Exercise-6.R

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###Exercise 6  
  
remove(list = ls())  
  
### a)  
A = matrix(c(13,-4,2,-4,13,-2,2,-2,10),3,3)  
EA = eigen(A)  
lamEA = EA$values  
  
###Eigenvalue matrix  
m\_lamEA = matrix(c(18,0,0,0,9,0,0,0,9),3,3)  
m\_lamEA

## [,1] [,2] [,3]  
## [1,] 18 0 0  
## [2,] 0 9 0  
## [3,] 0 0 9

###Eigenvector matrix  
eiVA = EA$vectors  
eiVA

## [,1] [,2] [,3]  
## [1,] 0.6666667 -0.7453560 0.0000000  
## [2,] -0.6666667 -0.5962848 0.4472136  
## [3,] 0.3333333 0.2981424 0.8944272

###sectral decompostion  
eiVA%\*%m\_lamEA%\*%t(eiVA)

## [,1] [,2] [,3]  
## [1,] 13 -4 2  
## [2,] -4 13 -2  
## [3,] 2 -2 10

###Wie zu erwarten entspreicht das Ergebnis der sectral decomposition der Matrix.  
  
### b)  
  
eiEA1 = EA$vectors[,1]  
eiEA2 = EA$vectors[,2]  
eiEA3 = EA$vectors[,3]  
  
### i)  
lamEA[1]\*eiEA1%\*%t(eiEA1)

## [,1] [,2] [,3]  
## [1,] 8 -8 4  
## [2,] -8 8 -4  
## [3,] 4 -4 2

### ii)  
lamEA[1]\*eiEA1%\*%t(eiEA1)+lamEA[2]\*eiEA2%\*%t(eiEA2)

## [,1] [,2] [,3]  
## [1,] 13 -4.0 2.0  
## [2,] -4 11.2 -5.6  
## [3,] 2 -5.6 2.8

### iii)  
lamEA[1]\*eiEA1%\*%t(eiEA1)+lamEA[2]\*eiEA2%\*%t(eiEA2)+lamEA[3]\*eiEA3%\*%t(eiEA3)

## [,1] [,2] [,3]  
## [1,] 13 -4 2  
## [2,] -4 13 -2  
## [3,] 2 -2 10

### c)  
sqm\_lamEA = sqrt(matrix(c(18,0,0,0,9,0,0,0,9),3,3))  
sqm\_A = eiVA%\*%sqm\_lamEA%\*%t(eiVA)  
sqm\_A

## [,1] [,2] [,3]  
## [1,] 3.5522847 -0.5522847 0.2761424  
## [2,] -0.5522847 3.5522847 -0.2761424  
## [3,] 0.2761424 -0.2761424 3.1380712