.8083977 0.5530912 0.01040648 -1.414095 0.3073787 -1.287005
##      x.3301   x.3302    x.3303     x.3304    x.3305    x.3306   x.3307
## 1 0.7301358 1.111653 0.4467705 -0.4303714 -1.414095 -1.414095 1.120657
##       x.3308    x.3309   x.3310     x.3311    x.3312   x.3313    x.3314
## 1 -0.5008481 0.3330335 3.076066 -0.2986022 -1.414095 2.195202 0.4277758
##      x.3315   x.3316 x.3317     x.3318     x.3319    x.3320     x.3321
## 1 0.5319429 1.689581 0.1541 -0.4242272 -0.1421923 -1.414095 -0.6449172
##      x.3322    x.3323    x.3324    x.3325     x.3326    x.3327    x.3328
## 1 0.5394009 0.3196212 -1.414095 0.6282857 -0.6488283 -1.027384 0.3772099
##      x.3329   x.3330  x.3331    x.3332     x.3333   x.3334     x.3335
## 1 0.1685724 2.261118 2.61695 -1.414095 0.03105276 2.053681 -0.6567014
##       x.3336     x.3337    x.3338   x.3339   x.3340     x.3341    x.3342
## 1 0.07453525 -0.3066376 -1.414095 1.113348 1.840982 -0.2001314 -1.414095
##      x.3343      x.3344    x.3345    x.3346    x.3347    x.3348    x.3349
```

```
## 1 0.3101135 -0.03036031 0.5593409 0.2060761 -1.414095 -1.414095 0.2332225
##      x.3350   x.3351   x.3352   x.3353      x.3354    x.3355    x.3356
## 1 0.3250099 1.628895 0.681544 2.863354 -0.02639806 -0.854685 0.5909643
##      x.3357     x.3358     x.3359   x.3360    x.3361    x.3362    x.3363
## 1 0.3553899 -0.5628723 -0.1005026 1.299052 0.4607605 0.1092469 0.2696299
##       x.3364   x.3365   x.3366     x.3367    x.3368     x.3369   x.3370
## 1 -0.4522089 0.430172 0.846276 -0.8068142 -1.414095 -0.3120343 1.446169
##       x.3371    x.3372    x.3373   x.3374   x.3375    x.3376    x.3377
## 1 -0.2569061 -1.414095 0.7868314 1.534509 0.363151 0.7876393 0.2317354
##       x.3378   x.3379    x.3380     x.3381     x.3382    x.3383     x.3384
## 1 -0.9209405 1.724831 0.3488714 -0.7351053 -0.2317848 -1.141199 -0.3736128
##      x.3385    x.3386   x.3387   x.3388    x.3389  x.3390    x.3391    x.3392
## 1 0.8826394 0.2739024 2.746976 1.269113 0.5113859 1.64822 -1.414095 0.3657234
##      x.3393    x.3394     x.3395     x.3396   x.3397   x.3398  x.3399    x.3400
## 1 0.9363115 0.2060761 -0.3649661 -0.7096083 2.615977 2.153374 2.31312 0.2581373
##       x.3401     x.3402   x.3403    x.3404 x.3405    x.3406    x.3407    x.3408
## 1 -0.7702531 -0.3367236 -0.20493 0.6147133 0.1541 0.1508523 -1.414095 -1.414095
##       x.3409     x.3410    x.3411   x.3412   x.3413     x.3414 x.3415
## 1 -0.3012728 -0.9867042 0.7738058 2.617274 2.679457 -0.9587224 2.2936
##       x.3416    x.3417     x.3418    x.3419      x.3420    x.3421     x.3422
## 1 -0.0343399 0.6048931 -0.1953579 0.1475931 -0.09836043 -1.414095 -0.5278935
##       x.3423   x.3424    x.3425       x.3426    x.3427    x.3428     x.3429
## 1 -0.4365573 1.892014 0.8723974 -0.006841702 -1.414095 -0.975408 -0.2268427
##      x.3430      x.3431    x.3432    x.3433     x.3434      x.3435    x.3436
## 1 -1.414095 -0.05246679 0.8672328 0.3695684 -0.8795999 -0.05043475 0.4903535
##       x.3437     x.3438     x.3439    x.3440    x.3441   x.3442    x.3443
## 1 -0.2645799 -0.1788456 -0.7481271 0.5562214 0.9321875 1.100272 -1.414095
##      x.3444   x.3445    x.3446    x.3447    x.3448    x.3449   x.3450
## 1 -1.414095 1.615022 -1.414095 0.6416585 -1.414095 -1.255913 -1.18254
##       x.3451     x.3452   x.3453    x.3454    x.3455     x.3456    x.3457
## 1 -0.7394252 -0.9924054 -1.22585 0.2060761 0.4034606 -0.7883499 -1.414095
##       x.3458    x.3459     x.3460    x.3461    x.3462    x.3463     x.3464
## 1 -0.8304347 0.4572831 -0.7792565 0.3695684 -1.414095 -1.414095 -0.2367538
##     x.3465     x.3466   x.3467     x.3468     x.3469    x.3470   x.3471
## 1 1.555576 -0.9104278 2.302344 -0.4810792 -0.2932844 0.0476033 3.101272
##       x.3472    x.3473     x.3474     x.3475    x.3476   x.3477    x.3478
## 1 0.09379042 -1.263587 -0.4975233 -0.3229246 -1.414095 1.117853 0.7884466
##      x.3479    x.3480     x.3481     x.3482   x.3483    x.3484     x.3485
## 1 0.1194072 -1.414095 -0.7394252 -0.7657846 1.061671 0.7892531 -0.6142194
##      x.3486   x.3487     x.3488    x.3489      x.3490     x.3491     x.3492
## 1 -1.344112 1.060475 -0.9209405 0.7852134 -0.08140263 -0.1765109 -0.1603343
##      x.3493    x.3494   x.3495   x.3496    x.3497    x.3498     x.3499
## 1 0.9758978 -1.414095 1.796819 1.043568 0.7622533 0.8898852 0.09031967
##       x.3500    x.3501     x.3502    x.3503     x.3504    x.3505    x.3506
## 1 -0.0877248 0.1311191 0.04395135 -1.414095 -0.8596137 0.4572831 0.9259662
##       x.3507     x.3508    x.3509    x.3510    x.3511    x.3512   x.3513
## 1 -0.4617309 -0.9477665 0.5979554 0.8139064 0.5415205 0.4836093 0.116033
##      x.3514    x.3515   x.3516   x.3517  x.3518   x.3519    x.3520    x.3521
## 1 0.6321266 -1.414095 2.409109 1.967213 1.24648 2.464413 -1.255913 -1.114648
##     x.3522   x.3523   x.3524    x.3525    x.3526     x.3527     x.3528   x.3529
## 1 1.625366 2.515701 2.527815 0.8325442 0.7197532 -0.1649269 -0.5210564 1.592974
##      x.3530   x.3531    x.3532    x.3533    x.3534    x.3535      x.3536
## 1 -1.414095 0.915502 0.3317011 -1.076219 0.3436227 0.1143413 -0.08350514
##      x.3537   x.3538    x.3539   x.3540    x.3541    x.3542     x.3543
```

```
## 1 0.9176045 0.669669 -1.414095 3.048934 0.5889569 0.8333125 -0.9000353
##       x.3544     x.3545    x.3546     x.3547    x.3548     x.3549    x.3550
## 1 -0.5955465 0.02733359 -1.414095 0.05666954 -1.414095 -0.9209405 -1.051474
##       x.3551    x.3552  x.3553   x.3554    x.3555     x.3556     x.3557
## 1 -0.2986022 0.4630714 3.20094 3.064518 0.2121791 -0.1626277 -0.5992506
##     x.3558   x.3559    x.3560   x.3561     x.3562     x.3563     x.3564
## 1 3.109919 2.850411 0.3566881 1.603571 -0.2853656 -0.6606636 -0.2775152
##       x.3565  x.3566     x.3567     x.3568    x.3569     x.3570     x.3571
## 1 -0.1906094 1.09683 0.06921229 -0.1788456 0.4688231 -0.3311789 -0.8256612
```

```
cat("In the Leukemia dataset we have :",ncol(leukemia),
"colunm and ",nrow(leukemia),"observations\n\n")
```

```
## In the Leukemia dataset we have : 3572 colunm and  72 observations
```

```
cat("The dimension of the output space is ",ncol(leukemia)-1,
"and the response is
the variable Y that is categorical
with 2 level : '0' and '1'\n\n")
```

```
## The dimension of the output space is  3571 and the response is
## the variable Y that is categorical
## with 2 level : '0' and '1'
```

```
cat(" We do not have acces to the dictionnary
of the the dataset leukemia.
So I made an exploration of the dataset .
I deduced that all the predictors are numeric
so it's type homogenous. To know if it it is scale-homogenous
i reseached the mean of the each predictor(colMean(leukemia)),
then i inspected the distribution by ploting the boxplot and
of course i looked at the outliers and the max was 3.271207.
I concluded with my finding that it is scale-homogenous.    \n\n" )
```

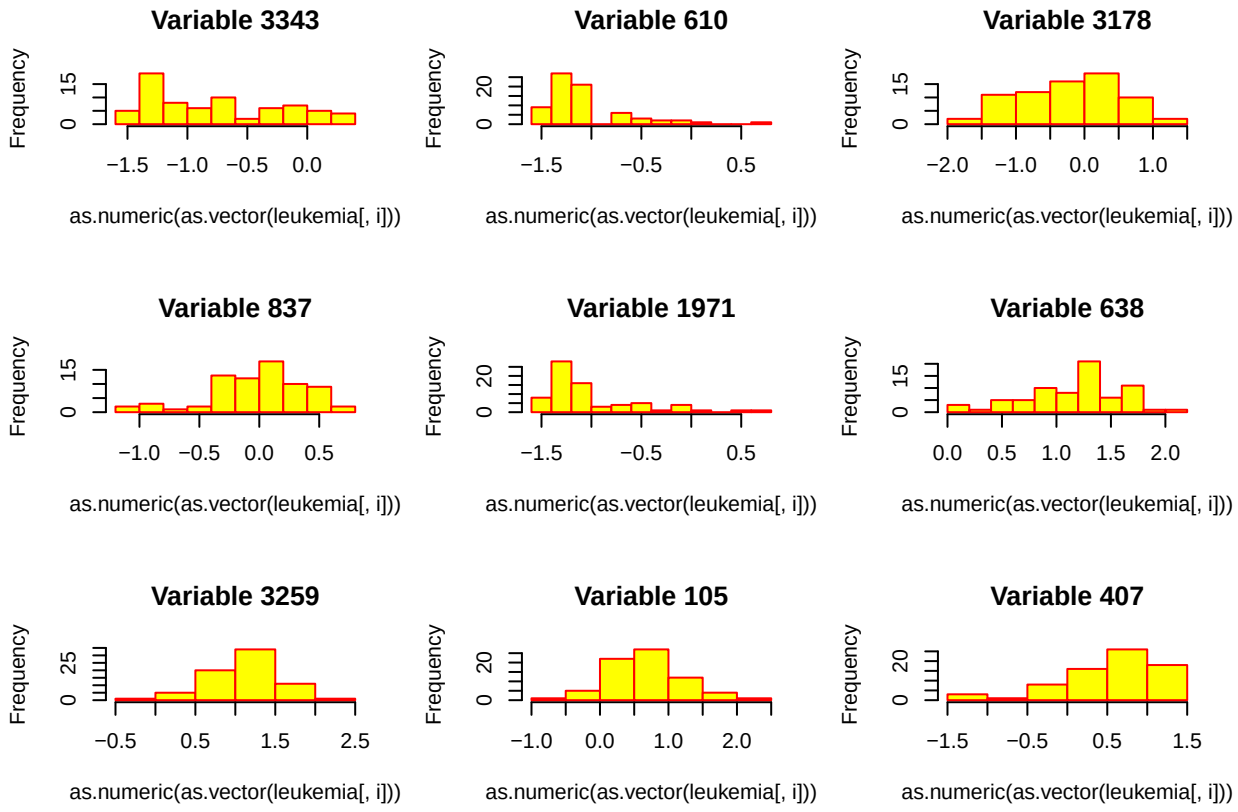
```
##  We do not have acces to the dictionnary
## of the the dataset leukemia.
## So I made an exploration of the dataset .
## I deduced that all the predictors are numeric
## so it's type homogenous. To know if it it is scale-homogenous
## i reseached the mean of the each predictor(colMean(leukemia)),
## then i inspected the distribution by ploting the boxplot and
## of course i looked at the outliers and the max was 3.271207.
## I concluded with my finding that it is scale-homogenous.
```

```
cat("We have k=n/p=",nrow(leukemia)/ncol(leukemia)," .
    This is very less than 5 so this data set
    in term of size is very bad in context
    of hight dimensional setting")
```

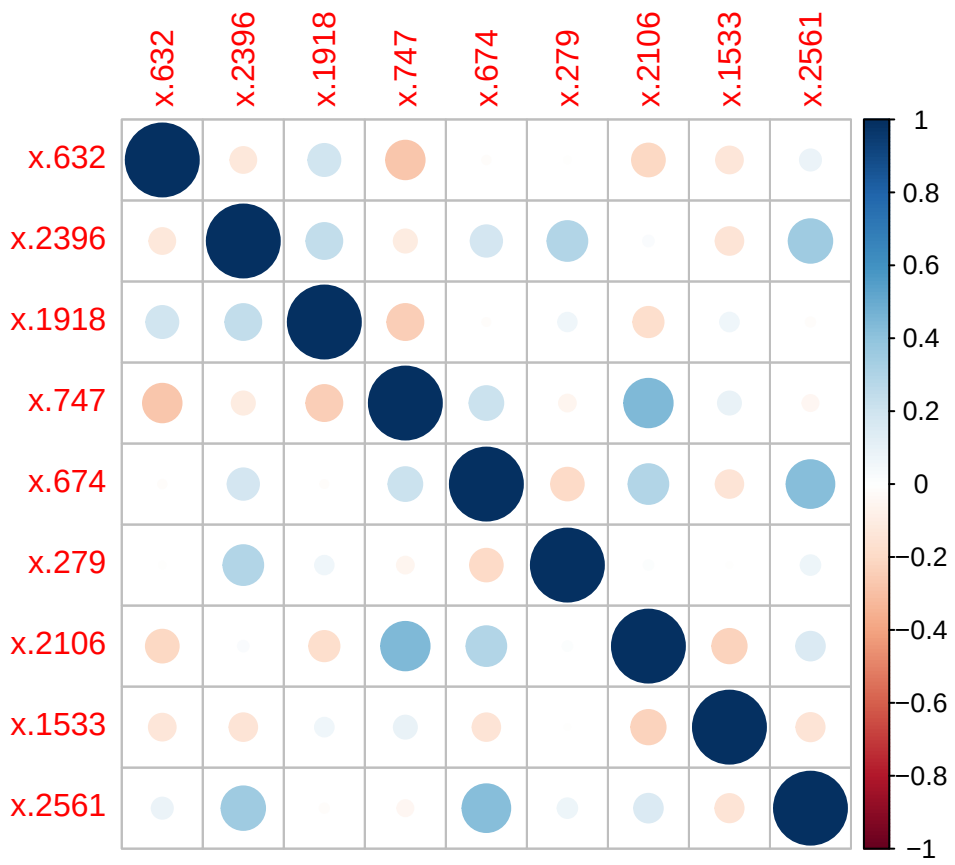
```
## We have k=n/p= 0.02015677  .
##     This is very less than 5 so this data set
##     in term of size is very bad in context
##     of hight dimensional setting
```

```
par(mfrow=c(3,3))

set <- sample(2:(ncol(leukemia)),9)
```

```
for (i in set){
 hist(as.numeric(as.vector(leukemia[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")
}
```




```
#### correlation of some variable
par(mfrow=c(1,1))
corrplot(cor(leukemia[,sample(2:ncol(leukemia),9)]))
```




```
cat("More is level more is the relation of corelation")
```

```
## More is level more is the relation of corelation
```

```
head(prostate,1)
```

```
##      Y X206212_at X207075_at X215872_at X201876_at X211935_at X206788_s_at
## PG13 0 -0.2177484 -0.3399249  -0.354397  0.3026506  0.6148128   -0.1541378
##      X216441_at X209290_s_at X219877_at X220675_s_at X204229_at X216460_at
## PG13 -0.3563217     0.346312 -0.3476009   -0.3519888 -0.3248372  -0.349697
##      X215861_at X207287_at X211875_x_at X205055_at X216887_s_at X213319_s_at
## PG13 -0.3141736 -0.3008636   -0.3483616  0.1470909   -0.3098196   -0.3305093
##      X220709_at X204011_at X216174_at X219416_at X200793_s_at X216050_at
## PG13 -0.3491685 -0.2051633 -0.2837889 -0.2635437   0.04699453 -0.3565952
##      X216788_at X201699_at X201610_at X221695_s_at X219889_at X201632_at
## PG13 -0.3511941  0.2743752 -0.3533065   -0.1883429 -0.1902415  0.1436346
##      X218164_at X214007_s_at X215584_at X213817_at X207195_at X203386_at
## PG13  0.2466569   0.02566953 -0.2666364 -0.3398453    -0.3497 -0.1178275
##      X208861_s_at X206202_at X214767_s_at X209454_s_at X203216_s_at
## PG13     0.286057 -0.3530564   -0.2035596   -0.2020473    0.5667742
##      X222314_x_at X213009_s_at X208243_s_at X204742_s_at X214451_at
## PG13   -0.3485037    0.2024989   -0.3474458   -0.2894569 -0.3540157
##      X206296_x_at X221183_at X208087_s_at X212939_at X221662_s_at X212707_s_at
## PG13   -0.3469409 -0.3428994   -0.3464954 -0.3492401   -0.3278019   -0.2783247
##      X220995_at X207780_at X204905_s_at X213631_x_at X205715_at X219849_at
## PG13 -0.2916161 -0.3237928   0.08066098   -0.2825929 -0.3510803  -0.278187
##      X216394_x_at X216274_s_at X216794_at X216782_at X222183_x_at X204711_at
```

```
## PG13   -0.3501942     1.019773 -0.3503652  -0.351094   -0.3505852 -0.1599709
##      X211491_at X206023_at X201899_s_at X208531_at X211646_at X218261_at
## PG13 -0.3192752 -0.3528606    0.3081631 -0.3498723 -0.3490394  0.1946981
##      X200989_at X216665_s_at X209353_s_at X216820_at X215862_at X217122_s_at
## PG13   2.272554   -0.3451688   -0.3505107 -0.3332113 -0.3369121     1.218735
##      X215180_at X208048_at X210808_s_at X215801_at X221209_s_at X215524_x_at
## PG13  -0.303506 -0.3259374    -0.337646 -0.3053783   -0.3316742   -0.3128176
##      X208242_at X210565_at X216953_s_at X207461_at X216800_at X207285_x_at
## PG13  -0.350201 -0.3402634   -0.3531664 -0.3431062  -0.353258    -0.351809
##      X216057_at X217469_at X217919_s_at X215027_at X202359_s_at X221761_at
## PG13 -0.3543631 -0.3529147    0.4718682 -0.3052142   -0.2209473 0.08195972
##      X221093_at X210493_s_at X202089_s_at X222124_at X210055_at X204381_at
## PG13 -0.3537613   -0.3491707     1.139675 -0.3381842 -0.3530894 -0.2821833
##      X215031_x_at X207848_at X220889_s_at X219829_at X208557_at X205082_s_at
## PG13   -0.2082292 -0.3460228   -0.3491542  -0.352054  -0.325617   -0.3099986
##      X208017_s_at X213691_at X213810_s_at X206547_s_at X207853_s_at
## PG13   -0.3517722 -0.3322525   -0.3157025   -0.3164824   -0.3485811
##      X208374_s_at X211660_at X206338_at X220850_at X217283_at X215738_at
## PG13     0.930933 -0.2576853 -0.3491219 -0.3536786 -0.3490346 -0.3220609
##      X218230_at X210244_at X214897_at X216634_at X220656_at X207100_s_at
## PG13 0.01199624 -0.3515182 -0.3507273 -0.3379717 -0.3555534   -0.3023835
##      X216995_x_at X217844_at X218789_s_at X204153_s_at X205692_s_at
## PG13   -0.3530041  0.4022477   0.09126012   -0.2847932   -0.2975519
##      X217215_s_at X217716_s_at X213873_at X218732_at X220359_s_at X214471_x_at
## PG13   -0.3532257     1.326601 -0.2423098  0.1319257   -0.3503187    -0.259207
##      X205814_at X217663_at X213191_at X214267_s_at X207933_at X201521_s_at
## PG13 -0.3083388 -0.3478473 -0.2759976   -0.3512603 -0.3524861  -0.06529916
##      X200996_at X201975_at X200604_s_at X220553_s_at X221658_s_at X204424_s_at
## PG13  0.6037776 0.04291818     0.421707   -0.2146048   -0.3478597   -0.1911989
##      X202132_at X204418_x_at X211094_s_at X217101_at X212099_at X215184_at
## PG13 -0.2500822  -0.05791861    -0.306009 -0.3537361   1.644099 -0.3308612
##      X213560_at X216423_at X205024_s_at X209916_at X215402_at X206532_at
## PG13 -0.3453982 -0.3539957   -0.2935757  -0.221385 -0.3503974 -0.3542795
##      X221393_at X220384_at X218747_s_at X218133_s_at X219739_at X215756_at
## PG13 -0.3469799 -0.3549349   -0.2056985  -0.07856455 -0.2962822 -0.2560211
##      X208462_s_at X208513_at X211233_x_at X216025_x_at X201450_s_at
## PG13   -0.2826487 -0.3474051   -0.3366792   -0.2499829   -0.1428424
##      X222297_x_at X217323_at X219185_at  X212864_at X215417_at  X52159_at
## PG13   -0.1335004  -0.354606 -0.2099911 -0.04587124 -0.3479543 -0.2139086
##      X220503_at X210676_x_at X221420_at X207964_x_at X207743_at X211910_at
## PG13 -0.3567283   0.08201616  -0.356379   -0.3020466  -0.341378 -0.3493706
##      X202093_s_at X210326_at X204708_at X214254_at X212455_at X214961_at
## PG13   -0.1441939 -0.3431369 -0.3384186 -0.3544713  0.9240327  -0.340538
##      X204294_at X218833_at X207887_s_at X215816_at X217406_at X222037_at
## PG13 -0.0248155 -0.3067729   -0.3537327 -0.3092314 -0.2993552 -0.3091246
##      X202735_at X209812_x_at X204443_at X220182_at X209048_s_at X205602_x_at
## PG13 -0.1278737   -0.3473577 -0.2167977  -0.337963   -0.1030669   -0.3102091
##      X215161_at X210532_s_at X215333_x_at X210525_x_at X205428_s_at X214008_at
## PG13 -0.3521534     1.774275   -0.1324898   -0.3553861   -0.2950307 -0.3286241
##      X204058_at X210766_s_at X209757_s_at X216584_at X204030_s_at X213611_at
## PG13 -0.3055459  0.008393222   -0.3462937 -0.3524905   -0.2054456 -0.3520035
##         X823_at AFFX.ThrX.3_at X218675_at X215106_at X206317_s_at  X218984_at
## PG13 -0.1525243     -0.3529233 -0.2818548 -0.3532389   -0.3473619 -0.02501931
##      X222112_at X206071_s_at X200047_s_at X208907_s_at X217000_at X214856_at
```

```
## PG13 -0.3547096   -0.3080788     0.626085  -0.03204706 -0.3542095 -0.3559525
##      X211446_at X202610_s_at X207658_s_at X219597_s_at X220488_s_at
## PG13 -0.2917524  -0.06311598   -0.3479942   -0.3106046   -0.1768352
##      X207890_s_at X216437_at X201626_at X217636_at X208102_s_at X213814_s_at
## PG13    -0.270822 -0.3153345 0.07157226 -0.3434494   -0.3432379   -0.3055573
##      X215746_at X207276_at X215730_at X212419_at X210103_s_at X212352_s_at
## PG13 -0.3377454 -0.3511056 -0.3375299 0.09710839   -0.3485609      1.93264
##      X217034_at X209597_s_at X212433_x_at X205625_s_at X215987_at X219546_at
## PG13 -0.3501421    -0.345113     8.483072   -0.3338012 -0.3349518 -0.2940655
##      X216731_s_at X214509_at X220449_at X217974_at X215516_at X207629_s_at
## PG13   -0.3549837 -0.3516958 -0.2809285 -0.3035353 -0.3478492   -0.1919471
##      X216233_at X205616_at X222181_at X221127_s_at X208245_at X217495_x_at
## PG13 -0.3362664  -0.306798 -0.3346378   -0.2749954 -0.3571417   -0.3493274
##      X205386_s_at X218161_s_at X216351_x_at X200023_s_at X204265_s_at
## PG13   -0.3306421   -0.3126659   -0.2484031     1.564548   -0.2171395
##      X220377_at X214432_at X216436_at X219270_at X217458_at X200803_s_at
## PG13 -0.3542819 -0.3380781 -0.3544934 -0.3179893  -0.345437     2.104175
##      X208448_x_at X211986_at X217137_x_at X208522_s_at X210392_x_at X204664_at
## PG13   -0.2984936   1.490155   -0.3483076   -0.3470509   -0.3531339 -0.3546174
##      X207245_at X216632_at X201290_at X221580_s_at X203545_at X216646_at
## PG13 -0.3538624 -0.3537967   1.415305    0.1691742  0.2203906 -0.3520648
##      X208260_at X217211_at X220670_at X215126_at X207951_at  X213540_at
## PG13 -0.3338332 -0.2264103  -0.338192 -0.2995734 -0.2584107 -0.08040811
##      X203225_s_at X204390_at X217178_at X216358_at X214737_x_at X210659_at
## PG13    0.2749953 -0.3561609 -0.3343981 -0.3218351     1.823829 -0.2848229
##      X218664_at X215303_at X205152_at X215939_at X213447_at X217758_s_at
## PG13 -0.1945122 -0.3261742 -0.3280151 -0.3406907  0.2360436     2.155449
##      X212760_at X210038_at X208117_s_at X215107_s_at X219735_s_at X213166_x_at
## PG13   0.190735 -0.2785135    -0.164155   -0.3562549    -0.133992    0.6012778
##      X207373_at X213813_x_at X205507_at X216760_at X200786_at X212545_s_at
## PG13 -0.3556416   -0.2372055 -0.2754383 -0.3499442  0.7732261   -0.3258405
##      X210197_at X208787_at X215225_s_at X216772_at X219577_s_at X215060_at
## PG13 -0.3095445   1.990856   -0.3526997 -0.3352123   -0.2688281 -0.3091986
##      X213780_at X208369_s_at X218824_at X215346_at X210035_s_at X220561_at
## PG13 -0.3278115   -0.2164375 -0.2770462 -0.3099375    -0.344643 -0.3516841
##      X203770_s_at X207118_s_at X217332_at X206455_s_at X206881_s_at X215713_at
## PG13   -0.3491928   -0.3485666 -0.3182996   -0.3121988   -0.3489727 -0.3452429
##      X212705_x_at X220767_at X221118_at X207736_s_at X209529_at X221240_s_at
## PG13   -0.2169888 -0.3086577 -0.3554593   -0.3561291 0.07243748   -0.2809033
##       X208838_at X208650_s_at X203096_s_at X206811_at X210940_s_at X216283_s_at
## PG13 -0.03562514     1.647145   -0.2008834 -0.3522139   -0.3551079   -0.3223856
##      X217951_s_at X222100_at X207801_s_at X207846_at X210282_at X211207_s_at
## PG13   -0.3033349 -0.3505179     0.188661 -0.3574931  -0.313991   -0.3344417
##      X206907_at X214676_x_at X210196_s_at X206815_at X215309_at X203666_at
## PG13 -0.3206388   -0.1745441   -0.3573866 -0.3529445 -0.3570145 -0.2455652
##      X215162_at X206406_at X204051_s_at X220882_at X208706_s_at X208225_at
## PG13 -0.2743656 -0.3504096    0.5490338 -0.3512514    0.3694041 -0.3526199
##      X216740_at X202366_at X214748_at X219839_x_at X218285_s_at X206598_at
## PG13  -0.356527 -0.2490506 -0.1858073   -0.3539761  -0.06494081 -0.3553171
##      X217535_at X206423_at X200755_s_at X209327_s_at X206806_at AFFX.TrpnX.M_at
## PG13 -0.3322315  -0.350394   0.08294589   -0.3542379 -0.3423452      -0.3563181
##      X210618_at X210107_at X205245_at X215296_at X208880_s_at X217128_s_at
## PG13 -0.3417171 -0.3107299 -0.2699169  -0.300588    -0.138741   -0.2835429
##      X212249_at X216363_at X214309_s_at X221223_x_at X214970_s_at X204110_at
```

```
## PG13 -0.2823038 -0.3265507   -0.3405827   -0.2009782   -0.3403919 -0.3067341
##      X220705_s_at  X202813_at X212173_at X220627_at X215080_s_at X207493_x_at
## PG13   -0.2871695 -0.01866643 -0.3336511 -0.2731192   -0.3543141   -0.3543674
##      X219834_at   X218269_at X206820_at X214769_at X216771_at X218199_s_at
## PG13 -0.3019238 -0.004668724 -0.3516076  -0.328461 -0.3554296   -0.1066698
##      X222219_s_at X217004_s_at X217257_at X215778_x_at X206941_x_at X217464_at
## PG13   -0.3249089    -0.329315 -0.3447863    -0.221842   -0.3383407 -0.3555514
##      X221546_at X208603_s_at X206859_s_at X215028_at X219205_at X203599_s_at
## PG13  -0.311658   -0.3460156   -0.3499622 -0.3064157 -0.1892451   -0.1809095
##      X200059_s_at X221342_at X208084_at X205000_at X214744_s_at X215880_at
## PG13     4.006275 -0.3389723 -0.3220361 0.07049427   -0.3542189 -0.3348892
##      X214065_s_at X220094_s_at X201104_x_at X219835_at X217192_s_at
## PG13   -0.3241601  -0.08059849     1.543342 -0.3547697   -0.3278417
##      X207447_s_at X217115_at X211618_s_at X215479_at X217904_s_at X215361_at
## PG13   -0.3432001 -0.3515206   -0.3535208 -0.2614024    -0.150267 -0.3546118
##      X206465_at X214503_x_at X205385_at X220703_at X219113_x_at X212640_at
## PG13  -0.330634   -0.3526675 -0.3496162 -0.2779856   -0.3215054   1.301276
##      X205083_at X214001_x_at X215423_at X206581_at X215753_at X217302_at
## PG13 -0.2136357    -0.117505 -0.3447271 -0.3214744 -0.3442887 -0.3435915
##      X219842_at X217925_s_at X212250_at X212938_at X208294_x_at X201713_s_at
## PG13 -0.2825489   -0.1927286 0.09551878 -0.3087781   -0.3530079    0.2532173
##      X204339_s_at X208253_at X201480_s_at X208989_s_at X214809_at X219930_at
## PG13    -0.315814  -0.327738   0.01648233   -0.2111509 -0.3354691  -0.349288
##      X218140_x_at X211172_x_at X213013_at X201734_at X210102_at X221784_at
## PG13     1.412412   -0.2981997 -0.2193286    1.10188 -0.2560981 -0.3460602
##      X220673_s_at X213695_at X214390_s_at X205387_s_at X220465_at X201531_at
## PG13   -0.3561498 -0.3199788   -0.3485622   -0.3509817 -0.1014339   1.829381
##      X215673_at X217522_at X213054_at X213466_at X216869_at X212812_at
## PG13 -0.3571809 -0.3375143 -0.3429953  -0.351548 -0.2874733   3.486538
##      X214639_s_at X217372_at X210122_at X216324_at   X220420_at X211313_s_at
## PG13   -0.3553138 -0.3549059 -0.3535183 -0.3547083 -0.007194473   -0.3455153
##      X218575_at X205137_x_at X203036_s_at X208140_s_at X211926_s_at X205320_at
## PG13 -0.1301682   -0.3425205   -0.3521499   -0.2822669    0.2675665 -0.3296608
##      X221469_at X217060_at X220247_at X203794_at X220249_at X208551_at
## PG13 -0.3495283 -0.3112365 -0.3523874 -0.0825175 -0.3500255 -0.3133575
##      X211788_s_at X218379_at X210599_at X219524_s_at X202652_at X215486_at
## PG13   -0.3556365  0.2636019 -0.3264633   -0.3503525 -0.2801078 -0.3241247
##      X209207_s_at X217262_s_at X211756_at X218246_at  X202346_at X209717_at
## PG13   0.01912003   -0.3559509 -0.3431732 -0.2162278 -0.01017263 -0.2514204
##      X206077_at X213692_s_at X214899_at X207068_at
## PG13 -0.3393309   -0.3161388 -0.3504453 -0.3324365
```

```
cat("In the Prostate dataset we have :",ncol(prostate),
"colunm and ",nrow(prostate),"observations\n\n ")
```

```
## In the Prostate dataset we have : 501 colunm and  79 observations
##
##
```

```
cat("The dimension of the output space is ",ncol(prostate)-1,
"and the response is the variable Y that
is categorical with 2 level : '0' and '1'\n\n")
```

```
## The dimension of the output space is  500 and the response is the variable Y that
## is categorical with 2 level : '0' and '1'
```

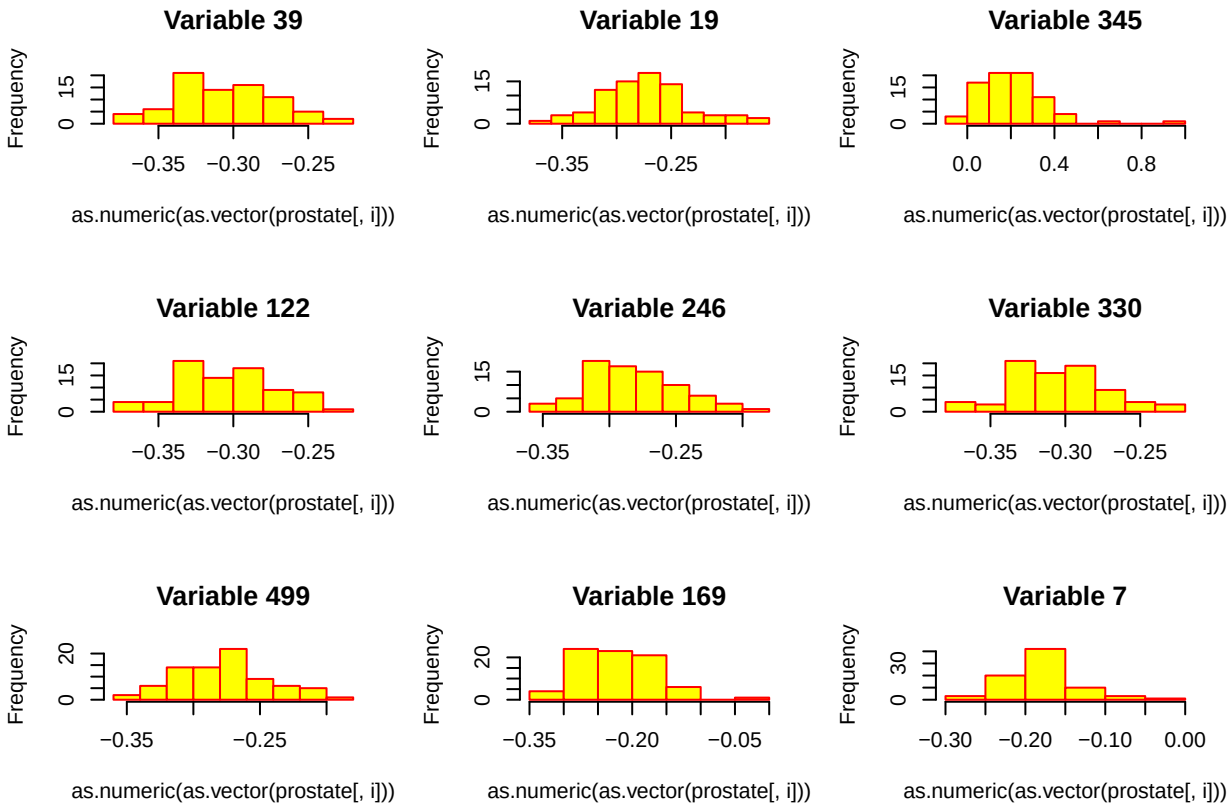
```r
cat(" We do not have acces to the dictionnary
of the the dataset prostate.
So I made an exploration of the dataset .
I deduced that all the predictors are numeric
so it's type homogenous. To know if it it is scale-homogenous
i reseached the mean of the each predictor(colMean(prostate)),
then i inspected the distribution by ploting the boxplot
and of course i looked at the outliers and the max was 7.5599.
I concluded with my finding that it is scale-homogenous. \n\n" )
```

```
##  We do not have acces to the dictionnary
## of the the dataset prostate.
## So I made an exploration of the dataset .
## I deduced that all the predictors are numeric
## so it's type homogenous. To know if it it is scale-homogenous
## i reseached the mean of the each predictor(colMean(prostate)),
## then i inspected the distribution by ploting the boxplot
## and of course i looked at the outliers and the max was 7.5599.
## I concluded with my finding that it is scale-homogenous.
```

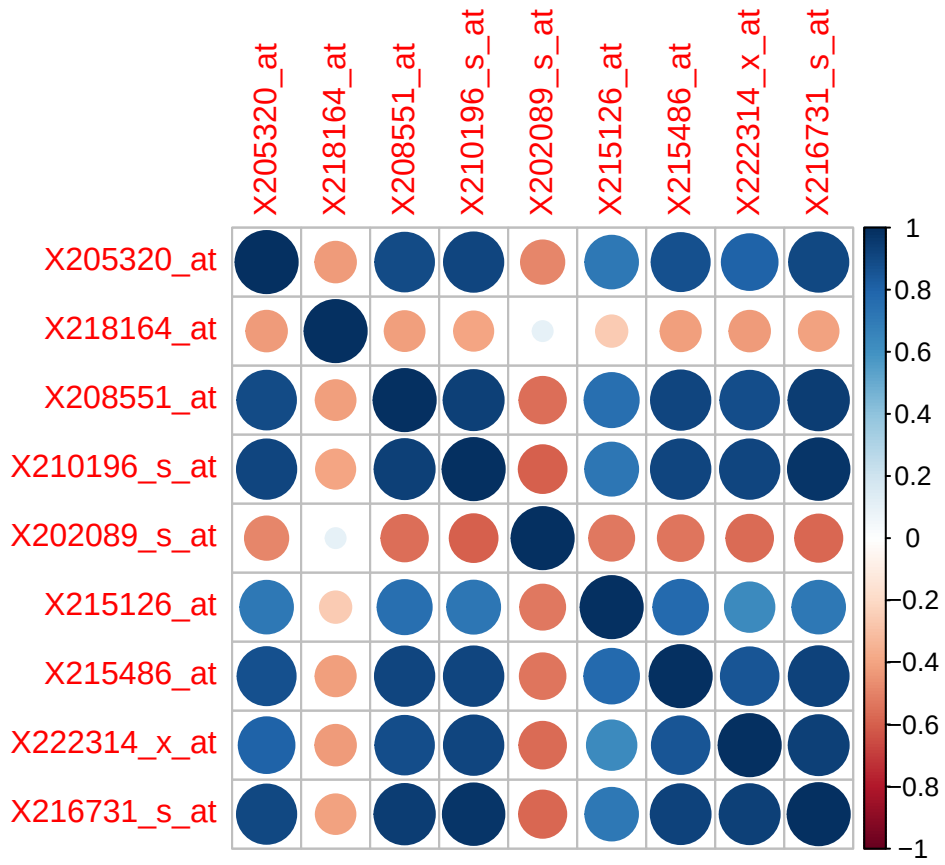
```r
cat("We have k=n/p=",nrow(prostate)/ncol(prostate)," .
This is very less than 5 so this data set
in term of size is very bad in context
of hight dimensional setting")
```

```
## We have k=n/p= 0.1576846  .
## This is very less than 5 so this data set
## in term of size is very bad in context
## of hight dimensional setting
```

```r
par(mfrow=c(3,3))

set <- sample(2:(ncol(prostate)),9)
for (i in set){
 hist(as.numeric(as.vector(prostate[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")
}
```




```
par(mfrow=c(1,1))
corrplot(cor(prostate[,sample(2:ncol(prostate),9)]))
```




```
cat("More is level more is the relation of corelation")
```

```
## More is level more is the relation of corelation
```

```
head(colon,1)
```

```
##   colon.y       X1       X2       X3       X4      X5       X6       X7
## 1       1 3.622527 3.308826 2.986154 2.710537 2.09131 3.119126 2.745517
##         X8       X9      X10      X11      X12      X13      X14      X15
## 1 2.421422 3.352726 2.969204 1.90314 1.972724 2.730563 2.686384 2.035089
##        X16      X17      X18      X19      X20      X21      X22      X23
## 1 3.150487 2.042083 2.101822 2.204231 2.305542 2.721739 2.850186 2.82556
##        X24      X25      X26      X27      X28      X29      X30      X31
## 1 2.854386 2.386778 2.422398 1.398847 1.764856 2.447027 1.530278 1.687756
##        X32      X33      X34      X35      X36      X37      X38      X39
## 1 2.564583 2.747216 2.525883 1.899852 2.416312 1.445855 2.280893 2.428956
##        X40      X41      X42      X43    X44      X45      X46      X47
## 1 2.428956 2.428956 2.428956 1.638994 2.9826 1.877549 2.352754 1.841401
##        X48      X49      X50      X51      X52      X53      X54      X55
## 1 1.974687 2.544603 1.831988 1.831988 1.831988 1.831988 1.538324 2.457141
##       X56      X57      X58      X59      X60      X61      X62      X63
## 1 2.20235 1.759538 2.085742 2.494372 1.919649 1.218718 1.575742 1.955653
##        X64      X65      X66      X67      X68      X69      X70      X71
## 1 1.719619 2.295165 2.049503 1.902298 1.736614 1.535782 2.284463 1.451667
##         X72      X73       X74      X75       X76       X77      X78      X79
## 1 0.8372946 1.962073 0.9900902 1.747859 0.7968509 0.8715953 1.314881 0.99891
##        X80      X81       X82      X83      X84      X85      X86      X87
```

```
## 1 1.503216 1.844501 0.9514944 1.223477 1.522589 1.281158 1.180292 1.732708
##         X88      X89       X90       X91       X92       X93       X94       X95
## 1 0.9965702 1.25673 0.9703745 1.474806 1.586414 1.284709 2.155888 0.514535
##        X96       X97       X98       X99      X100      X101      X102      X103
## 1 1.454979 0.6553843 1.391402 1.701916 1.562545 2.203901 2.102747 1.426573
##       X104      X105      X106      X107     X108      X109      X110      X111
## 1 2.290204 1.457137 2.194776 0.8197595 1.30673 1.309042 1.758348 2.777564
##       X112      X113      X114     X115      X116      X117      X118      X119
## 1 1.322402 1.674027 1.202532 1.55202 0.7551732 1.769527 0.9698365 1.722233
##       X120      X121      X122      X123       X124      X125      X126       X127
## 1 1.857829 1.516833 1.189702 1.075553 0.6987118 1.954439 1.282788 0.6588534
##        X128       X129       X130      X131       X132      X133      X134       X135
## 1 0.4580386 0.6551352 0.7178748 1.356132 0.6611438 1.113046 1.646563 0.7969412
##       X136      X137       X138       X139      X140       X141       X142       X143
## 1 1.418196 1.306095 0.6923188 0.5280799 2.172257 0.3805733 0.6382307 0.4818355
##       X144      X145       X146         X147      X148      X149      X150       X151
## 1 1.082319 2.000723 0.8055698 -0.04878408 1.725704 1.873706 1.096606 0.9771114
##       X152      X153      X154      X155       X156      X157      X158     X159
## 1 1.219273 1.566278 1.247878 1.752247 0.5887698 1.534105 1.076534 2.18829
##        X160      X161      X162       X163      X164      X165      X166      X167
## 1 0.9318338 1.716779 1.595657 0.4775435 1.012554 1.717292 1.385524 1.938988
##        X168      X169       X170      X171       X172       X173       X174      X175
## 1 0.6659716 1.521137 0.6129573 1.446343 0.9235493 0.7474718 0.9750669 1.359509
##       X176       X177      X178       X179       X180      X181      X182      X183
## 1 1.107412 0.2361346 1.048785 0.1919453 0.9051818 1.889296 1.789121 2.012548
##        X184      X185      X186      X187      X188      X189     X190       X191
## 1 0.8574548 1.492481 1.554866 0.911996 1.201727 0.431708 1.10183 0.8759297
##      X192       X193       X194       X195       X196      X197      X198       X199
## 1 0.92781 0.1608177 0.9797156 0.8996654 0.6589103 0.853296 1.270795 0.7225554
##       X200      X201      X202       X203       X204      X205      X206       X207
## 1 0.511703 2.667982 1.764598 0.7378256 0.8691585 1.494833 1.397353 0.7082043
##       X208       X209      X210         X211       X212       X213      X214
## 1 1.919895 0.8825746 1.679333 -0.03943018 0.2222991 0.6706434 1.383381
##        X215       X216         X217      X218      X219       X220      X221      X222
## 1 0.6678472 0.3916057 -0.07436341 1.100426 1.115495 0.3552471 1.294517 0.768441
##        X223      X224      X225      X226       X227      X228      X229       X230
## 1 0.8947804 1.370192 1.783304 1.356519 0.1697996 1.425127 1.973725 0.4015454
##       X231      X232       X233        X234      X235       X236       X237       X238
## 1 1.377962 0.623862 0.9649219 -0.2605298 1.395396 0.3561225 0.7297745 0.7596472
##       X239       X240       X241       X242       X243       X244      X245
## 1 1.273631 0.1250447 0.5143422 0.8294418 0.3785414 0.6356829 1.888216
##         X246      X247       X248      X249      X250       X251       X252       X253
## 1 0.05092696 1.005097 0.2987462 2.231491 1.431656 0.9879322 0.6860265 0.9779777
##        X254      X255       X256       X257         X258       X259      X260
## 1 0.5617057 1.478475 0.4841653 0.4452098 -0.07136068 0.6052845 1.413776
##       X261      X262      X263       X264       X265       X266      X267       X268
## 1 1.413776 1.413776 1.413776 0.1580283 0.8540021 0.3326452 1.926576 0.6300386
##      X269      X270       X271        X272      X273      X274       X275      X276
## 1 1.77447 1.016302 0.6331499 -0.2729877 1.449023 1.241237 0.1493384 1.301331
##        X277      X278      X279         X280      X281      X282       X283      X284
## 1 0.0536931 1.304912 0.658728 0.001577074 1.178793 1.546363 0.2318707 1.435741
##        X285   X286    X287        X288      X289      X290       X291      X292
## 1 0.3100619 2.2414 1.27775 -0.3555269 1.188217 0.753778 -0.131193 1.330909
##      X293      X294      X295        X296        X297       X298       X299      X300
```

```
## 1 1.03478 1.060377 1.374474 0.03112774 0.06339702 0.3000221 0.5302126 0.924005
##       X301     X302      X303     X304      X305     X306    X307      X308
## 1 2.267733 0.628883 0.1781552 1.030077 0.4248952 1.203251 2.03466 0.5665031
##        X309       X310      X311      X312      X313     X314      X315
## 1 0.5694176 -0.3878415 0.6373381 0.9215588 0.3567956 1.945726 0.5662055
##        X316       X317     X318      X319     X320     X321      X322      X323
## 1 0.3340837 -0.5218007 1.284959 0.1934462 1.346916 1.675338 0.8102634 0.8251861
##        X324      X325     X326       X327     X328     X329     X330      X331
## 1 0.1512887 0.5469498 1.182924 0.09394931 1.268716 1.239738 1.209644 0.8270295
##       X332      X333     X334        X335     X336     X337       X338     X339
## 1 1.002965 0.7740276 0.182237 -0.06130301 1.595663 0.409745 -0.5046836 1.001554
##        X340     X341       X342     X343     X344      X345      X346     X347
## 1 0.9665778 1.608568 -0.4335742 1.115355 1.512973 0.7290377 0.9442877 1.135318
##        X348      X349     X350       X351      X352      X353      X354
## 1 0.7312335 0.5933873 1.493054 0.09537388 0.5410884 0.8942661 0.4864744
##        X355     X356     X357     X358      X359       X360    X361      X362
## 1 0.4859437 0.578013 1.461598 1.115712 0.2712699 0.03750769 1.21239 0.7256541
##        X363       X364       X365     X366      X367       X368      X369
## 1 0.7247531 -0.5241792 -0.1999481 0.795747 0.9034858 -0.1477187 0.4085995
##       X370     X371       X372      X373      X374      X375      X376     X377
## 1 1.021847 1.483943 -0.2489809 0.3003382 0.5824301 0.1571384 0.7303133 1.107265
##        X378       X379       X380      X381      X382      X383     X384
## 1 0.9040663 -0.4494567 -0.7895193 0.1154748 0.2937431 0.8710167 1.890958
##         X385      X386       X387      X388      X389     X390      X391
## 1 0.02633797 0.5278179 0.09079694 0.3066441 0.5682528 1.168658 0.6673036
##         X392     X393     X394     X395       X396     X397        X398
## 1 -0.6312713 0.121504 0.867023 1.459547 -0.1781432 1.321762 -0.06004709
##         X399      X400    X401      X402     X403      X404      X405      X406
## 1 -0.3669694 0.7217513 1.38452 0.5367727 1.154596 0.2419896 -0.672944 0.2103292
##        X407      X408       X409     X410      X411       X412       X413
## 1 0.1666688 0.1007998 -0.3200734 1.458961 -0.281304 -0.1256822 -0.4945952
##       X414     X415      X416      X417     X418      X419      X420      X421
## 1 0.918369 2.652427 0.3773633 0.5688043 1.358572 0.2467807 0.2667441 0.5265747
##        X422      X423      X424      X425      X426      X427     X428
## 1 0.8119408 0.5289598 0.6386371 0.1139863 0.3064963 0.2464837 1.025995
##        X429        X430      X431       X432     X433      X434      X435
## 1 0.7663471 -0.05293811 0.4684144 -0.2361688 1.051621 0.9769269 0.2928016
##        X436      X437       X438     X439      X440      X441     X442
## 1 0.6321891 0.9414286 0.05170526 1.421559 0.1744244 0.9975197 1.412203
##        X443      X444      X445      X446      X447      X448      X449
## 1 0.1989234 0.8202293 0.4694941 0.4141083 0.7490272 0.5813665 0.3346752
##         X450     X451      X452       X453     X454       X455      X456
## 1 -0.2031707 1.338872 0.6606329 0.07798261 1.074583 0.02155203 0.8985662
##        X457     X458      X459       X460      X461      X462        X463
## 1 0.7113988 1.850982 0.5265747 -0.4409238 0.9713622 0.6105782 -0.04946655
##        X464      X465      X466     X467        X468       X469       X470
## 1 -1.203825 0.8284087 -0.441067 1.279602 -0.05540415 -0.3213423 -0.1119851
##        X471      X472      X473     X474      X475       X476      X477
## 1 0.8874218 0.6848274 0.2508159 1.618712 0.4139914 -0.1136274 0.3803962
##        X478     X479        X480      X481      X482        X483      X484
## 1 0.5490451 0.211135 -0.04683299 0.5547891 0.3457871 0.003027805 0.6621945
##       X485     X486        X487      X488      X489      X490      X491
## 1 2.149698 0.675376 -0.09810467 0.4592556 0.8130828 0.3132401 0.4381114
##          X492     X493      X494      X495      X496     X497      X498
```

```
## 1 -0.05847546 1.681005 0.6192598 0.2482969 0.4427531 1.238914 0.2982882
##       X499      X500      X501       X502      X503      X504      X505
## 1 1.344522 0.3096589 0.3930812 -0.6356915 0.5187949 0.4046397 0.4337295
##       X506      X507       X508      X509       X510     X511       X512
## 1 1.115146 0.2776363 0.00201796 0.7481989 -0.3736665 1.364537 -0.3305082
##        X513      X514       X515        X516     X517       X518     X519
## 1 0.5584461 0.3311335 -0.1437978 -0.08756716 1.315677 -0.1247285 1.434259
##        X520      X521      X522       X523      X524      X525      X526
## 1 0.8666651 0.2314208 0.2675024 -0.2079217 0.5106847 0.9845771 0.5307637
##        X527    X528      X529      X530      X531      X532        X533
## 1 0.5175941 0.16471 0.4275061 0.2235402 0.2137252 0.8518739 -0.09789689
##        X534      X535      X536     X537       X538      X539     X540
## 1 0.1553781 0.6756025 0.2358635 1.370743 -0.2690558 0.4628098 1.226675
##         X541      X542      X543      X544      X545       X546       X547
## 1 -0.0529172 0.1462728 0.4501139 -0.424879 0.7238877 -0.3015161 -0.2219675
##        X548     X549       X550      X551      X552      X553      X554    X555
## 1 0.4035649 1.017409 -0.3414107 -0.588713 0.7978229 0.4833688 0.5173175 2.69797
##         X556      X557        X558      X559      X560       X561      X562
## 1 -0.2295996 0.1683171 -0.04233793 -1.146084 0.8158699 0.06932233 0.3461572
##       X563      X564       X565      X566     X567     X568       X569     X570
## 1 0.957241 0.3799148 -0.9028154 0.6921962 1.040464 1.185854 -0.4685866 0.213456
##        X571       X572      X573        X574       X575     X576       X577
## 1 -0.244136 -0.3970189 0.7410401 -0.01687368 -0.3137197 0.848983 0.08173479
##       X578      X579       X580     X581      X582      X583       X584
## 1 -0.14085 0.6694461 -0.1614276 0.898858 0.3767094 0.1128951 -0.3522169
##        X585      X586      X587       X588     X589      X590      X591
## 1 0.7511267 0.5725209 0.2655427 -0.4819505 1.188501 0.5794464 0.4601248
##         X592     X593      X594      X595        X596      X597       X598
## 1 0.01323281 1.064817 0.5935622 0.2256889 -0.07235171 0.4575022 0.05734768
##      X599       X600      X601      X602      X603      X604      X605
## 1 1.40697 -0.8264763 0.9896707 0.7654151 0.1020432 0.4713209 0.5336658
##           X606       X607       X608       X609       X610       X611      X612
## 1 -0.002877228 -0.5325651 0.03870722 -0.1719652 -0.1942009 -0.6742424 0.7892684
##         X613      X614      X615      X616       X617       X618       X619
## 1 -0.1203034 0.1033299 0.3173128 0.1301389 -0.2335457 -0.1643613 -0.6693873
##         X620      X621       X622       X623     X624      X625     X626
## 1 -0.1578488 0.1844249 -0.2864481 -0.0843529 1.327359 0.8109178 -0.53926
##       X627      X628     X629      X630       X631       X632     X633     X634
## 1 0.140059 0.1128729 1.621035 0.2879459 -0.1174272 0.07017457 0.501852 0.539458
##         X635     X636       X637       X638      X639      X640       X641
## 1 -0.4009315 0.884393 0.07300055 -0.1047669 0.4061351 0.5308838 -0.6692333
##         X642        X643       X644       X645       X646      X647      X648
## 1 0.09224753 0.008982406 -0.3868155 -0.6005447 -0.7739067 0.1904708 0.5331944
##        X649      X650      X651      X652     X653      X654       X655
## 1 0.1775333 -0.923615 0.4541447 0.2500838 1.261428 -0.201973 -0.2903703
##       X656       X657      X658      X659      X660     X661     X662      X663
## 1 0.317291 -0.9537487 0.2397467 0.2946721 0.9209862 2.183895 1.144795 0.2325399
##       X664        X665       X666       X667     X668     X669      X670
## 1 0.666195 -0.03265577 -0.4311007 -0.8903035 0.563728 0.195154 0.9759861
##         X671      X672      X673     X674      X675      X676      X677
## 1 -0.2508236 0.4315168 0.4119101 1.008113 -1.217996 0.4116987 0.7748765
##       X678     X679      X680      X681      X682       X683      X684
## 1 1.488247 1.069523 0.6960725 0.1692242 0.6708573 -0.8157658 0.8419771
##        X685      X686      X687     X688      X689      X690       X691
```

```
## 1 0.4157824 0.9822432 0.2509479 1.626105 0.3984784 0.2951383 -0.4272053
##         X692      X693       X694      X695      X696     X697       X698
## 1 0.02113183 -0.542538 -0.4568354 0.1082553 0.1155779 0.400013 -0.6218272
##        X699      X700        X701      X702     X703       X704      X705
## 1 0.5973477 0.2700131 -0.08104614 0.4195722 1.092198 -0.3251195 -0.914286
##        X706      X707       X708      X709       X710      X711       X712
## 1 0.2872888 0.7780018 -0.5288239 0.4684533 -0.3664987 0.3774966 -0.3155691
##         X713       X714     X715     X716       X717       X718        X719
## 1 -0.7806619 -0.2090608 -1.17529 0.304546 -0.2384908 -0.1607012 -0.07899429
##         X720     X721     X722       X723      X724       X725        X726
## 1 -0.1352467 0.199222 0.216417 -0.9847357 0.5399515 -0.3350671 -0.04988355
##        X727      X728        X729     X730      X731      X732       X733
## 1 -0.256647 -0.120479 -0.06386885 0.104879 0.7208006 -0.103192 -0.2525996
##         X734       X735       X736      X737       X738     X739      X740
## 1 0.03808134 -0.3771883 -0.6535776 0.3545083 -0.5296615 1.780115 0.7163976
##         X741       X742      X743       X744       X745       X746      X747
## 1 -0.1547268 -0.3461324 0.8695459 -0.2129067 -0.5081381 0.09076584 0.2292475
##        X748      X749      X750       X751      X752      X753      X754
## 1 0.2755111 0.1774476 0.1575844 -0.3022185 -0.120805 0.2416258 0.1036704
##         X755       X756      X757       X758        X759     X760       X761
## 1 -0.3710012 -0.6700995 0.1926264 0.2438412 -0.02606295 1.071229 -0.3810864
##        X762       X763      X764     X765     X766       X767       X768
## 1 0.5511225 -0.1809678 0.8491008 1.965824 0.017412 -0.1270414 -0.5671742
##       X769       X770      X771       X772      X773      X774       X775
## 1 1.121491 -0.5328929 -0.864964 -0.3312172 0.3108473 0.1107055 -0.4719521
##        X776      X777     X778      X779      X780       X781       X782
## 1 0.5410302 -0.113633 0.555388 0.4618611 0.1686322 -0.5470991 -0.6703018
##        X783      X784       X785      X786       X787      X788       X789
## 1 0.2850004 0.6337784 -0.1981112 -1.290447 0.9608445 0.1778181 -0.6080781
##         X790      X791     X792      X793      X794       X795        X796
## 1 -0.1630659 0.4898572 1.315396 0.1362307 0.4466114 -0.3882596 -0.01238757
##       X797     X798       X799      X800       X801      X802       X803
## 1 0.203872 1.329134 -0.4101289 0.4902773 0.03893645 0.6322545 -0.2710912
##         X804      X805     X806     X807      X808        X809     X810
## 1 -0.9413959 0.1899363 1.257297 2.869949 0.4912204 -0.04085236 1.175349
##         X811       X812       X813       X814       X815         X816
## 1 -0.6101812 0.03550528 -0.2620919 -0.5269374 -0.5750099 -0.003460869
##         X817      X818      X819        X820      X821     X822      X823
## 1 -0.2629482 0.7741873 -1.436607 -0.02609449 0.1684138 2.885762 0.4281302
##         X824     X825      X826      X827        X828      X829      X830
## 1 0.05893909 0.497004 0.2211545 0.5748253 0.002360351 -1.061386 0.8770477
##        X831       X832       X833      X834     X835      X836       X837
## 1 0.7759159 -0.3201496 -0.2098911 0.1582678 -0.42534 0.3689611 -0.1813477
##         X838     X839      X840       X841        X842       X843      X844
## 1 -0.6858685 1.666994 -0.261951 -0.2598184 -0.06413848 -0.3791855 0.3719849
##       X845      X846      X847       X848      X849      X850      X851
## 1 1.191507 0.5843555 0.2019109 0.04149743 0.7705529 0.8691972 0.2673195
##        X852      X853      X854       X855       X856      X857       X858
## 1 0.7635256 0.3391879 0.1959229 -0.4316634 0.04447469 0.0669703 -0.2979582
##         X859       X860       X861      X862       X863       X864      X865
## 1 0.01480387 0.02779708 -0.4310931 -1.007325 0.08810332 -0.3173947 -1.165768
##         X866      X867      X868       X869      X870       X871      X872
## 1 -0.1177003 0.3794692 -0.976254 -0.1783774 0.6720655 -0.3840134 0.1978997
##        X873      X874       X875       X876       X877     X878       X879
```

```
## 1 0.4346791 -1.184952 -0.9095772 -0.7404817 -0.2626007 1.034385 0.01712417
##         X880       X881      X882       X883      X884      X885       X886
## 1 -0.3474821 -0.1850239 0.6077638 -0.1357904 0.8615961 -0.274051 -0.1962355
##         X887       X888      X889         X890      X891      X892        X893
## 1 -0.4551545 -0.1720155 0.1184125 0.0008137385 0.2748685 0.1340121 -0.05405258
##         X894     X895       X896     X897       X898      X899      X900
## 1 -0.3286038 1.197203 -0.1029997 1.397938 0.00935242 -1.249843 0.2665421
##         X901       X902       X903        X904       X905      X906      X907
## 1 -0.2799219 -0.4428753 0.09923998 -0.02839836 -0.2234428 0.1595443 0.6729993
##        X908      X909        X910       X911       X912       X913       X914
## 1 0.9308896 -1.073224 -0.01273929 -0.5600379 -0.5866987 -0.3146067 -0.1079351
##         X915       X916       X917     X918      X919      X920        X921
## 1 -0.9417864 0.01018091 -0.2017217 1.421872 -0.485418 0.1463372 -0.03959234
##        X922       X923      X924      X925       X926      X927     X928
## 1 -1.020849 0.01816778 0.5455319 0.4180264 -0.3453536 -1.010656 1.259813
##        X929         X930       X931       X932       X933       X934      X935
## 1 0.6519451 -0.008321477 0.04621608 0.06441416 -0.1159568 -0.1718096 -1.141515
##         X936        X937       X938      X939     X940    X941      X942
## 1 -0.3447496 -0.02872045 -0.9822676 0.5417855 0.455018 0.74566 -0.102238
##        X943       X944       X945       X946       X947        X948       X949
## 1 -1.352151 -0.5703231 -0.2623691 -0.7231443 -0.4248186 0.005972371 -0.3534199
##         X950       X951       X952      X953      X954       X955      X956
## 1 -0.5084991 -0.1223283 -0.5430151 0.3115751 0.6260096 -0.4835424 0.4220193
##        X957     X958        X959      X960       X961       X962     X963
## 1 0.4511572 -0.78445 -0.01963768 0.3196776 -1.119985 -0.0606652 0.806261
##          X964       X965       X966      X967    X968      X969        X970
## 1 -0.03644598 -0.5953894 -0.3437102 -0.178294 -1.2895 -0.167074 -0.03842152
##         X971       X972       X973      X974     X975       X976       X977
## 1 -0.7275069 -0.2456788 -0.9788381 0.2359303 1.127211 -0.9111077 -0.2452001
##        X978       X979       X980      X981      X982       X983        X984
## 1 0.3473053 -0.1155617 -0.3051604 0.2175381 0.1416995 -0.6235545 -0.08907323
##        X985       X986        X987      X988       X989        X990       X991
## 1 -1.309693 -0.1577582 -0.03429238 0.8625737 -0.1687498 -0.05352397 -0.4911368
##       X992     X993       X994      X995      X996       X997       X998
## 1 1.177874 2.066247 -0.4651872 -1.052218 0.1164763 -0.0632118 0.08429366
##         X999     X1000     X1001    X1002      X1003      X1004      X1005
## 1 -0.5910793 0.1411542 0.4283753 1.228655 0.01617848 -0.2044092 -0.2960808
##        X1006     X1007      X1008     X1009     X1010     X1011      X1012
## 1 0.08764382 -0.555437 -0.6553642 -0.620442 0.4021857 0.6807077 0.02083047
##       X1013      X1014        X1015    X1016      X1017      X1018      X1019
## 1 0.2136248 -0.7518072 -0.008511632 -1.18792 -0.6132921 0.07587064 -0.9389793
##         X1020    X1021     X1022     X1023    X1024      X1025     X1026
## 1 -0.09522697 -1.04527 0.1194027 0.0487256 1.935716 -0.2980515 0.1824691
##       X1027      X1028     X1029     X1030    X1031       X1032      X1033
## 1 -0.396409 0.01878662 0.1246719 0.1376219 1.705502 -0.02408501 -0.5032035
##        X1034       X1035      X1036     X1037      X1038      X1039     X1040
## 1 -0.6347519 -0.01315147 0.01118468 -1.370619 0.06767933 -0.9978993 0.4032552
##       X1041      X1042     X1043    X1044     X1045       X1046     X1047
## 1 0.1506177 -0.6254229 0.6614983 0.293941 0.3458242 -0.04489604 0.6510384
##        X1048      X1049      X1050      X1051      X1052     X1053      X1054
## 1 -0.3398134 -0.6331261 -0.0100492 -0.3522732 0.01384042 0.1071579 0.02700726
##        X1055     X1056     X1057      X1058      X1059      X1060       X1061
## 1 -0.3755958 -0.747415 -1.728923 -0.3283582 -0.6224333 -0.9438039 -0.04054237
##       X1062     X1063     X1064      X1065      X1066      X1067      X1068
```

```
## 1 0.8856606 -0.427754 0.1659582 -0.7687875 -0.9824643 -0.3692764 -0.4672559
##      X1069    X1070      X1071      X1072      X1073      X1074      X1075
## 1 1.601494 0.298215 -0.5428533 -0.4948866 -0.2296768 -0.9114214 -0.7797278
##       X1076     X1077      X1078      X1079     X1080      X1081     X1082
## 1 0.4003437 0.4076417 -0.3681687 -0.3298615 0.3889239 -0.7009934 0.3002408
##        X1083      X1084     X1085      X1086      X1087      X1088      X1089
## 1 -0.3320026 -0.6439145 0.5564581 0.01256155 -0.6524983 -0.5242833 -0.6871603
##       X1090     X1091     X1092     X1093     X1094     X1095     X1096
## 1 0.7318376 -0.138551 0.2761495 0.1457917 -1.062683 0.5563437 0.0425001
##        X1097   X1098      X1099      X1100       X1101    X1102      X1103
## 1 -0.3350115 -1.4304 -0.1968782 -0.6024971 -0.09619257 1.516837 -0.8528114
##         X1104    X1105      X1106     X1107      X1108      X1109     X1110
## 1 -0.05014502 -1.05748 -0.9386545 0.1291366 -0.7525487 -0.4707509 -0.125817
##        X1111     X1112     X1113      X1114      X1115     X1116     X1117
## 1 -0.2272714 0.2644163 0.2907006 0.04577982 -0.2961939 -1.542342 0.1270555
##       X1118      X1119     X1120      X1121     X1122     X1123     X1124
## 1 -1.543918 -0.9204713 0.2018418 -0.1414035 0.3713128 0.2156632 0.3569874
##       X1125     X1126      X1127      X1128      X1129     X1130      X1131
## 1 -1.134296 -0.316736 -0.1782446 -0.7774767 -0.1525604 -1.186234 -0.1657282
##        X1132     X1133      X1134     X1135     X1136     X1137     X1138
## 1 -0.8460411 0.2001143 -0.8606976 -0.353786 0.4076047 0.5434872 0.2829731
##        X1139       X1140     X1141      X1142     X1143    X1144      X1145
## 1 -0.9242898 -0.05006604 0.2590448 -0.3620303 0.2042315 1.751584 -0.8605487
##        X1146      X1147      X1148      X1149      X1150     X1151       X1152
## 1 -0.4142525 -0.7678431 -0.4296603 -0.1103399 -0.4110281 0.4408558 -0.09084158
##       X1153     X1154      X1155      X1156     X1157     X1158      X1159
## 1 0.7929468 0.3242919 -0.7140929 -0.4963666 0.8922439 -0.913857 -0.5819046
##        X1160      X1161     X1162     X1163      X1164     X1165      X1166
## 1 -0.7777659 -0.2320151 0.1045479 0.6585067 -0.4426754 -1.027121 -0.9671969
##        X1167       X1168     X1169      X1170      X1171      X1172     X1173
## 1 -0.6521577 -0.09182474 -1.388979 -0.6773955 -0.3828242 -0.1885041 0.1226475
##       X1174     X1175     X1176      X1177       X1178      X1179     X1180
## 1 -0.986617 -0.945067 0.2299434 0.08968039 -0.05875418 -0.8825007 -1.624592
##        X1181      X1182      X1183      X1184     X1185    X1186      X1187
## 1 -0.7637679 -0.6011021 -0.4053539 -0.9998587 -1.272009 1.130697 -0.9192632
##          X1188     X1189     X1190     X1191     X1192      X1193     X1194
## 1 -0.008891328 -1.362833 0.7356682 0.4426699 0.1766645 -0.7112837 0.4904189
##        X1195     X1196    X1197      X1198      X1199       X1200      X1201
## 1 0.06283755 0.4812057 0.402339 -0.8938401 -0.1608234 -0.02183101 -0.3248164
##        X1202     X1203      X1204      X1205      X1206      X1207     X1208
## 1 0.01336015 -1.043175 -0.7892268 -0.4831213 -0.4607906 -0.5623549 -1.030814
##        X1209     X1210       X1211     X1212      X1213      X1214     X1215
## 1 -0.5104705 0.4421568 -0.06640413 0.6566967 0.04599797 -0.3569524 -2.429217
##        X1216      X1217      X1218      X1219     X1220     X1221     X1222
## 1 -0.9088575 -0.6799785 -0.8935491 -0.3296208 0.1445752 -1.046243 -1.141254
##       X1223     X1224      X1225      X1226     X1227      X1228     X1229
## 1 0.4935957 0.2631318 -0.7664017 -0.9757849 -1.263643 -0.4885427 -1.198566
##       X1230      X1231      X1232     X1233      X1234       X1235      X1236
## 1 0.7567661 -0.8140436 -0.5101252 -1.583059 -0.2197602 -0.04106717 -0.8384721
##        X1237     X1238      X1239      X1240      X1241     X1242      X1243
## 1 -0.2972055 -1.035226 0.04450565 -0.9511389 -0.5611698 0.3318307 -0.7435005
##       X1244     X1245     X1246     X1247      X1248      X1249     X1250
## 1 0.8628234 -1.390038 -0.926317 0.6443938 -0.1406504 -0.3116642 -0.835542
##       X1251      X1252      X1253      X1254      X1255      X1256     X1257
```

```
## 1 -1.047739 -0.1779986 -0.3901557 -0.9046783 -0.9950802 -0.5494887 0.1448461
##       X1258      X1259      X1260     X1261      X1262      X1263      X1264
## 1 0.4424905 -0.8348278 -0.9522838 -1.240562 -0.7471081 -0.6128891 -0.3026133
##        X1265      X1266     X1267     X1268      X1269     X1270      X1271
## 1 -0.5947547 -0.3976413 -1.333107 0.1675716 -0.9453451 0.1983484 -0.1499438
##       X1272      X1273       X1274      X1275      X1276      X1277     X1278
## 1 0.6206031 -0.1815437 -0.03823596 -0.5746156 -0.6677808 -0.6524416 -1.319599
##       X1279    X1280     X1281    X1282    X1283      X1284        X1285
## 1 -1.086989 1.262355 0.2537121 0.499387 1.098584 -0.6673691 -0.007571215
##        X1286      X1287      X1288      X1289     X1290      X1291      X1292
## 1 0.01516104 -0.8931768 -0.7909398 -0.7082866 0.3084892 -0.1903475 -0.7604565
##       X1293      X1294      X1295      X1296     X1297      X1298       X1299
## 1 0.4133487 -0.6539282 -0.8385176 -0.9104927 -1.452003 -0.6358683 -0.08278103
##        X1300      X1301     X1302      X1303    X1304      X1305      X1306
## 1 -0.4333685 -0.2005542 -1.208164 -0.5749836 1.757611 -0.6940384 -0.7043645
##        X1307      X1308      X1309      X1310     X1311      X1312     X1313
## 1 -0.8153889 -0.4548198 -0.8621891 -0.2245352 0.3068566 -0.2562761 -1.422343
##       X1314      X1315      X1316      X1317     X1318      X1319     X1320
## 1 -1.075421 -0.7861441 -0.2172435 -0.7347277 -1.244463 -0.6651337 -1.368811
##      X1321      X1322     X1323       X1324    X1325     X1326      X1327
## 1 1.336409 -0.2643588 -1.137468 -0.01903067 1.100093 0.4090343 0.01755832
##       X1328      X1329      X1330     X1331     X1332     X1333      X1334
## 1 -0.054422 -0.5911416 -0.8228972 0.3282611 0.1686112 -1.000299 -0.5681706
##      X1335      X1336      X1337     X1338     X1339      X1340      X1341
## 1 -1.11649 -0.1917803 -0.6574023 -1.753062 -0.663487 -0.1022142 -0.6661499
##        X1342     X1343      X1344     X1345     X1346     X1347     X1348
## 1 -0.6505698 -1.241561 -0.4784553 -1.570646 -1.363999 -1.017666 0.4065634
##       X1349     X1350      X1351      X1352      X1353      X1354      X1355
## 1 -0.199271 -1.013993 -0.4714615 -0.5864733 -0.7742883 -0.5805201 -0.6449138
##       X1356       X1357     X1358      X1359      X1360      X1361     X1362
## 1 -1.109451 -0.09306455 -1.635066 -0.4549139 -0.4178098 -0.4383327 -0.415936
##        X1363      X1364     X1365     X1366     X1367      X1368       X1369
## 1 -0.4186204 -0.2466166 0.1546714 -1.092794 -1.571814 -0.5580192 -0.05747692
##        X1370      X1371      X1372     X1373       X1374      X1375      X1376
## 1 -0.4667233 -0.8573569 -0.5358986 -1.602334 -0.06662673 -0.5665962 -0.8554583
##        X1377    X1378       X1379     X1380     X1381      X1382     X1383
## 1 -0.3252643 1.532161 -0.07748224 0.0258205 -0.335761 0.09484431 0.9334139
##       X1384     X1385      X1386    X1387      X1388     X1389      X1390
## 1 0.3581233 -1.501097 -0.9002973 2.254121 -0.4931554 -1.527979 -0.6187841
##        X1391     X1392      X1393     X1394     X1395     X1396      X1397
## 1 -0.5591575 0.1233462 -0.7773911 -1.486073 -1.090325 0.1165412 -0.3869749
##      X1398      X1399      X1400       X1401     X1402     X1403      X1404
## 1 -1.13101 -0.3915871 -0.6524537 -0.09429498 0.4328114 0.6206413 -0.4160333
##        X1405       X1406     X1407      X1408      X1409     X1410    X1411
## 1 -0.8672784 -0.05009212 0.6482361 -0.3112726 -0.6396825 -1.352474 1.474758
##      X1412       X1413     X1414      X1415      X1416      X1417      X1418
## 1 -0.34431 -0.08936051 0.5620899 -0.7275559 -0.6149293 -0.4729657 -0.2035903
##        X1419      X1420      X1421      X1422    X1423     X1424     X1425
## 1 -0.8638671 -0.7745459 -0.2408622 -0.7716046 1.885739 0.9696653 -1.996213
##       X1426     X1427      X1428      X1429      X1430     X1431     X1432
## 1 -1.001621 -1.160557 -0.7754123 -0.7335479 -0.6021617 -1.363594 0.3786881
##       X1433      X1434      X1435      X1436    X1437      X1438     X1439
## 1 0.3439277 -0.0413035 -0.1569037 -0.7379764 -1.40224 -0.3890353 -1.465162
##       X1440     X1441      X1442      X1443     X1444      X1445      X1446
```

```
## 1 0.3133675 -1.403473 -0.7306278 -0.7477649 -1.383213 0.06371548 -0.7950935
##       X1447     X1448   X1449     X1450      X1451      X1452      X1453
## 1 -1.067573 -1.807976 -1.4206 0.1064212 -0.1123899 -0.1159067 -0.9201383
##      X1454     X1455     X1456      X1457      X1458     X1459     X1460
## 1 -1.21793 -1.782319 0.2229979 -0.1397985 -0.5160193 -1.168542 -1.601203
##        X1461      X1462     X1463    X1464     X1465     X1466      X1467
## 1 -0.7680446 -0.8103865 -1.877812 1.570822 0.8255595 -1.636312 -0.2931099
##       X1468      X1469     X1470     X1471      X1472     X1473     X1474
## 1 -1.024681 -0.9075658 0.8759383 0.2660421 -0.3470763 0.1127575 0.2904884
##       X1475      X1476     X1477      X1478      X1479      X1480     X1481
## 1 -1.272742 -0.4736394 0.6108712 -0.5725764 -0.9304621 -0.4092996 -1.033984
##        X1482      X1483    X1484      X1485     X1486      X1487     X1488
## 1 -0.7694246 0.05282481 1.089793 -0.3826865 0.4406468 -0.1208833 -1.459924
##       X1489      X1490      X1491     X1492      X1493    X1494     X1495
## 1 -1.003575 -0.7758184 -0.1904853 -1.879753 -0.5515161 1.247923 0.6585851
##       X1496     X1497      X1498      X1499       X1500       X1501      X1502
## 1 -0.409204 -1.247372 -0.7126256 -0.8515795 -0.09171605 -0.03394161 -0.8395077
##       X1503     X1504     X1505     X1506       X1507      X1508      X1509
## 1 -1.362121 -1.073525 -2.015302 -0.460188 -0.08630757 0.04368605 -0.2389936
##          X1510       X1511    X1512     X1513     X1514      X1515      X1516
## 1 -0.004735256 -0.09286869 -1.18509 0.8916448 -1.554439 -0.7025334 -0.7583529
##        X1517     X1518      X1519      X1520      X1521      X1522      X1523
## 1 -0.7898284 -0.812424 -0.8545378 -0.8743479 -0.5581042 -0.5076378 -0.9549859
##       X1524     X1525    X1526     X1527     X1528       X1529      X1530
## 1 -1.600077 -0.526078 1.132934 -1.142959 0.4266442 -0.05108339 -0.4953563
##       X1531      X1532     X1533      X1534     X1535     X1536       X1537
## 1 -1.355018 -0.3435662 -1.412636 -0.9200273 -1.560507 -1.044066 -0.05979611
##        X1538     X1539      X1540      X1541      X1542     X1543     X1544
## 1 -0.6232879 -1.539858 -0.5284906 0.06441259 -0.1075965 -1.506677 0.2834569
##       X1545     X1546    X1547     X1548      X1549      X1550     X1551
## 1 0.4331024 -1.109578 -1.34966 -2.035119 -0.5593818 -0.8062358 -1.635954
##       X1552      X1553      X1554     X1555     X1556      X1557     X1558
## 1 -1.254687 -0.7627966 -0.4924848 -1.125541 0.1955753 -0.3137129 -1.429175
##       X1559     X1560      X1561     X1562     X1563      X1564      X1565
## 1 -1.259823 -1.456574 -0.8635533 -1.269985 -0.996901 -0.1557915 -0.5956846
##       X1566       X1567     X1568     X1569      X1570     X1571     X1572
## 1 -1.149513 -0.07298094 -1.053322 0.3445455 -0.8816095 -1.228329 -1.202621
##        X1573     X1574      X1575      X1576     X1577      X1578      X1579
## 1 -0.8892226 -1.249045 -0.5983107 -0.9877314 -1.042117 -0.7105962 -0.8233117
##       X1580    X1581     X1582      X1583      X1584    X1585      X1586
## 1 0.3972898 1.110252 -1.193479 -0.5842369 -0.6512919 1.576489 -0.7686924
##       X1587      X1588      X1589      X1590     X1591      X1592     X1593
## 1 -1.621207 -0.4460411 -0.4507812 -0.8838366 0.5836328 -0.6767071 -0.389747
##       X1594      X1595     X1596     X1597    X1598      X1599      X1600
## 1 -1.379107 -0.9383406 -1.086771 -1.237899 -1.97625 -0.3684187 -0.3266549
##        X1601      X1602     X1603     X1604      X1605     X1606      X1607
## 1 -0.4516575 -0.1615276 -1.462418 -1.949583 -0.4547342 -0.865548 -0.7720645
##        X1608      X1609     X1610     X1611   X1612     X1613      X1614
## 1 -0.6844709 -0.8043207 -1.248004 -1.215416 -1.6653 -1.512929 -0.2674963
##       X1615     X1616     X1617      X1618     X1619      X1620     X1621
## 1 -1.127265 -1.078503 -1.402481 -0.1178063 -1.367467 -0.3045348 -1.764844
##         X1622     X1623      X1624     X1625      X1626        X1627      X1628
## 1 -0.09821404 0.3507207 -0.8748193 -1.399285 0.04063587 -0.001253292 -0.3726428
##        X1629      X1630     X1631      X1632      X1633       X1634      X1635
```

```
## 1 -0.9851088 -0.7597407 -1.094785 -0.9278543 0.08902168 -0.09878843 0.04189268
##        X1636     X1637     X1638      X1639    X1640   X1641      X1642
## 1 -0.9744959 -1.357744 0.4705971 -0.7384296 -1.17963 -1.2463 -0.2745531
##        X1643      X1644     X1645  X1646      X1647     X1648    X1649
## 1 -0.5691722 -0.4172848 -1.652192 0.4375 -0.6019929 -1.440829 1.226183
##       X1650      X1651      X1652    X1653     X1654       X1655      X1656
## 1 0.1507545 -0.2763477 0.05133503 0.119779 -1.359285 -0.06854739 -0.7020515
##       X1657      X1658     X1659     X1660     X1661      X1662      X1663
## 1 0.2545661 -0.8270609 -1.254763 -1.060706 -1.005722 -0.5581399 -0.6182443
##       X1664       X1665        X1666    X1667      X1668    X1669      X1670
## 1 -0.986143 0.001160781 -0.001772997 1.571719 -0.4683745 -1.02911 -0.6898405
##       X1671       X1672     X1673      X1674     X1675      X1676      X1677
## 1 -2.398794 -0.02034632 -1.518931 -0.4817122 -0.759015 -0.1325726 -0.7443603
##       X1678      X1679      X1680     X1681      X1682       X1683      X1684
## 1 -1.031161 -0.8180594 -0.7074703 -1.121102 -0.1346909 -0.05445053 -0.8236143
##        X1685      X1686      X1687     X1688     X1689      X1690      X1691
## 1 -0.8075035 -0.5798154 -0.9180935 -1.001768 -1.030168 -0.7015893 -0.6511556
##       X1692    X1693      X1694     X1695     X1696      X1697    X1698
## 1 -1.134586 -1.28324 -0.5959351 0.6420719 -1.834219 -0.6966051 0.645039
##       X1699     X1700    X1701      X1702     X1703      X1704     X1705
## 1 -2.507076 -0.774419 1.037876 -0.9434758 -1.233561 -0.5667518 -1.584866
##        X1706      X1707     X1708      X1709      X1710      X1711      X1712
## 1 -0.4601723 -0.7690317 -1.814645 -0.3570093 -0.5931384 -0.2818613 -0.3032093
##        X1713     X1714     X1715      X1716     X1717    X1718      X1719
## 1 -0.7796152 -1.703692 -1.123583 -0.4428753 0.1065507 -1.17068 -0.6590355
##        X1720      X1721      X1722      X1723     X1724      X1725     X1726
## 1 -0.8326656 -0.5629176 -0.4588433 -0.2027522 -1.704656 -0.9097846 -1.179678
##      X1727      X1728      X1729     X1730      X1731     X1732     X1733
## 1 1.908224 -0.6782327 -0.5482447 -1.150436 -0.1731633 -1.084592 -1.348962
##        X1734     X1735    X1736     X1737     X1738     X1739     X1740
## 1 -0.4050914 -1.421614 1.699578 0.3086867 -1.230321 0.4779971 -1.340237
##         X1741      X1742      X1743     X1744     X1745      X1746     X1747
## 1 0.007919173 -0.5932633 -0.5173678 -1.095665 -1.446604 -0.5315823 -1.013517
##        X1748    X1749   X1750      X1751      X1752     X1753     X1754
## 1 -0.5994576 -1.05179 1.59279 -0.5876922 -0.6389073 -1.083287 -1.468255
##       X1755      X1756     X1757      X1758      X1759     X1760     X1761
## 1 -1.579951 -0.9222019 -1.598956 -0.5607808 -0.9760716 -0.995027 -0.380557
##        X1762     X1763      X1764      X1765      X1766      X1767      X1768
## 1 -0.7341017 -1.771291 -0.7187701 -0.4892142 -0.2878668 -0.6943934 -0.4560812
##       X1769     X1770     X1771     X1772     X1773     X1774      X1775
## 1 -1.109994 -1.048061 -1.173433 -1.584033 -0.530785 -1.817666 -0.3597681
##       X1776      X1777      X1778     X1779     X1780     X1781     X1782
## 1 -1.859798 -0.1376029 -0.3511498 -2.284365 -1.311759 -1.594682 -1.899895
##       X1783     X1784      X1785     X1786     X1787    X1788      X1789
## 1 0.5100054 -0.685145 -0.4998701 -1.811335 -1.916012 -2.38231 -0.2619253
##       X1790    X1791      X1792      X1793     X1794     X1795    X1796
## 1 -1.184503 2.684329 0.06811221 -0.9836847 -1.237148 -1.430645 -1.22103
##        X1797     X1798      X1799      X1800     X1801     X1802      X1803
## 1 -0.4018074 0.8240604 -0.3386542 -0.8155266 0.4441356 -1.320185 0.04523808
##        X1804     X1805     X1806      X1807     X1808      X1809     X1810
## 1 -0.1962524 -1.770919 -1.127114 -0.4428984 -0.726227 -0.7911894 -1.272061
##        X1811     X1812     X1813    X1814    X1815     X1816     X1817
## 1 -0.6976411 0.5328198 -0.330116 -1.62784 -2.20962 0.5326906 -1.028358
##        X1818     X1819     X1820      X1821     X1822      X1823     X1824
```

```
## 1 -0.3475101 0.7686568 -1.545463 -0.6185828 -1.134007 -0.9424668 -1.145416
##        X1825     X1826      X1827     X1828     X1829     X1830     X1831
## 1 -0.7679951 -2.038628 -0.3643403 -1.070545 -1.103436 -1.742015 0.2935554
##       X1832     X1833      X1834     X1835    X1836      X1837     X1838
## 1 -1.570405 -1.744019 -0.8446157 -2.001481 1.119694 -0.9879479 -1.390627
##       X1839      X1840      X1841     X1842     X1843     X1844     X1845
## 1 -1.443371 -0.7511736 -0.4410159 -1.278333 0.6230263 -0.731162 -1.657573
##        X1846      X1847     X1848     X1849     X1850     X1851      X1852
## 1 -0.3896813 -0.5248378 -1.057847 0.5263034 0.3000158 -1.167809 -0.7197911
##       X1853      X1854      X1855      X1856     X1857    X1858     X1859
## 1 -1.023249 -0.8583424 -0.4999108 -0.9781327 0.7594021 -1.84039 -0.898932
##       X1860      X1861      X1862     X1863     X1864     X1865      X1866
## 1 -2.165606 -0.9721825 -0.9916334 0.5094352 -2.031089 -1.575839 -0.7519221
##       X1867      X1868      X1869      X1870      X1871     X1872     X1873
## 1 -2.070206 -0.4853695 -0.2486064 -0.8860107 -0.1591085 -0.745864 0.8504776
##        X1874      X1875      X1876     X1877      X1878       X1879     X1880
## 1 -0.2417665 -0.4306584 -0.8962383 -1.134921 -0.8177362 -0.06002703 0.1575292
##        X1881      X1882     X1883      X1884     X1885     X1886     X1887
## 1 -0.8119142 -0.9340686 -1.204903 -0.9790395 -1.378874 -2.245341 -1.260573
##        X1888     X1889     X1890      X1891      X1892     X1893      X1894
## 1 -0.9408798 -1.607949 -1.296205 -0.1812231 -0.0717655 -1.294095 -0.4914837
##       X1895     X1896      X1897     X1898     X1899      X1900     X1901
## 1 -1.576626 -2.400446 -0.8876094 -1.086422 -1.293857 -0.9207908 -1.142037
##       X1902      X1903     X1904     X1905      X1906     X1907     X1908
## 1 -1.234856 -0.8608509 -1.776944 -2.718944 -0.3169261 -1.207868 -1.018739
##       X1909     X1910     X1911     X1912      X1913      X1914     X1915
## 1 -1.194077 -1.037287 -1.158136 -1.372855 -0.5962884 -0.6062776 -1.193962
##       X1916      X1917     X1918     X1919     X1920     X1921     X1922
## 1 -1.275139 -0.5702849 -1.022353 -1.135638 -2.074948 -1.586016 -1.181656
##       X1923     X1924     X1925      X1926     X1927     X1928      X1929
## 1 -1.067846 -1.468444 -2.095283 -0.8856531 -1.517834 -1.608881 -0.2653132
##        X1930     X1931     X1932      X1933     X1934     X1935     X1936
## 1 -0.6761839 -0.965145 -1.366105 -0.2896761 -0.492816 -1.977302 -1.383836
##        X1937     X1938      X1939     X1940      X1941     X1942     X1943
## 1 -0.9138815 -1.604886 -0.8378923 -1.454124 -0.4362448 -1.474507 -1.431748
##       X1944      X1945      X1946     X1947     X1948     X1949     X1950
## 1 -1.988876 -0.9121551 -0.9460532 -1.456008 -1.041672 -1.792779 -1.431174
##       X1951     X1952     X1953     X1954     X1955      X1956    X1957
## 1 -2.287603 0.1712958 -1.106578 -1.523087 -1.645777 -0.5577233 -1.39045
##        X1958       X1959      X1960     X1961      X1962     X1963      X1964
## 1 -0.5314312 -0.02851114 -0.8106189 -1.825788 -0.4140208 -1.217036 -0.7686388
##       X1965     X1966    X1967      X1968      X1969     X1970     X1971
## 1 -1.418581 -1.152263 1.979239 -0.9444605 -0.9311724 -1.431176 0.2625387
##        X1972     X1973     X1974     X1975     X1976     X1977    X1978
## 1 -0.2331457 -1.946624 0.8757369 -1.037066 -1.097046 -1.677406 -1.93882
##      X1979      X1980      X1981     X1982      X1983     X1984    X1985
## 1 -1.09294 -0.4501846 -0.5615329 -1.056125 -0.7217584 -1.983672 -1.42732
##       X1986     X1987     X1988     X1989      X1990      X1991     X1992
## 1 -1.878454 -1.131629 0.2351519 -1.831907 0.03403009 -0.7050278 -1.026668
##        X1993      X1994     X1995     X1996      X1997      X1998    X1999
## 1 -0.9833565 -0.5311039 -1.142698 -1.108899 -0.5203857 -0.3145187 -1.76419
##       X2000
## 1 -2.749956
```

```r
cat("In the Colon dataset we have :",ncol(colon),
"colunm and ",nrow(colon),"observations\n\n ")
```

```
## In the Colon dataset we have : 2001 colunm and  62 observations
##
##
```

```r
cat("The dimension of the output space is ",ncol(colon)-1,
    "and the response is the variable colon.y
    that is categorical with 2 level : '1' and '2'\n\n")
```

```
## The dimension of the output space is  2000 and the response is the variable colon.y
##     that is categorical with 2 level : '1' and '2'
```

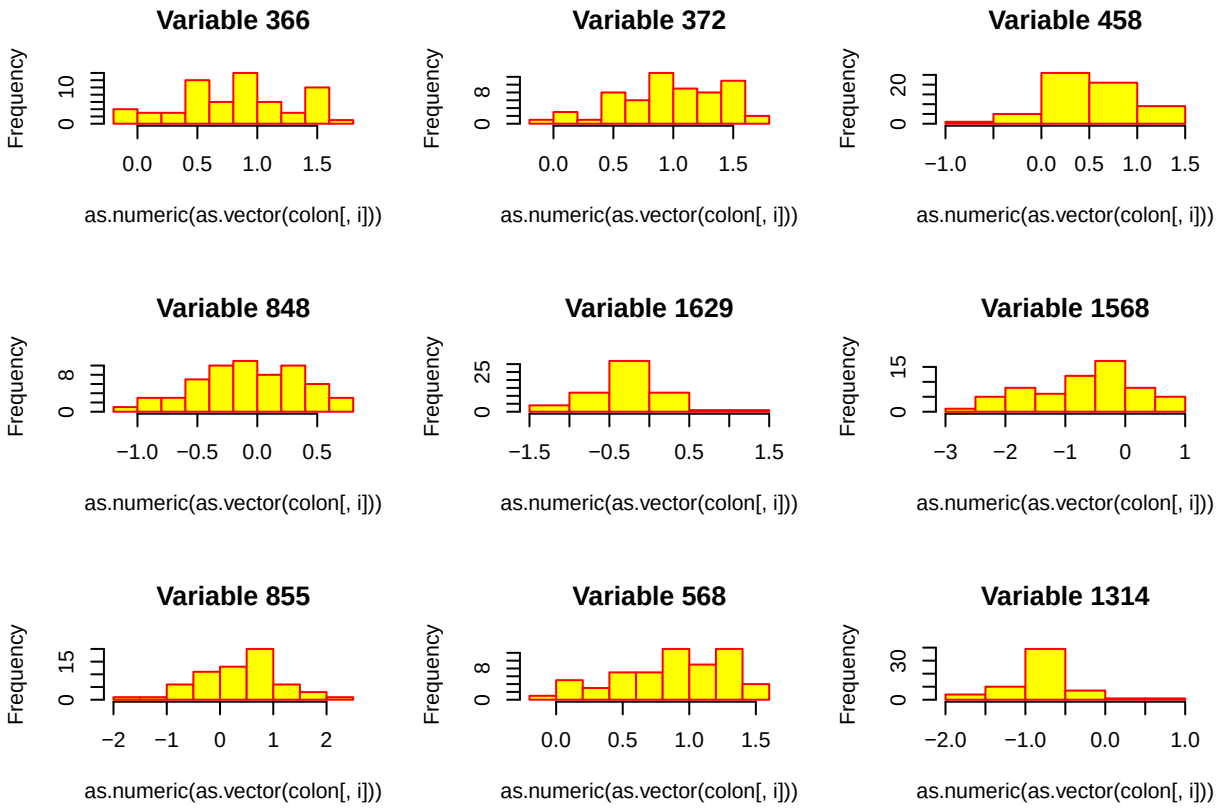
```r
cat(" We do not have acces to the dictionnary
    of the the dataset Colon.
    So I made an exploration of the dataset .
    I deduced that all the predictors are numeric
    so it's type homogenous.
    To know if  it is scale-homogenous i reseached the mean of
    the each predictor(colMean(colon)),
    then i inspected the distribution by ploting the boxplot
    and of course i looked at the outliers and the max was 3.330481.
    I concluded with my finding that it is scale-homogenous. \n\n" )
```

```
##  We do not have acces to the dictionnary
##     of the the dataset Colon.
##     So I made an exploration of the dataset .
##     I deduced that all the predictors are numeric
##     so it's type homogenous.
##     To know if  it is scale-homogenous i reseached the mean of
##     the each predictor(colMean(colon)),
##     then i inspected the distribution by ploting the boxplot
##     and of course i looked at the outliers and the max was 3.330481.
##     I concluded with my finding that it is scale-homogenous.
```

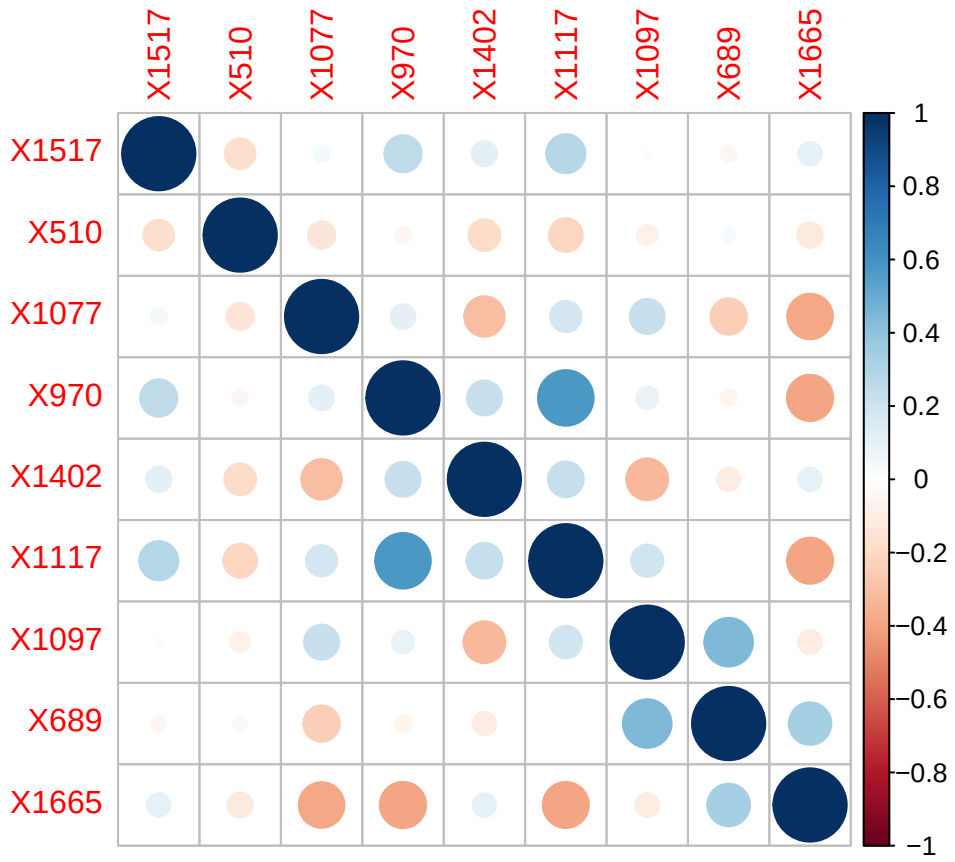
```r
cat("We have k=n/p=",nrow(colon)/ncol(colon)," .
    This is very less than 5 so this data set
    in term of size is very bad in context of hight dimensional setting")
```

```
## We have k=n/p= 0.03098451  .
##     This is very less than 5 so this data set
##     in term of size is very bad in context of hight dimensional setting
```

```r
par(mfrow=c(3,3))

set <- sample(2:(ncol(colon)),9)
for (i in set){
 hist(as.numeric(as.vector(colon[, i])),
      main = paste("Variable", i), col = "yellow", border = "red")
}
```




```
par(mfrow=c(1,1))
corrplot(cor(colon[,sample(2:ncol(colon),9)]))
```




```
cat("More is level more is the relation of corelation")
```

```
## More is level more is the relation of corelation
```