Exercice de cours

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```r
help(matrix)
m = matrix(data = c(2,5,2,1,0,0,1,4,3,1),nrow = 5, ncol = 2)
m
```

```
##      [,1] [,2]
## [1,]    2    0
## [2,]    5    1
## [3,]    2    4
## [4,]    1    3
## [5,]    0    1
```

```r
X  = prop.table(m)
Y = matrix(,nrow = 5, ncol = 2)
for(i in 1:5)
  for(j in 1:2)
    Y[i,j] = X[i,j] / sqrt(sum(X[i,]) * sum(X[,j]))
Y
```

```
##           [,1]      [,2]
## [1,] 0.4472136 0.0000000
## [2,] 0.6454972 0.1360828
## [3,] 0.2581989 0.5443311
## [4,] 0.1581139 0.5000000
## [5,] 0.0000000 0.3333333
```

```r
R = t(Y) %*% Y
R
```

```
##           [,1]      [,2]
## [1,] 0.7083333 0.3074437
## [2,] 0.3074437 0.6759259
```

```r
Z = Y %*% t(Y)
Z
```

```
##            [,1]       [,2]      [,3]       [,4]       [,5]
## [1,] 0.20000000 0.28867513 0.1154701 0.07071068 0.00000000
## [2,] 0.28867513 0.43518519 0.2407407 0.17010345 0.04536092
## [3,] 0.11547005 0.24074074 0.3629630 0.31299036 0.18144368
## [4,] 0.07071068 0.17010345 0.3129904 0.27500000 0.16666667
## [5,] 0.00000000 0.04536092 0.1814437 0.16666667 0.11111111
```

```r
eigen(R)
```

```
## eigen() decomposition
## $values
## [1] 1.0000000 0.3842593
##
## $vectors
##            [,1]      [,2]
## [1,] -0.7254763  0.6882472
```

```
## [2,] -0.6882472 -0.7254763
```

```r
eigen(Z)
```

```
## eigen() decomposition
## $values
## [1]  1.000000e+00  3.842593e-01  4.440892e-16  2.775558e-17 -1.387779e-17
##
## $vectors
##             [,1]       [,2]        [,3]        [,4]        [,5]
## [1,] -0.3244428  0.4965320  0.80510420  0.00000000  0.0000000
## [2,] -0.5619515  0.5574195 -0.57023402  0.05525223  0.2127777
## [3,] -0.5619515 -0.3503780 -0.01036789 -0.60946993 -0.4357576
## [4,] -0.4588315 -0.4096180  0.06772278  0.76969395 -0.1570719
## [5,] -0.2294157 -0.3901124  0.14814359 -0.18183733  0.8603310
```