Actividad1.5

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1. Considere la matriz de datos siguiente:

```
b = matrix(c(1,1,1),ncol=3)
b2 = matrix(c(1,2,-3),ncol=3)
x = matrix(c(1,6,8,4,2,3,3,6,3),ncol=3)
trans_X = t(x)
y1 = b%*%trans_X
y2 = b2%*%trans_X
y1
```

```
##      [,1] [,2] [,3]
## [1,]    8   14   14
```

```
y2
```

```
##      [,1] [,2] [,3]
## [1,]    0   -8    5
```

```
x = matrix(c(1,6,8,4,2,3,3,6,3),ncol=3)
A = matrix(c(1,1,1,1,2,-3),ncol=2)
y = x%*%A
y
```

```
##      [,1] [,2]
## [1,]    8    0
## [2,]   14   -8
## [3,]   14    5
```

a)

```
mean(y)
```

```
## [1] 5.5
```

```
covar = cov(y)
covar
```

```
##      [,1] [,2]
## [1,]   12   -3
## [2,]   -3   43
```

```
lambda = eigen(covar)
lambda$values
```

```
## [1] 43.28765 11.71235
```

```
lambda$vector
```

```
##             [,1]        [,2]
```

```
## [1,] -0.09544671 -0.99543454
## [2,]  0.99543454 -0.09544671
```

```
det(covar)
```

```
## [1] 507
```

b)

```
mean(x)
```

```
## [1] 4
```

```
covar = var(x)
covar
```

```
##      [,1] [,2] [,3]
## [1,] 13.0 -2.5  1.5
## [2,] -2.5  1.0 -1.5
## [3,]  1.5 -1.5  3.0
```

```
det(covar)
```

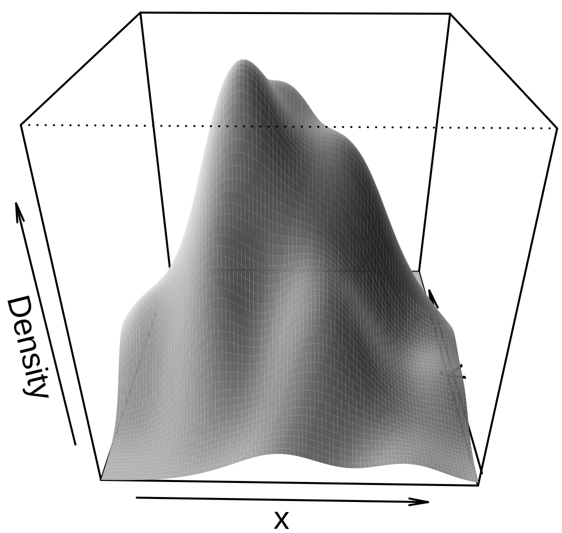
```
## [1] 0
```

c) Argumentar acerca si X es independiente, y si Y es independiente.

La X es independiente dado que el determinante de la matriz de covarianzas y varianzas es 0, y Y es dependiente dado que el determinante es diferente a 0

2. Explore los resultados del siguiente código e dé una interpretación (se sugiere intersertarlo en un trozo de R en Rmarkdown para que dé varias ventanas de salida de resutados):

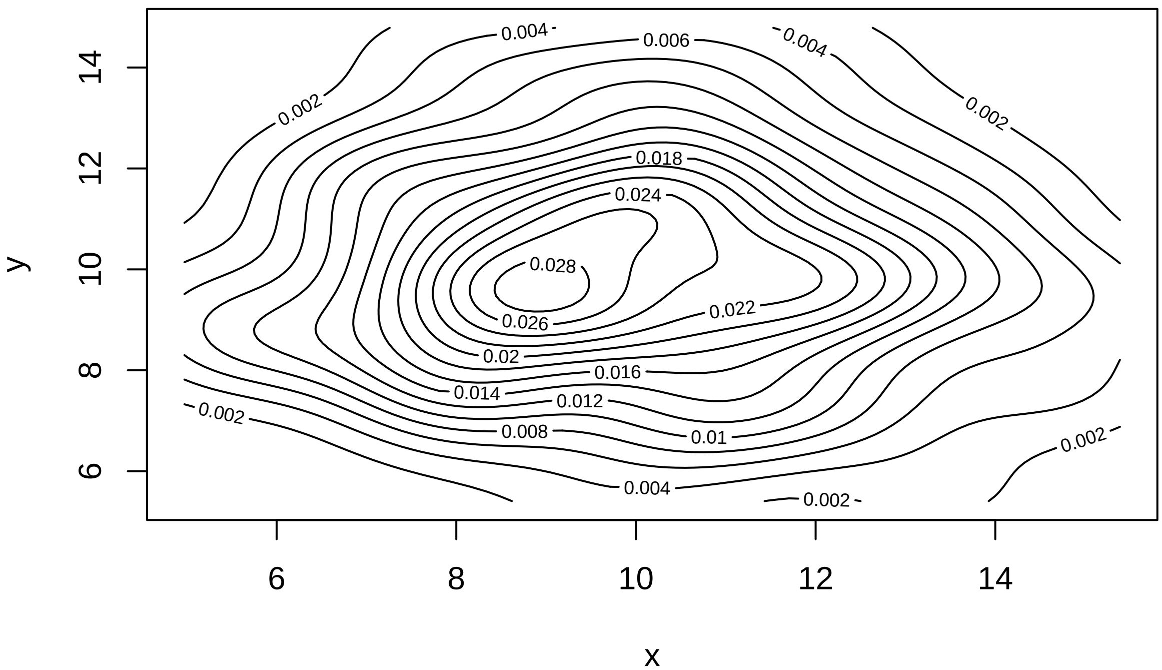
```
library(MVN)
x = rnorm(100, 10, 2)
y = rnorm(100, 10, 2)
datos = data.frame(x,y)
mvn(datos, mvnTest = "mardia", multivariatePlot = "persp")
```




```
## $multivariateNormality
##              Test          Statistic           p value Result
## 1 Mardia Skewness  3.51384939469087 0.475775640699713    YES
## 2 Mardia Kurtosis -1.42016125515096 0.155560740496252    YES
```

```
## 3           MVN              <NA>             <NA>    YES
##
## $univariateNormality
##              Test  Variable Statistic   p value Normality
## 1 Anderson-Darling     x        0.1880    0.9002    YES
## 2 Anderson-Darling     y        0.2877    0.6126    YES
##
## $Descriptives
##     n      Mean  Std.Dev    Median      Min      Max     25th     75th
## x 100 10.024041 2.264714 10.038110 4.973660 15.38756 8.365605 11.55620
## y 100  9.996865 1.987522  9.798057 5.408566 14.78589 8.672555 11.28882
##        Skew   Kurtosis
## x 0.1061944 -0.4363747
## y 0.1981419 -0.2994816
```

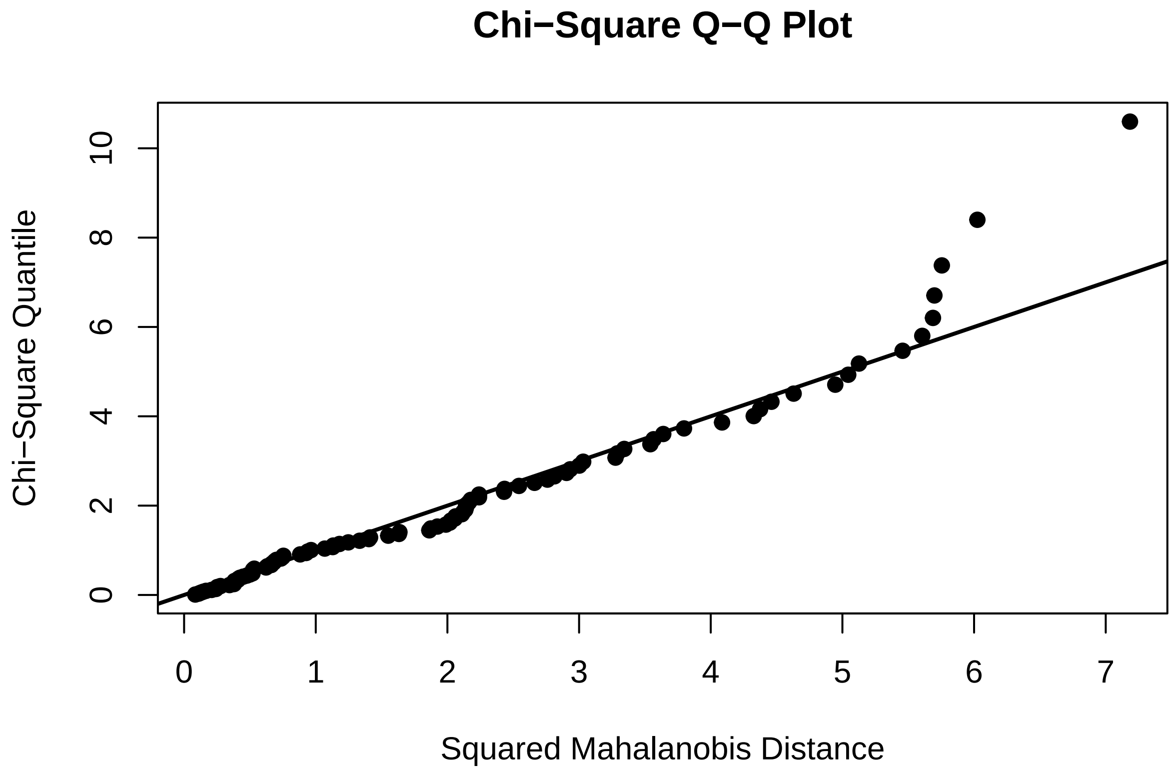
```r
mvn(datos, mvnTest = "mardia", multivariatePlot = "contour")
```




```
## $multivariateNormality
##             Test         Statistic           p value Result
## 1 Mardia Skewness  3.51384939469087 0.475775640699713    YES
## 2 Mardia Kurtosis -1.42016125515096 0.155560740496252    YES
## 3           MVN              <NA>             <NA>    YES
##
## $univariateNormality
##              Test  Variable Statistic   p value Normality
## 1 Anderson-Darling     x        0.1880    0.9002    YES
## 2 Anderson-Darling     y        0.2877    0.6126    YES
##
## $Descriptives
##     n      Mean  Std.Dev    Median      Min      Max     25th     75th
## x 100 10.024041 2.264714 10.038110 4.973660 15.38756 8.365605 11.55620
## y 100  9.996865 1.987522  9.798057 5.408566 14.78589 8.672555 11.28882
##        Skew   Kurtosis
```

```
## x 0.1061944 -0.4363747
## y 0.1981419 -0.2994816
```

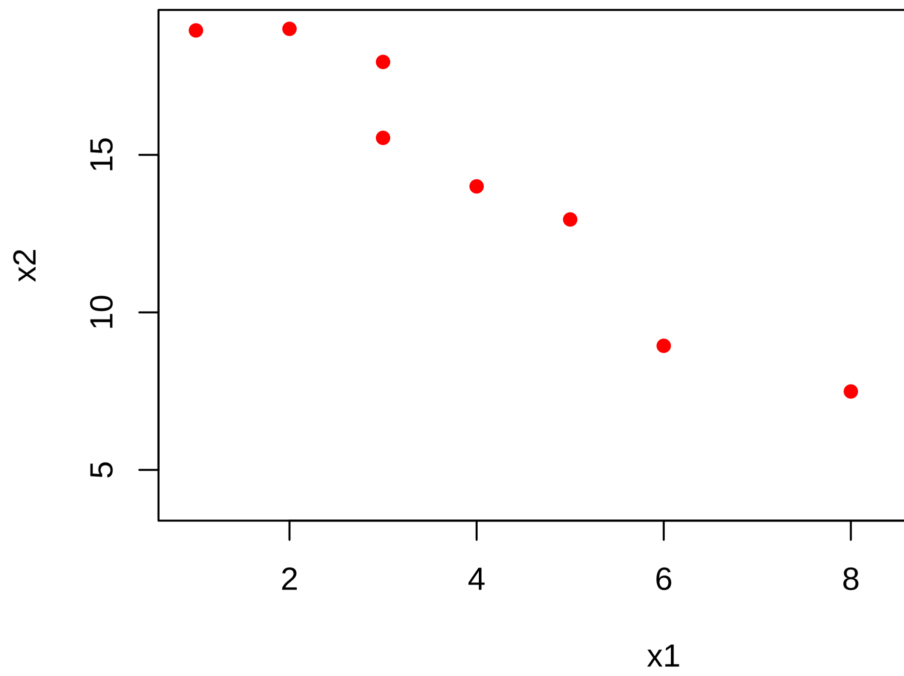
```r
mvn(datos, mvnTest = "mardia", multivariatePlot = "qq")
```




```
## $multivariateNormality
##              Test          Statistic           p value Result
## 1 Mardia Skewness   3.51384939469087 0.475775640699713    YES
## 2 Mardia Kurtosis -1.42016125515096 0.155560740496252    YES
## 3             MVN               <NA>              <NA>    YES
##
## $univariateNormality
##              Test  Variable Statistic   p value Normality
## 1 Anderson-Darling     x        0.1880    0.9002    YES
## 2 Anderson-Darling     y        0.2877    0.6126    YES
##
## $Descriptives
##     n      Mean  Std.Dev    Median      Min      Max     25th     75th
## x 100 10.024041 2.264714 10.038110 4.973660 15.38756 8.365605 11.55620
## y 100  9.996865 1.987522  9.798057 5.408566 14.78589 8.672555 11.28882
##        Skew   Kurtosis
## x 0.1061944 -0.4363747
## y 0.1981419 -0.2994816
```

3. Un periódico matutino enumera los siguientes precios de autos usados para un compacto extranjero con edad medida en años y precio en venta medido en miles de dólares.

```r
x1 = c(1, 2, 3, 3, 4, 5, 6, 8, 9, 11)
x2 = c(18.95, 19.00, 17.95, 15.54, 14.00, 12.95, 8.94, 7.49, 6.00, 3.99)
plot(x1, x2, pch = 16, col = "red")
```



a) Construya un diagrama de dispersión

b) Inferir el signo de la covarianza muestral a partir del gráfico. Observador los datos, podemos inferir que la covarianza sera negativa.

```
df = data.frame(x1, x2)
names(df)
```

c) Calcular el cuadrado de las distancias estadísticas (Malhalanobis)

```
## [1] "x1" "x2"
```

```
vm = apply(df, 2, mean)
vm
```

```
##     x1     x2
##  5.200 12.481
```

```
df_cov = cov(df)
df_cov
```

```
##           x1        x2
## x1  10.62222 -17.71022
## x2 -17.71022  30.85437
```

```
dm = mahalanobis(df, vm, df_cov)
dm
```

```
##  [1] 1.8753045 2.0203262 2.9009088 0.7352659 0.3105192 0.0176162 3.7329012
##  [8] 0.8165401 1.3753379 4.2152799
```

```
x = matrix(c(x1, x2), ncol = 2)
x
```

d) Usando las anteriores distancias, determine la proporción de las observaciones que caen dentro del contorno de probabilidad estimado del 50% de una distribución normal bivariada.

```
##       [,1]  [,2]
##  [1,]    1 18.95
##  [2,]    2 19.00
##  [3,]    3 17.95
##  [4,]    3 15.54
##  [5,]    4 14.00
##  [6,]    5 12.95
##  [7,]    6  8.94
##  [8,]    8  7.49
##  [9,]    9  6.00
## [10,]   11  3.99
```

```
sort(dm)
```

```
##  [1] 0.0176162 0.3105192 0.7352659 0.8165401 1.3753379 1.8753045 2.0203262
##  [8] 2.9009088 3.7329012 4.2152799
```

```
qchisq(0.5, 2)
```

```
## [1] 1.386294
```