Actividad 1

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Actividad 1.1

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1) Dadas las siguientes matrices:

```
A = matrix(c(2,0,9,4,-2,0,-3,5,6), ncol =3)
B = matrix(c(8, 6, -2, -7,9,-5,-3,5,1),ncol = 3)
A
```

```
##      [,1] [,2] [,3]
## [1,]    2    4   -3
## [2,]    0   -2    5
## [3,]    9    0    6
```

```
B
```

```
##      [,1] [,2] [,3]
## [1,]    8   -7   -3
## [2,]    6    9    5
## [3,]   -2   -5    1
```

a) A + B

```
A+B
```

```
##      [,1] [,2] [,3]
## [1,]   10   -3   -6
## [2,]    6    7   10
## [3,]    7   -5    7
```

b) 4A +3B

```
4*A + 3*B
```

```
##      [,1] [,2] [,3]
## [1,]   32   -5  -21
## [2,]   18   19   35
## [3,]   30  -15   27
```

c) A´

```
transpuestA <- t(A)
transpuestA
```

```
##      [,1] [,2] [,3]
## [1,]    2    0    9
## [2,]    4   -2    0
## [3,]   -3    5    6
```

d) A^-1

```
inversA <- solve(A)
inversA
```

```
##            [,1]       [,2]        [,3]
## [1,] -0.1176471 -0.2352941  0.13725490
## [2,]  0.4411765  0.3823529 -0.09803922
## [3,]  0.1764706  0.3529412 -0.03921569
```

e. El determinante de A y A^-1

```
detA <- det(A)
detA
```

```
## [1] 102
```

```
detIA <- det(inversA)
detIA
```

```
## [1] 0.009803922
```

f. El determinante de B y B^-1

```
detB <- det(B)
detB
```

```
## [1] 420
```

```
inversB <- solve(B)
detIB <- det(inversB)
detIB
```

```
## [1] 0.002380952
```

2) Dadas las siguientes matrices:

Calcula el producto matricial CD

```
C = matrix(c(2,1,3,-3,3,0,-2,-1,4,5,0,-5),ncol=4)
D = matrix(c(4,2,-3,1,5,-2,8,0),ncol=2)
C%*%D
```

```
##      [,1] [,2]
## [1,]   13    0
## [2,]   13   -9
## [3,]   -5   47
```

3) Baja el archivo del menú de McDonald:

Explora las variables y selecciona 4 variables cuantitativas de tu interés.

Calcula:

```
M = read.csv("mc-donalds-menu.csv")
names(M)
```

```
##  [1] "Category"                      "Item"
##  [3] "Serving.Size"                  "Calories"
##  [5] "Calories.from.Fat"             "Total.Fat"
##  [7] "Total.Fat....Daily.Value."     "Saturated.Fat"
##  [9] "Saturated.Fat....Daily.Value." "Trans.Fat"
## [11] "Cholesterol"                   "Cholesterol....Daily.Value."
## [13] "Sodium"                        "Sodium....Daily.Value."
## [15] "Carbohydrates"                 "Carbohydrates....Daily.Value."
## [17] "Dietary.Fiber"                 "Dietary.Fiber....Daily.Value."
## [19] "Sugars"                        "Protein"
## [21] "Vitamin.A....Daily.Value."     "Vitamin.C....Daily.Value."
## [23] "Calcium....Daily.Value."       "Iron....Daily.Value."
```

```
M1 = M[,c(4,11,13,19)]
M1
```

```
##     Calories Cholesterol Sodium Sugars
## 1        300         260    750      3
## 2        250          25    770      3
## 3        370          45    780      2
## 4        450         285    860      2
## 5        400          50    880      2
## 6        430         300    960      3
## 7        460         250   1300      3
## 8        520         250   1410      4
## 9        410          35   1300      3
## 10       470          35   1420      4
## 11       430          30   1080      2
## 12       480          30   1190      3
## 13       510         250   1170      2
## 14       570         250   1280      3
## 15       460          35   1180      3
## 16       520          35   1290      3
## 17       410          30   1180      3
## 18       470          30   1290      4
## 19       540         280   1470      3
## 20       460         250   1250     15
## 21       400          35   1250     16
## 22       420          35   1030     15
## 23       550         265   1320     15
## 24       500          50   1320     15
## 25       620         275   1480      7
```

```
## 26       570          60   1480      8
## 27       670         295   1510      7
## 28       740         555   1560      3
## 29       800         555   1680      3
## 30       640          35   1590      3
## 31       690          35   1700      4
## 32      1090         575   2150     17
## 33      1150         575   2260     17
## 34       990          55   2170     17
## 35      1050          55   2290     18
## 36       350          20    590     14
## 37       520          50    930     14
## 38       300         115    790      2
## 39       150           0    310      0
## 40       460          15    370     32
## 41       290           5    160     32
## 42       260           5    115     18
## 43       530          85    960      9
## 44       520          95   1100     10
## 45       600         105   1440     12
## 46       610         105   1180     10
## 47       540          85    960      9
## 48       750         160   1280     10
## 49       240          30    480      6
## 50       290          45    680      7
## 51       430          90   1040      7
## 52       720         115   1470     14
## 53       380          75    840      7
## 54       440          90   1110      7
## 55       430          80    760      7
## 56       430          80   1030      6
## 57       500          70    980     11
## 58       510          45    990     10
## 59       350          65    820      8
## 60       670          85   1410     11
## 61       510         105   1250      9
## 62       610          70   1400     11
## 63       450          90   1230      9
## 64       750          90   1720     16
## 65       590         110   1560     14
## 66       430          45    910      7
## 67       360          35    800      5
## 68       480          65   1260      6
## 69       430          50   1260      6
## 70       360          35    990      5
## 71       630          80   1540      7
## 72       480          95   1370      6
## 73       610          65   1340      8
## 74       450          80   1170      6
## 75       670          60   1480     12
```

```
## 76       520          80   1320     10
## 77       540          50   1260     14
## 78       380          65   1090     12
## 79       190          25    360      0
## 80       280          40    540      0
## 81       470          65    900      0
## 82       940         135   1800      0
## 83      1880         265   3600      1
## 84       390          40    590      5
## 85       140          25    300      4
## 86       380          70    860      5
## 87       220          85    690      4
## 88       140          10    150      6
## 89       450          50    850     12
## 90       290          70    680     10
## 91       340          30    780      8
## 92       260          40    700      7
## 93       330          35    730      3
## 94       250          45    650      2
## 95       360          40    810      3
## 96       280          45    720      2
## 97       230           0    130      0
## 98       340           0    190      0
## 99       510           0    290      0
## 100      110           0     65      0
## 101       20           0     10      2
## 102       15           0      0      3
## 103      150           5     70     23
## 104      250           0    170     13
## 105      160          10     90     15
## 106      150          10    135     13
## 107       45           5     20      6
## 108      330          25    170     48
## 109      340          30    150     43
## 110      280          25     85     45
## 111      140           0      0     39
## 112      200           0      5     55
## 113      280           0      5     76
## 114      100           0      0     28
## 115        0           0     10      0
## 116        0           0     20      0
## 117        0           0     35      0
## 118        0           0     15      0
## 119      140           0     45     35
## 120      190           0     65     51
## 121      270           0     90     70
## 122      100           0     30     26
## 123        0           0     70      0
## 124        0           0    100      0
## 125        0           0    140      0
```

```
## 126        0           0     50      0
## 127      140           0     30     37
## 128      200           0     45     54
## 129      280           0     60     74
## 130      100           0     25     27
## 131      100          10    125     12
## 132      130           5    135     22
## 133       80           0     15     19
## 134      150           0      0     30
## 135      190           0      0     39
## 136      280           0      5     58
## 137        0           0      0      0
## 138        0           0     10      0
## 139        0           0     10      0
## 140        0           0     15      0
## 141        0           0      5      0
## 142      150           0     10     36
## 143      180           0     10     45
## 144      220           0     10     54
## 145      110           0      5     27
## 146        0           0      0      0
## 147        0           0      0      0
## 148        0           0      0      0
## 149      170          25    115     12
## 150      210          30    140     15
## 151      280          40    180     20
## 152      270          25    115     38
## 153      340          30    140     48
## 154      430          40    180     59
## 155      270          25    115     38
## 156      330          30    140     47
## 157      430          40    180     58
## 158      260          25    115     36
## 159      330          30    140     45
## 160      420          40    190     56
## 161      210          25    150     12
## 162      260          30    190     15
## 163      330          40    240     20
## 164      100           5    110     13
## 165      130           5    135     16
## 166      170          10    180     21
## 167      200           5    110     39
## 168      250           5    135     48
## 169      310          10    180     59
## 170      200           5    110     38
## 171      250           5    135     48
## 172      310          10    180     59
## 173      190           5    115     37
## 174      240           5    140     46
## 175      300          10    180     56
```

```
## 176      140           5    150     13
## 177      170           5    180     16
## 178      220          10    240     21
## 179      340          35    150     42
## 180      410          40    190     53
## 181      500          50    240     63
## 182      270          15    150     43
## 183      330          15    190     53
## 184      390          20    240     64
## 185      320          35    170     40
## 186      390          40    220     50
## 187      480          50    270     60
## 188      250          15    170     41
## 189      310          15    210     51
## 190      370          20    270     61
## 191      360          40    180     45
## 192      440          50    220     56
## 193      540          60    280     68
## 194      280          15    180     46
## 195      340          15    220     57
## 196      400          20    280     69
## 197      140          15     35     22
## 198      190          25     50     30
## 199      270          35     75     45
## 200      130          15     35     21
## 201      180          25     50     28
## 202      260          35     65     42
## 203      130          15     35     20
## 204      180          25     50     28
## 205      250          35     75     41
## 206      120          15     40     19
## 207      170          25     55     26
## 208      240          35     80     39
## 209       80          15     65      1
## 210      120          25     90      2
## 211      160          35    135      2
## 212      290          35    125     34
## 213      350          40    150     43
## 214      480          50    220     62
## 215      240          20    125     35
## 216      290          20    150     43
## 217      390          25    220     62
## 218      280          35    140     33
## 219      340          40    170     41
## 220      460          50    250     59
## 221      230          20    140     33
## 222      270          20    170     41
## 223      370          25    250     59
## 224      450          65    125     57
## 225      550          75    160     71
```

```
## 226      670          90    190     88
## 227      450          65    125     57
## 228      550          80    160     71
## 229      670          95    190     88
## 230      530          65    135     67
## 231      630          80    160     81
## 232      760          95    200     99
## 233      220           5     40     44
## 234      260           5     50     54
## 235      340           5     65     70
## 236      210           5     50     44
## 237      250           5     60     54
## 238      330           5     80     70
## 239      210           5     40     46
## 240      260           5     45     56
## 241      340           5     60     72
## 242      530          60    160     63
## 243      660          75    200     81
## 244      820          90    260    101
## 245      550          60    160     79
## 246      690          75    210    100
## 247      850          90    260    123
## 248      560          60    240     77
## 249      700          75    300     97
## 250      850          85    380    120
## 251      660          75    210     93
## 252      820          90    260    115
## 253      650          50    180     89
## 254      930          75    260    128
## 255      430          35    120     59
## 256      510          45    280     64
## 257      690          55    380     85
## 258      340          30    190     43
## 259      810          60    400    103
## 260      410          30    200     51
```

a. El vector de medias,

```
Medias =
c(mean(M1$Calories),mean(M1$Cholesterol),mean(M1$Sodium),mean(M1$Sugars))
Medias
```

```
## [1] 368.26923  54.94231 495.75000  29.42308
```

b. La matriz de varianzas y covarianzas

```
varianza = var(M1)
covarianza = cov(M1)
varianza
```

```
##              Calories Cholesterol     Sodium     Sugars
## Calories    57729.618   12505.402  98755.936  1788.8625
## Cholesterol 12505.402    7615.923  31440.777  -339.1840
## Sodium      98755.936   31440.777 332959.377 -7058.7355
## Sugars       1788.862    -339.184  -7058.736   822.5307

covarianza

##              Calories Cholesterol     Sodium     Sugars
## Calories    57729.618   12505.402  98755.936  1788.8625
## Cholesterol 12505.402    7615.923  31440.777  -339.1840
## Sodium      98755.936   31440.777 332959.377 -7058.7355
## Sugars       1788.862    -339.184  -7058.736   822.5307
```

c. La matriz de correlación

```
cor(M1)

##              Calories Cholesterol     Sodium     Sugars
## Calories    1.0000000   0.5963992  0.7123087  0.2595981
## Cholesterol 0.5963992   1.0000000  0.6243619 -0.1355183
## Sodium      0.7123087   0.6243619  1.0000000 -0.4265355
## Sugars      0.2595981  -0.1355183 -0.4265355  1.0000000
```

d. Calcula los eigen vectores (vectores propios) y eigen valores (valores propios) de la matriz de varianzas y covarianzas.

```
cat("Eigen valor y eigen vector de la varianza")

## Eigen valor y eigen vector de la varianza

eVar <- eigen(varianza)
eVar$values

## [1] 367994.9168  26772.9957   4222.6140    136.9233

eVar$vector

##             [,1]       [,2]        [,3]        [,4]
## [1,] -0.30526013  0.9343751  0.12067791 -0.13855026
## [2,] -0.09327546  0.1012320 -0.99014472  0.02579126
## [3,] -0.94754060 -0.3083759  0.05928708  0.05963348
## [4,]  0.01681501  0.1469676  0.03918305  0.98822188

cat("\n Eigen valor y eigen vector de la covarianza")

##
##  Eigen valor y eigen vector de la covarianza

eCov <- eigen(covarianza)
eCov$values

## [1] 367994.9168  26772.9957   4222.6140    136.9233
```

```
eCov$vector
```

```
##             [,1]       [,2]        [,3]        [,4]
## [1,] -0.30526013  0.9343751  0.12067791 -0.13855026
## [2,] -0.09327546  0.1012320 -0.99014472  0.02579126
## [3,] -0.94754060 -0.3083759  0.05928708  0.05963348
## [4,]  0.01681501  0.1469676  0.03918305  0.98822188
```

4. Hallar la descomposición espectral de A

```
ev <- eigen(A)
# extract components
(L <- ev$values)
```

```
## [1] 5.294566+0.000i 0.352717+4.375i 0.352717-4.375i
```

```
(V <- ev$vectors)
```

```
##                [,1]                  [,2]                  [,3]
## [1,] -0.06451703+0i  0.4461355+0.1983057i  0.4461355-0.1983057i
## [2,]  0.56419753+0i -0.6191151+0.0000000i -0.6191151+0.0000000i
## [3,]  0.82311524+0i -0.2913205-0.5417257i -0.2913205+0.5417257i
```

```
A1 = L[1] * V[,1] %*% t(V[,1])
A1
```

```
##                [,1]          [,2]          [,3]
## [1,]  0.02203835+0i -0.1927241+0i -0.2811677+0i
## [2,] -0.19272406+0i  1.6853602+0i  2.4587944+0i
## [3,] -0.28116768+0i  2.4587944+0i  3.5871677+0i
```

```
A2 = L[2] * V[,2] %*% t(V[,2])
A2
```

```
##                        [,1]                [,2]                [,3]
## [1,] -0.7177901+0.7611494i  0.439713-1.251720i  1.302159-0.204240i
## [2,]  0.4397129-1.2517199i  0.135198+1.676953i -1.403718+0.907377i
## [3,]  1.3021589-0.2042398i -1.403718+0.907377i -1.454465-0.801293i
```

```
A3 = L[3] * V[,3] %*% t(V[,3])
A3
```

```
##                        [,1]                [,2]                [,3]
## [1,] -0.7177901-0.7611494i  0.439713+1.251720i  1.302159+0.204240i
## [2,]  0.4397129+1.2517199i  0.135198-1.676953i -1.403718-0.907377i
## [3,]  1.3021589+0.2042398i -1.403718-0.907377i -1.454465+0.801293i
```

```
A1 + A2 + A3
```

```
##               [,1]          [,2]          [,3]
## [1,] -1.4135419+0i  0.6867016+0i  2.3231501+0i
## [2,]  0.6867016+0i  1.9557555+0i -0.3486407+0i
## [3,]  2.3231501+0i -0.3486407+0i  0.6782379+0i
```