Ejercicios Día 3

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1. Dataframes

***Busca los datasets "beaver1" y "beaver2" que contienen información sobre la temperatura corporal de dos castores. Añade una columna llamada "ID" al dataset beaver1 que tenga siempre el valor 1. De forma similar añade una columna "ID" al dataset beaver2 que tenga siempre el valor 2. A continuación concatena de forma vertical los dos dataframes y busca el subset de datos donde ambos Castores están activos.**

```
ID = rep(1,nrow(beaver1))
beaver1 = cbind(beaver1,ID)
ID = rep(2,nrow(beaver2))
beaver2 = cbind(beaver2,ID)
beaver = rbind.data.frame(beaver1,beaver2)
beaver[beaver[,"activ"] == 1,]
```

```
##     day time  temp activ ID
## 54  346 1730 37.07     1  1
## 68  346 1950 37.10     1  1
## 80  346 2150 37.53     1  1
## 83  346 2230 37.25     1  1
## 86  346 2300 37.24     1  1
## 114 347  340 37.15     1  1
## 153 307 1550 37.98     1  2
## 154 307 1600 38.02     1  2
## 155 307 1610 38.00     1  2
## 156 307 1620 38.24     1  2
## 157 307 1630 38.10     1  2
## 158 307 1640 38.24     1  2
## 159 307 1650 38.11     1  2
## 160 307 1700 38.02     1  2
## 161 307 1710 38.11     1  2
## 162 307 1720 38.01     1  2
## 163 307 1730 37.91     1  2
## 164 307 1740 37.96     1  2
## 165 307 1750 38.03     1  2
## 166 307 1800 38.17     1  2
## 167 307 1810 38.19     1  2
## 168 307 1820 38.18     1  2
## 169 307 1830 38.15     1  2
## 170 307 1840 38.04     1  2
## 171 307 1850 37.96     1  2
## 172 307 1900 37.84     1  2
## 173 307 1910 37.83     1  2
## 174 307 1920 37.84     1  2
## 175 307 1930 37.74     1  2
## 176 307 1940 37.76     1  2
```

```
## 177 307 1950 37.76     1  2
## 178 307 2000 37.64     1  2
## 179 307 2010 37.63     1  2
## 180 307 2020 38.06     1  2
## 181 307 2030 38.19     1  2
## 182 307 2040 38.35     1  2
## 183 307 2050 38.25     1  2
## 184 307 2100 37.86     1  2
## 185 307 2110 37.95     1  2
## 186 307 2120 37.95     1  2
## 187 307 2130 37.76     1  2
## 188 307 2140 37.60     1  2
## 189 307 2150 37.89     1  2
## 190 307 2200 37.86     1  2
## 191 307 2210 37.71     1  2
## 192 307 2220 37.78     1  2
## 193 307 2230 37.82     1  2
## 194 307 2240 37.76     1  2
## 195 307 2250 37.81     1  2
## 196 307 2300 37.84     1  2
## 197 307 2310 38.01     1  2
## 198 307 2320 38.10     1  2
## 199 307 2330 38.15     1  2
## 200 307 2340 37.92     1  2
## 201 307 2350 37.64     1  2
## 202 308    0 37.70     1  2
## 203 308   10 37.46     1  2
## 204 308   20 37.41     1  2
## 205 308   30 37.46     1  2
## 206 308   40 37.56     1  2
## 207 308   50 37.55     1  2
## 208 308  100 37.75     1  2
## 209 308  110 37.76     1  2
## 210 308  120 37.73     1  2
## 211 308  130 37.77     1  2
## 212 308  140 38.01     1  2
## 213 308  150 38.04     1  2
## 214 308  200 38.07     1  2
```

*** Vamos a trabajar con un ejemplo que viene por defecto en la instalación de R USArrests. Este data frame contiene la información para cada estado Americano de las tasas de criminales (por 100.000 habitantes). Los datos de las columnas se refieren a Asesinatos, violaciones y porcentaje de la población que vive en áreas urbanas. Los datos son de 1973. Contesta a las siguientes preguntas sobre los datos:**

```
#Las dimensiones del dataframe
dim(USArrests)
```

```
## [1] 50  4
```

```
#La longitud del dataframe (filas o columnas)
length(USArrests)
```

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

```r
#Numero  de columnas
ncol(USArrests)
```

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

```r
#¿Cómo calcularías el número de filas?
nrow(USArrests)
```

```
## [1] 50
```

```r
#Obtén el nombre de las filas y las columnas para este data frame
row.names.data.frame(USArrests)
```

```
##  [1] "Alabama"        "Alaska"         "Arizona"        "Arkansas"
##  [5] "California"     "Colorado"       "Connecticut"    "Delaware"
##  [9] "Florida"        "Georgia"        "Hawaii"         "Idaho"
## [13] "Illinois"       "Indiana"        "Iowa"           "Kansas"
## [17] "Kentucky"       "Louisiana"      "Maine"          "Maryland"
## [21] "Massachusetts"  "Michigan"       "Minnesota"      "Mississippi"
## [25] "Missouri"       "Montana"        "Nebraska"       "Nevada"
## [29] "New Hampshire"  "New Jersey"     "New Mexico"     "New York"
## [33] "North Carolina" "North Dakota"   "Ohio"           "Oklahoma"
## [37] "Oregon"         "Pennsylvania"   "Rhode Island"   "South Carolina"
## [41] "South Dakota"   "Tennessee"      "Texas"          "Utah"
## [45] "Vermont"        "Virginia"       "Washington"     "West Virginia"
## [49] "Wisconsin"      "Wyoming"
```

```r
colnames(USArrests)
```

```
## [1] "Murder"   "Assault"  "UrbanPop" "Rape"
```

```r
#Échale un vistazo a los datos, por ejemplo a las seis primeras filas
USArrests[1:6,]
```

```
##            Murder Assault UrbanPop Rape
## Alabama      13.2     236       58 21.2
## Alaska       10.0     263       48 44.5
## Arizona       8.1     294       80 31.0
## Arkansas      8.8     190       50 19.5
## California    9.0     276       91 40.6
## Colorado      7.9     204       78 38.7
```

```r
#Ordena de forma decreciente las filas de nuestro data frame según el porcentaje de población
#en el área urbana. Para ello investiga la función order () y sus parámetros.

USArrests[order(USArrests$UrbanPop,decreasing = TRUE),]
```

```
##               Murder Assault UrbanPop Rape
## California       9.0     276       91 40.6
## New Jersey       7.4     159       89 18.8
## Rhode Island     3.4     174       87  8.3
## New York        11.1     254       86 26.1
## Massachusetts    4.4     149       85 16.3
## Hawaii           5.3      46       83 20.2
## Illinois        10.4     249       83 24.0
## Nevada          12.2     252       81 46.0
## Arizona          8.1     294       80 31.0
## Florida         15.4     335       80 31.9
```

```
## Texas            12.7     201       80 25.5
## Utah              3.2     120       80 22.9
## Colorado          7.9     204       78 38.7
## Connecticut       3.3     110       77 11.1
## Ohio              7.3     120       75 21.4
## Michigan         12.1     255       74 35.1
## Washington        4.0     145       73 26.2
## Delaware          5.9     238       72 15.8
## Pennsylvania      6.3     106       72 14.9
## Missouri          9.0     178       70 28.2
## New Mexico       11.4     285       70 32.1
## Oklahoma          6.6     151       68 20.0
## Maryland         11.3     300       67 27.8
## Oregon            4.9     159       67 29.3
## Kansas            6.0     115       66 18.0
## Louisiana        15.4     249       66 22.2
## Minnesota         2.7      72       66 14.9
## Wisconsin         2.6      53       66 10.8
## Indiana           7.2     113       65 21.0
## Virginia          8.5     156       63 20.7
## Nebraska          4.3     102       62 16.5
## Georgia          17.4     211       60 25.8
## Wyoming           6.8     161       60 15.6
## Tennessee        13.2     188       59 26.9
## Alabama          13.2     236       58 21.2
## Iowa              2.2      56       57 11.3
## New Hampshire     2.1      57       56  9.5
## Idaho             2.6     120       54 14.2
## Montana           6.0     109       53 16.4
## Kentucky          9.7     109       52 16.3
## Maine             2.1      83       51  7.8
## Arkansas          8.8     190       50 19.5
## Alaska           10.0     263       48 44.5
## South Carolina   14.4     279       48 22.5
## North Carolina   13.0     337       45 16.1
## South Dakota      3.8      86       45 12.8
## Mississippi      16.1     259       44 17.1
## North Dakota      0.8      45       44  7.3
## West Virginia     5.7      81       39  9.3
## Vermont           2.2      48       32 11.2
```

```
#¿Podrías añadir un segundo criterio de orden?, ¿cómo?

USArrests[order(USArrests$UrbanPop,USArrests$Rape,decreasing = TRUE),]
```

```
##               Murder Assault UrbanPop Rape
## California       9.0     276       91 40.6
## New Jersey       7.4     159       89 18.8
## Rhode Island     3.4     174       87  8.3
## New York        11.1     254       86 26.1
## Massachusetts    4.4     149       85 16.3
## Illinois        10.4     249       83 24.0
## Hawaii           5.3      46       83 20.2
## Nevada          12.2     252       81 46.0
## Florida         15.4     335       80 31.9
```

```
## Arizona           8.1     294       80 31.0
## Texas            12.7     201       80 25.5
## Utah              3.2     120       80 22.9
## Colorado          7.9     204       78 38.7
## Connecticut       3.3     110       77 11.1
## Ohio              7.3     120       75 21.4
## Michigan         12.1     255       74 35.1
## Washington        4.0     145       73 26.2
## Delaware          5.9     238       72 15.8
## Pennsylvania      6.3     106       72 14.9
## New Mexico       11.4     285       70 32.1
## Missouri          9.0     178       70 28.2
## Oklahoma          6.6     151       68 20.0
## Oregon            4.9     159       67 29.3
## Maryland         11.3     300       67 27.8
## Louisiana        15.4     249       66 22.2
## Kansas            6.0     115       66 18.0
## Minnesota         2.7      72       66 14.9
## Wisconsin         2.6      53       66 10.8
## Indiana           7.2     113       65 21.0
## Virginia          8.5     156       63 20.7
## Nebraska          4.3     102       62 16.5
## Georgia          17.4     211       60 25.8
## Wyoming           6.8     161       60 15.6
## Tennessee        13.2     188       59 26.9
## Alabama          13.2     236       58 21.2
## Iowa              2.2      56       57 11.3
## New Hampshire     2.1      57       56  9.5
## Idaho             2.6     120       54 14.2
## Montana           6.0     109       53 16.4
## Kentucky          9.7     109       52 16.3
## Maine             2.1      83       51  7.8
## Arkansas          8.8     190       50 19.5
## Alaska           10.0     263       48 44.5
## South Carolina   14.4     279       48 22.5
## North Carolina   13.0     337       45 16.1
## South Dakota      3.8      86       45 12.8
## Mississippi      16.1     259       44 17.1
## North Dakota      0.8      45       44  7.3
## West Virginia     5.7      81       39  9.3
## Vermont           2.2      48       32 11.2
```

```
#Muestra por pantalla la columna con los datos de asesinato

USArrests$Murder
```

```
##  [1] 13.2 10.0  8.1  8.8  9.0  7.9  3.3  5.9 15.4 17.4  5.3  2.6 10.4  7.2
## [15]  2.2  6.0  9.7 15.4  2.1 11.3  4.4 12.1  2.7 16.1  9.0  6.0  4.3 12.2
## [29]  2.1  7.4 11.4 11.1 13.0  0.8  7.3  6.6  4.9  6.3  3.4 14.4  3.8 13.2
## [43] 12.7  3.2  2.2  8.5  4.0  5.7  2.6  6.8
```

```
#Muestra las tasas de asesinato para el segundo, tercer y cuarto estado

USArrests[2:4,"Murder"]
```

```
## [1] 10.0  8.1  8.8
```

```r
#Muestra las primeras cinco filas de todas las columnas

USArrests[1:5,]
```

```
##            Murder Assault UrbanPop Rape
## Alabama      13.2     236       58 21.2
## Alaska       10.0     263       48 44.5
## Arizona       8.1     294       80 31.0
## Arkansas      8.8     190       50 19.5
## California    9.0     276       91 40.6
```

```r
#Muestra todas las filas para las dos primeras columnas

USArrests[,1:2]
```

```
##                Murder Assault
## Alabama          13.2     236
## Alaska           10.0     263
## Arizona           8.1     294
## Arkansas          8.8     190
## California        9.0     276
## Colorado          7.9     204
## Connecticut       3.3     110
## Delaware          5.9     238
## Florida          15.4     335
## Georgia          17.4     211
## Hawaii            5.3      46
## Idaho             2.6     120
## Illinois         10.4     249
## Indiana           7.2     113
## Iowa              2.2      56
## Kansas            6.0     115
## Kentucky          9.7     109
## Louisiana        15.4     249
## Maine             2.1      83
## Maryland         11.3     300
## Massachusetts     4.4     149
## Michigan         12.1     255
## Minnesota         2.7      72
## Mississippi      16.1     259
## Missouri          9.0     178
## Montana           6.0     109
## Nebraska          4.3     102
## Nevada           12.2     252
## New Hampshire     2.1      57
## New Jersey        7.4     159
## New Mexico       11.4     285
## New York         11.1     254
## North Carolina   13.0     337
## North Dakota      0.8      45
## Ohio              7.3     120
## Oklahoma          6.6     151
## Oregon            4.9     159
## Pennsylvania      6.3     106
## Rhode Island      3.4     174
```

```
## South Carolina   14.4     279
## South Dakota      3.8      86
## Tennessee        13.2     188
## Texas            12.7     201
## Utah              3.2     120
## Vermont           2.2      48
## Virginia          8.5     156
## Washington        4.0     145
## West Virginia     5.7      81
## Wisconsin         2.6      53
## Wyoming           6.8     161
```

```
#Muestra todas las filas de las columnas 1 y 3

USArrests[,c(1,3)]
```

```
##                Murder UrbanPop
## Alabama          13.2       58
## Alaska           10.0       48
## Arizona           8.1       80
## Arkansas          8.8       50
## California        9.0       91
## Colorado          7.9       78
## Connecticut       3.3       77
## Delaware          5.9       72
## Florida          15.4       80
## Georgia          17.4       60
## Hawaii            5.3       83
## Idaho             2.6       54
## Illinois         10.4       83
## Indiana           7.2       65
## Iowa              2.2       57
## Kansas            6.0       66
## Kentucky          9.7       52
## Louisiana        15.4       66
## Maine             2.1       51
## Maryland         11.3       67
## Massachusetts     4.4       85
## Michigan         12.1       74
## Minnesota         2.7       66
## Mississippi      16.1       44
## Missouri          9.0       70
## Montana           6.0       53
## Nebraska          4.3       62
## Nevada           12.2       81
## New Hampshire     2.1       56
## New Jersey        7.4       89
## New Mexico       11.4       70
## New York         11.1       86
## North Carolina   13.0       45
## North Dakota      0.8       44
## Ohio              7.3       75
## Oklahoma          6.6       68
## Oregon            4.9       67
## Pennsylvania      6.3       72
```

```
## Rhode Island      3.4       87
## South Carolina   14.4       48
## South Dakota      3.8       45
## Tennessee        13.2       59
## Texas            12.7       80
## Utah              3.2       80
## Vermont           2.2       32
## Virginia          8.5       63
## Washington        4.0       73
## West Virginia     5.7       39
## Wisconsin         2.6       66
## Wyoming           6.8       60
```

```
#Muestra solo las primeras cinco filas de las columnas 1 y 2

USArrests[1:5,1:2]
```

```
##            Murder Assault
## Alabama      13.2     236
## Alaska       10.0     263
## Arizona       8.1     294
## Arkansas      8.8     190
## California    9.0     276
```

```
#Extrae las filas para el ??ndice Murder
USArrests[,"Murder"]
```

```
##  [1] 13.2 10.0  8.1  8.8  9.0  7.9  3.3  5.9 15.4 17.4  5.3  2.6 10.4  7.2
## [15]  2.2  6.0  9.7 15.4  2.1 11.3  4.4 12.1  2.7 16.1  9.0  6.0  4.3 12.2
## [29]  2.1  7.4 11.4 11.1 13.0  0.8  7.3  6.6  4.9  6.3  3.4 14.4  3.8 13.2
## [43] 12.7  3.2  2.2  8.5  4.0  5.7  2.6  6.8
```

```
#¿Que estado tiene la menor tasa de asesinatos? ¿qué línea contiene esa información?, obtén esa informa
datos = USArrests[order(USArrests$Murder,decreasing = FALSE),]
datos
```

```
##                Murder Assault UrbanPop Rape
## North Dakota      0.8      45       44  7.3
## Maine             2.1      83       51  7.8
## New Hampshire     2.1      57       56  9.5
## Iowa              2.2      56       57 11.3
## Vermont           2.2      48       32 11.2
## Idaho             2.6     120       54 14.2
## Wisconsin         2.6      53       66 10.8
## Minnesota         2.7      72       66 14.9
## Utah              3.2     120       80 22.9
## Connecticut       3.3     110       77 11.1
## Rhode Island      3.4     174       87  8.3
## South Dakota      3.8      86       45 12.8
## Washington        4.0     145       73 26.2
## Nebraska          4.3     102       62 16.5
## Massachusetts     4.4     149       85 16.3
## Oregon            4.9     159       67 29.3
## Hawaii            5.3      46       83 20.2
## West Virginia     5.7      81       39  9.3
## Delaware          5.9     238       72 15.8
## Kansas            6.0     115       66 18.0
```

```
## Montana           6.0     109       53 16.4
## Pennsylvania      6.3     106       72 14.9
## Oklahoma          6.6     151       68 20.0
## Wyoming           6.8     161       60 15.6
## Indiana           7.2     113       65 21.0
## Ohio              7.3     120       75 21.4
## New Jersey        7.4     159       89 18.8
## Colorado          7.9     204       78 38.7
## Arizona           8.1     294       80 31.0
## Virginia          8.5     156       63 20.7
## Arkansas          8.8     190       50 19.5
## California        9.0     276       91 40.6
## Missouri          9.0     178       70 28.2
## Kentucky          9.7     109       52 16.3
## Alaska           10.0     263       48 44.5
## Illinois         10.4     249       83 24.0
## New York         11.1     254       86 26.1
## Maryland         11.3     300       67 27.8
## New Mexico       11.4     285       70 32.1
## Michigan         12.1     255       74 35.1
## Nevada           12.2     252       81 46.0
## Texas            12.7     201       80 25.5
## North Carolina   13.0     337       45 16.1
## Alabama          13.2     236       58 21.2
## Tennessee        13.2     188       59 26.9
## South Carolina   14.4     279       48 22.5
## Florida          15.4     335       80 31.9
## Louisiana        15.4     249       66 22.2
## Mississippi      16.1     259       44 17.1
## Georgia          17.4     211       60 25.8
```

```
USArrests[which(USArrests == datos[1,"Murder"]),]
```

```
##              Murder Assault UrbanPop Rape
## North Dakota    0.8      45       44  7.3
```

El estado del Norte de Dakota es el que menor tasa de asesinatos tiene y está en la posición 34 del dataset USArrests.

```
# ¿Qué estados tienen una tasa inferior al 4%?, obtén esa información
USArrests[which(USArrests$Murder < 4),]
```

```
##               Murder Assault UrbanPop Rape
## Connecticut      3.3     110       77 11.1
## Idaho            2.6     120       54 14.2
## Iowa             2.2      56       57 11.3
## Maine            2.1      83       51  7.8
## Minnesota        2.7      72       66 14.9
## New Hampshire    2.1      57       56  9.5
## North Dakota     0.8      45       44  7.3
## Rhode Island     3.4     174       87  8.3
## South Dakota     3.8      86       45 12.8
## Utah             3.2     120       80 22.9
## Vermont          2.2      48       32 11.2
## Wisconsin        2.6      53       66 10.8
```

```r
# Que estados estan en el cuartil superior (75) en lo que a poblacion en zonas urbanas se refiere
quantile(USArrests$UrbanPop)
```

```
##    0%   25%   50%   75%  100%
## 32.00 54.50 66.00 77.75 91.00
```

```r
USArrests[which(USArrests$UrbanPop >= quantile(USArrests$UrbanPop)[4]) ,]
```

```
##               Murder Assault UrbanPop Rape
## Arizona          8.1     294       80 31.0
## California       9.0     276       91 40.6
## Colorado         7.9     204       78 38.7
## Florida         15.4     335       80 31.9
## Hawaii           5.3      46       83 20.2
## Illinois        10.4     249       83 24.0
## Massachusetts    4.4     149       85 16.3
## Nevada          12.2     252       81 46.0
## New Jersey       7.4     159       89 18.8
## New York        11.1     254       86 26.1
## Rhode Island     3.4     174       87  8.3
## Texas           12.7     201       80 25.5
## Utah             3.2     120       80 22.9
```

***Carga el set de datos CO2 y realiza las siguientes acciones:**

a. Ordena alfabéticamente los datos en función de la variable Plant. Recuerda que Plant es un factor. Imprime el resultado por pantalla para comprobarlo.

```r
rm(CO2)
```

```
## Warning in rm(CO2): object 'CO2' not found
```

```r
factor(CO2$Plant)
```

```
##  [1] Qn1 Qn1 Qn1 Qn1 Qn1 Qn1 Qn1 Qn2 Qn2 Qn2 Qn2 Qn2 Qn2 Qn2 Qn3 Qn3 Qn3
## [18] Qn3 Qn3 Qn3 Qn3 Qc1 Qc1 Qc1 Qc1 Qc1 Qc1 Qc1 Qc2 Qc2 Qc2 Qc2 Qc2 Qc2
## [35] Qc2 Qc3 Qc3 Qc3 Qc3 Qc3 Qc3 Qc3 Mn1 Mn1 Mn1 Mn1 Mn1 Mn1 Mn1 Mn2 Mn2
## [52] Mn2 Mn2 Mn2 Mn2 Mn2 Mn3 Mn3 Mn3 Mn3 Mn3 Mn3 Mn3 Mc1 Mc1 Mc1 Mc1 Mc1
## [69] Mc1 Mc1 Mc2 Mc2 Mc2 Mc2 Mc2 Mc2 Mc2 Mc3 Mc3 Mc3 Mc3 Mc3 Mc3 Mc3
## 12 Levels: Qn1 < Qn2 < Qn3 < Qc1 < Qc3 < Qc2 < Mn3 < Mn2 < Mn1 < ... < Mc1
```

```r
orden = levels(CO2$Plant)
c = orden[order(levels(CO2$Plant))]
levels(CO2$Plant) = c
CO2
```

```
##    Plant        Type  Treatment conc uptake
## 1    Mc1      Quebec nonchilled   95   16.0
## 2    Mc1      Quebec nonchilled  175   30.4
## 3    Mc1      Quebec nonchilled  250   34.8
## 4    Mc1      Quebec nonchilled  350   37.2
## 5    Mc1      Quebec nonchilled  500   35.3
## 6    Mc1      Quebec nonchilled  675   39.2
## 7    Mc1      Quebec nonchilled 1000   39.7
## 8    Mc2      Quebec nonchilled   95   13.6
```

```
## 9    Mc2      Quebec nonchilled  175   27.3
## 10   Mc2      Quebec nonchilled  250   37.1
## 11   Mc2      Quebec nonchilled  350   41.8
## 12   Mc2      Quebec nonchilled  500   40.6
## 13   Mc2      Quebec nonchilled  675   41.4
## 14   Mc2      Quebec nonchilled 1000   44.3
## 15   Mc3      Quebec nonchilled   95   16.2
## 16   Mc3      Quebec nonchilled  175   32.4
## 17   Mc3      Quebec nonchilled  250   40.3
## 18   Mc3      Quebec nonchilled  350   42.1
## 19   Mc3      Quebec nonchilled  500   42.9
## 20   Mc3      Quebec nonchilled  675   43.9
## 21   Mc3      Quebec nonchilled 1000   45.5
## 22   Mn1      Quebec    chilled   95   14.2
## 23   Mn1      Quebec    chilled  175   24.1
## 24   Mn1      Quebec    chilled  250   30.3
## 25   Mn1      Quebec    chilled  350   34.6
## 26   Mn1      Quebec    chilled  500   32.5
## 27   Mn1      Quebec    chilled  675   35.4
## 28   Mn1      Quebec    chilled 1000   38.7
## 29   Mn3      Quebec    chilled   95    9.3
## 30   Mn3      Quebec    chilled  175   27.3
## 31   Mn3      Quebec    chilled  250   35.0
## 32   Mn3      Quebec    chilled  350   38.8
## 33   Mn3      Quebec    chilled  500   38.6
## 34   Mn3      Quebec    chilled  675   37.5
## 35   Mn3      Quebec    chilled 1000   42.4
## 36   Mn2      Quebec    chilled   95   15.1
## 37   Mn2      Quebec    chilled  175   21.0
## 38   Mn2      Quebec    chilled  250   38.1
## 39   Mn2      Quebec    chilled  350   34.0
## 40   Mn2      Quebec    chilled  500   38.9
## 41   Mn2      Quebec    chilled  675   39.6
## 42   Mn2      Quebec    chilled 1000   41.4
## 43   Qc3 Mississippi nonchilled   95   10.6
## 44   Qc3 Mississippi nonchilled  175   19.2
## 45   Qc3 Mississippi nonchilled  250   26.2
## 46   Qc3 Mississippi nonchilled  350   30.0
## 47   Qc3 Mississippi nonchilled  500   30.9
## 48   Qc3 Mississippi nonchilled  675   32.4
## 49   Qc3 Mississippi nonchilled 1000   35.5
## 50   Qc2 Mississippi nonchilled   95   12.0
## 51   Qc2 Mississippi nonchilled  175   22.0
## 52   Qc2 Mississippi nonchilled  250   30.6
## 53   Qc2 Mississippi nonchilled  350   31.8
## 54   Qc2 Mississippi nonchilled  500   32.4
## 55   Qc2 Mississippi nonchilled  675   31.1
## 56   Qc2 Mississippi nonchilled 1000   31.5
## 57   Qc1 Mississippi nonchilled   95   11.3
## 58   Qc1 Mississippi nonchilled  175   19.4
## 59   Qc1 Mississippi nonchilled  250   25.8
## 60   Qc1 Mississippi nonchilled  350   27.9
## 61   Qc1 Mississippi nonchilled  500   28.5
## 62   Qc1 Mississippi nonchilled  675   28.1
```

```
## 63   Qc1 Mississippi nonchilled 1000   27.8
## 64   Qn3 Mississippi    chilled   95   10.5
## 65   Qn3 Mississippi    chilled  175   14.9
## 66   Qn3 Mississippi    chilled  250   18.1
## 67   Qn3 Mississippi    chilled  350   18.9
## 68   Qn3 Mississippi    chilled  500   19.5
## 69   Qn3 Mississippi    chilled  675   22.2
## 70   Qn3 Mississippi    chilled 1000   21.9
## 71   Qn1 Mississippi    chilled   95    7.7
## 72   Qn1 Mississippi    chilled  175   11.4
## 73   Qn1 Mississippi    chilled  250   12.3
## 74   Qn1 Mississippi    chilled  350   13.0
## 75   Qn1 Mississippi    chilled  500   12.5
## 76   Qn1 Mississippi    chilled  675   13.7
## 77   Qn1 Mississippi    chilled 1000   14.4
## 78   Qn2 Mississippi    chilled   95   10.6
## 79   Qn2 Mississippi    chilled  175   18.0
## 80   Qn2 Mississippi    chilled  250   17.9
## 81   Qn2 Mississippi    chilled  350   17.9
## 82   Qn2 Mississippi    chilled  500   17.9
## 83   Qn2 Mississippi    chilled  675   18.9
## 84   Qn2 Mississippi    chilled 1000   19.9
```

b. Ordena los datos en función del incremento de la variable uptake y el orden alfabético de la planta (en ese orden)

```
CO2[order(CO2$uptake,CO2$Plant),]
```

```
##    Plant        Type  Treatment conc uptake
## 71   Qn1 Mississippi    chilled   95    7.7
## 29   Mn3      Quebec    chilled   95    9.3
## 64   Qn3 Mississippi    chilled   95   10.5
## 43   Qc3 Mississippi nonchilled   95   10.6
## 78   Qn2 Mississippi    chilled   95   10.6
## 57   Qc1 Mississippi nonchilled   95   11.3
## 72   Qn1 Mississippi    chilled  175   11.4
## 50   Qc2 Mississippi nonchilled   95   12.0
## 73   Qn1 Mississippi    chilled  250   12.3
## 75   Qn1 Mississippi    chilled  500   12.5
## 74   Qn1 Mississippi    chilled  350   13.0
## 8    Mc2      Quebec nonchilled   95   13.6
## 76   Qn1 Mississippi    chilled  675   13.7
## 22   Mn1      Quebec    chilled   95   14.2
## 77   Qn1 Mississippi    chilled 1000   14.4
## 65   Qn3 Mississippi    chilled  175   14.9
## 36   Mn2      Quebec    chilled   95   15.1
## 1    Mc1      Quebec nonchilled   95   16.0
## 15   Mc3      Quebec nonchilled   95   16.2
## 80   Qn2 Mississippi    chilled  250   17.9
## 81   Qn2 Mississippi    chilled  350   17.9
## 82   Qn2 Mississippi    chilled  500   17.9
## 79   Qn2 Mississippi    chilled  175   18.0
## 66   Qn3 Mississippi    chilled  250   18.1
```

```
## 83   Qn2 Mississippi    chilled  675   18.9
## 67   Qn3 Mississippi    chilled  350   18.9
## 44   Qc3 Mississippi nonchilled  175   19.2
## 58   Qc1 Mississippi nonchilled  175   19.4
## 68   Qn3 Mississippi    chilled  500   19.5
## 84   Qn2 Mississippi    chilled 1000   19.9
## 37   Mn2      Quebec    chilled  175   21.0
## 70   Qn3 Mississippi    chilled 1000   21.9
## 51   Qc2 Mississippi nonchilled  175   22.0
## 69   Qn3 Mississippi    chilled  675   22.2
## 23   Mn1      Quebec    chilled  175   24.1
## 59   Qc1 Mississippi nonchilled  250   25.8
## 45   Qc3 Mississippi nonchilled  250   26.2
## 9    Mc2      Quebec nonchilled  175   27.3
## 30   Mn3      Quebec    chilled  175   27.3
## 63   Qc1 Mississippi nonchilled 1000   27.8
## 60   Qc1 Mississippi nonchilled  350   27.9
## 62   Qc1 Mississippi nonchilled  675   28.1
## 61   Qc1 Mississippi nonchilled  500   28.5
## 46   Qc3 Mississippi nonchilled  350   30.0
## 24   Mn1      Quebec    chilled  250   30.3
## 2    Mc1      Quebec nonchilled  175   30.4
## 52   Qc2 Mississippi nonchilled  250   30.6
## 47   Qc3 Mississippi nonchilled  500   30.9
## 55   Qc2 Mississippi nonchilled  675   31.1
## 56   Qc2 Mississippi nonchilled 1000   31.5
## 53   Qc2 Mississippi nonchilled  350   31.8
## 16   Mc3      Quebec nonchilled  175   32.4
## 54   Qc2 Mississippi nonchilled  500   32.4
## 48   Qc3 Mississippi nonchilled  675   32.4
## 26   Mn1      Quebec    chilled  500   32.5
## 39   Mn2      Quebec    chilled  350   34.0
## 25   Mn1      Quebec    chilled  350   34.6
## 3    Mc1      Quebec nonchilled  250   34.8
## 31   Mn3      Quebec    chilled  250   35.0
## 5    Mc1      Quebec nonchilled  500   35.3
## 27   Mn1      Quebec    chilled  675   35.4
## 49   Qc3 Mississippi nonchilled 1000   35.5
## 10   Mc2      Quebec nonchilled  250   37.1
## 4    Mc1      Quebec nonchilled  350   37.2
## 34   Mn3      Quebec    chilled  675   37.5
## 38   Mn2      Quebec    chilled  250   38.1
## 33   Mn3      Quebec    chilled  500   38.6
## 28   Mn1      Quebec    chilled 1000   38.7
## 32   Mn3      Quebec    chilled  350   38.8
## 40   Mn2      Quebec    chilled  500   38.9
## 6    Mc1      Quebec nonchilled  675   39.2
## 41   Mn2      Quebec    chilled  675   39.6
## 7    Mc1      Quebec nonchilled 1000   39.7
## 17   Mc3      Quebec nonchilled  250   40.3
## 12   Mc2      Quebec nonchilled  500   40.6
## 13   Mc2      Quebec nonchilled  675   41.4
## 42   Mn2      Quebec    chilled 1000   41.4
## 11   Mc2      Quebec nonchilled  350   41.8
```

```
## 18   Mc3      Quebec nonchilled  350   42.1
## 35   Mn3      Quebec    chilled 1000   42.4
## 19   Mc3      Quebec nonchilled  500   42.9
## 20   Mc3      Quebec nonchilled  675   43.9
## 14   Mc2      Quebec nonchilled 1000   44.3
## 21   Mc3      Quebec nonchilled 1000   45.5
```

Para observar que se ha ordenado de forma correcta, bastaría con buscar dos valores idénticos de uptake y comprobar si está ordenado de forma correcta por el tipo de planta estando los índices descolocados.

c. Ordena de nuevo los datos en function del increment de la variable uptake y el orden alfabético reverso de la planta (en ese orden)

```
CO2[order(CO2$uptake,order(CO2$Plant, decreasing = TRUE)),]
```

```
##    Plant        Type  Treatment conc uptake
## 71   Qn1 Mississippi    chilled   95    7.7
## 29   Mn3      Quebec    chilled   95    9.3
## 64   Qn3 Mississippi    chilled   95   10.5
## 78   Qn2 Mississippi    chilled   95   10.6
## 43   Qc3 Mississippi nonchilled   95   10.6
## 57   Qc1 Mississippi nonchilled   95   11.3
## 72   Qn1 Mississippi    chilled  175   11.4
## 50   Qc2 Mississippi nonchilled   95   12.0
## 73   Qn1 Mississippi    chilled  250   12.3
## 75   Qn1 Mississippi    chilled  500   12.5
## 74   Qn1 Mississippi    chilled  350   13.0
## 8    Mc2      Quebec nonchilled   95   13.6
## 76   Qn1 Mississippi    chilled  675   13.7
## 22   Mn1      Quebec    chilled   95   14.2
## 77   Qn1 Mississippi    chilled 1000   14.4
## 65   Qn3 Mississippi    chilled  175   14.9
## 36   Mn2      Quebec    chilled   95   15.1
## 1    Mc1      Quebec nonchilled   95   16.0
## 15   Mc3      Quebec nonchilled   95   16.2
## 80   Qn2 Mississippi    chilled  250   17.9
## 81   Qn2 Mississippi    chilled  350   17.9
## 82   Qn2 Mississippi    chilled  500   17.9
## 79   Qn2 Mississippi    chilled  175   18.0
## 66   Qn3 Mississippi    chilled  250   18.1
## 83   Qn2 Mississippi    chilled  675   18.9
## 67   Qn3 Mississippi    chilled  350   18.9
## 44   Qc3 Mississippi nonchilled  175   19.2
## 58   Qc1 Mississippi nonchilled  175   19.4
## 68   Qn3 Mississippi    chilled  500   19.5
## 84   Qn2 Mississippi    chilled 1000   19.9
## 37   Mn2      Quebec    chilled  175   21.0
## 70   Qn3 Mississippi    chilled 1000   21.9
## 51   Qc2 Mississippi nonchilled  175   22.0
## 69   Qn3 Mississippi    chilled  675   22.2
## 23   Mn1      Quebec    chilled  175   24.1
## 59   Qc1 Mississippi nonchilled  250   25.8
## 45   Qc3 Mississippi nonchilled  250   26.2
```

```
## 30   Mn3      Quebec    chilled  175   27.3
## 9    Mc2      Quebec nonchilled  175   27.3
## 63   Qc1 Mississippi nonchilled 1000   27.8
## 60   Qc1 Mississippi nonchilled  350   27.9
## 62   Qc1 Mississippi nonchilled  675   28.1
## 61   Qc1 Mississippi nonchilled  500   28.5
## 46   Qc3 Mississippi nonchilled  350   30.0
## 24   Mn1      Quebec    chilled  250   30.3
## 2    Mc1      Quebec nonchilled  175   30.4
## 52   Qc2 Mississippi nonchilled  250   30.6
## 47   Qc3 Mississippi nonchilled  500   30.9
## 55   Qc2 Mississippi nonchilled  675   31.1
## 56   Qc2 Mississippi nonchilled 1000   31.5
## 53   Qc2 Mississippi nonchilled  350   31.8
## 48   Qc3 Mississippi nonchilled  675   32.4
## 54   Qc2 Mississippi nonchilled  500   32.4
## 16   Mc3      Quebec nonchilled  175   32.4
## 26   Mn1      Quebec    chilled  500   32.5
## 39   Mn2      Quebec    chilled  350   34.0
## 25   Mn1      Quebec    chilled  350   34.6
## 3    Mc1      Quebec nonchilled  250   34.8
## 31   Mn3      Quebec    chilled  250   35.0
## 5    Mc1      Quebec nonchilled  500   35.3
## 27   Mn1      Quebec    chilled  675   35.4
## 49   Qc3 Mississippi nonchilled 1000   35.5
## 10   Mc2      Quebec nonchilled  250   37.1
## 4    Mc1      Quebec nonchilled  350   37.2
## 34   Mn3      Quebec    chilled  675   37.5
## 38   Mn2      Quebec    chilled  250   38.1
## 33   Mn3      Quebec    chilled  500   38.6
## 28   Mn1      Quebec    chilled 1000   38.7
## 32   Mn3      Quebec    chilled  350   38.8
## 40   Mn2      Quebec    chilled  500   38.9
## 6    Mc1      Quebec nonchilled  675   39.2
## 41   Mn2      Quebec    chilled  675   39.6
## 7    Mc1      Quebec nonchilled 1000   39.7
## 17   Mc3      Quebec nonchilled  250   40.3
## 12   Mc2      Quebec nonchilled  500   40.6
## 42   Mn2      Quebec    chilled 1000   41.4
## 13   Mc2      Quebec nonchilled  675   41.4
## 11   Mc2      Quebec nonchilled  350   41.8
## 18   Mc3      Quebec nonchilled  350   42.1
## 35   Mn3      Quebec    chilled 1000   42.4
## 19   Mc3      Quebec nonchilled  500   42.9
## 20   Mc3      Quebec nonchilled  675   43.9
## 14   Mc2      Quebec nonchilled 1000   44.3
## 21   Mc3      Quebec nonchilled 1000   45.5
```

*** Para este ejercicio vamos a usar el dataset state.x77. Asegurate de que el objeto es un dataframe, si no lo es fuerza su conversión.**

```
class(state.x77)
```

```
## [1] "matrix"
```

```
state.x77.data.frame = as.data.frame(state.x77)
class(state.x77.data.frame)
```

```
## [1] "data.frame"
```

-Averigua cuantos estados tienen ingresos (Income) menores de 4300. Pista investiga subset()

```
subset(state.x77.data.frame, Income < 4300)
```

```
##                Population Income Illiteracy Life Exp Murder HS Grad Frost
## Alabama              3615   3624        2.1    69.05   15.1    41.3    20
## Arkansas             2110   3378        1.9    70.66   10.1    39.9    65
## Georgia              4931   4091        2.0    68.54   13.9    40.6    60
## Idaho                 813   4119        0.6    71.87    5.3    59.5   126
## Kentucky             3387   3712        1.6    70.10   10.6    38.5    95
## Louisiana            3806   3545        2.8    68.76   13.2    42.2    12
## Maine                1058   3694        0.7    70.39    2.7    54.7   161
## Mississippi          2341   3098        2.4    68.09   12.5    41.0    50
## Missouri             4767   4254        0.8    70.69    9.3    48.8   108
## New Hampshire         812   4281        0.7    71.23    3.3    57.6   174
## New Mexico           1144   3601        2.2    70.32    9.7    55.2   120
## North Carolina       5441   3875        1.8    69.21   11.1    38.5    80
## Oklahoma             2715   3983        1.1    71.42    6.4    51.6    82
## South Carolina       2816   3635        2.3    67.96   11.6    37.8    65
## South Dakota          681   4167        0.5    72.08    1.7    53.3   172
## Tennessee            4173   3821        1.7    70.11   11.0    41.8    70
## Texas               12237   4188        2.2    70.90   12.2    47.4    35
## Utah                 1203   4022        0.6    72.90    4.5    67.3   137
## Vermont               472   3907        0.6    71.64    5.5    57.1   168
## West Virginia        1799   3617        1.4    69.48    6.7    41.6   100
##                  Area
## Alabama         50708
## Arkansas        51945
## Georgia         58073
## Idaho           82677
## Kentucky        39650
## Louisiana       44930
## Maine           30920
## Mississippi     47296
## Missouri        68995
## New Hampshire    9027
## New Mexico     121412
## North Carolina  48798
## Oklahoma        68782
## South Carolina  30225
## South Dakota    75955
## Tennessee       41328
## Texas          262134
## Utah            82096
## Vermont          9267
## West Virginia   24070
```

-Averigua cual es el estado con los ingresos mas altos.

```
max(state.x77.data.frame$Income)
```

```
## [1] 6315
```

```
state.x77.data.frame[state.x77.data.frame$Income==max(state.x77.data.frame$Income),]
```

```
##        Population Income Illiteracy Life Exp Murder HS Grad Frost   Area
## Alaska        365   6315        1.5    69.31   11.3    66.7   152 566432
```

-Crea un data frame 2 df2 con los datasets existentes en R: state.abb, state.area, state.division, state.name, state.region. Las filas tienen que ser los nombres de los estados.

```
df2 = data.frame(state.abb,state.area,state.division, state.region, row.names = state.name)
df2
```

```
##                state.abb state.area     state.division  state.region
## Alabama               AL      51609 East South Central         South
## Alaska                AK     589757            Pacific          West
## Arizona               AZ     113909           Mountain          West
## Arkansas              AR      53104 West South Central         South
## California            CA     158693            Pacific          West
## Colorado              CO     104247           Mountain          West
## Connecticut           CT       5009        New England     Northeast
## Delaware              DE       2057     South Atlantic         South
## Florida               FL      58560     South Atlantic         South
## Georgia               GA      58876     South Atlantic         South
## Hawaii                HI       6450            Pacific          West
## Idaho                 ID      83557           Mountain          West
## Illinois              IL      56400 East North Central North Central
## Indiana               IN      36291 East North Central North Central
## Iowa                  IA      56290 West North Central North Central
## Kansas                KS      82264 West North Central North Central
## Kentucky              KY      40395 East South Central         South
## Louisiana             LA      48523 West South Central         South
## Maine                 ME      33215        New England     Northeast
## Maryland              MD      10577     South Atlantic         South
## Massachusetts         MA       8257        New England     Northeast
## Michigan              MI      58216 East North Central North Central
## Minnesota             MN      84068 West North Central North Central
## Mississippi           MS      47716 East South Central         South
## Missouri              MO      69686 West North Central North Central
## Montana               MT     147138           Mountain          West
## Nebraska              NE      77227 West North Central North Central
## Nevada                NV     110540           Mountain          West
## New Hampshire         NH       9304        New England     Northeast
## New Jersey            NJ       7836    Middle Atlantic     Northeast
## New Mexico            NM     121666           Mountain          West
## New York              NY      49576    Middle Atlantic     Northeast
## North Carolina        NC      52586     South Atlantic         South
## North Dakota          ND      70665 West North Central North Central
## Ohio                  OH      41222 East North Central North Central
## Oklahoma              OK      69919 West South Central         South
```

```
## Oregon                OR      96981            Pacific          West
## Pennsylvania          PA      45333    Middle Atlantic     Northeast
## Rhode Island          RI       1214        New England     Northeast
## South Carolina        SC      31055     South Atlantic         South
## South Dakota          SD      77047 West North Central North Central
## Tennessee             TN      42244 East South Central         South
## Texas                 TX     267339 West South Central         South
## Utah                  UT      84916           Mountain          West
## Vermont               VT       9609        New England     Northeast
## Virginia              VA      40815     South Atlantic         South
## Washington            WA      68192            Pacific          West
## West Virginia         WV      24181     South Atlantic         South
## Wisconsin             WI      56154 East North Central North Central
## Wyoming               WY      97914           Mountain          West
```

- Elimina de todas las variables la palabra state. Busca alguna función para strings.

```
colnames(df2) =unlist(strsplit(colnames(df2), split="state."))[-seq(1,8,by= 2)]
df2
```

```
##                abb   area           division        region
## Alabama         AL  51609 East South Central         South
## Alaska          AK 589757            Pacific          West
## Arizona         AZ 113909           Mountain          West
## Arkansas        AR  53104 West South Central         South
## California      CA 158693            Pacific          West
## Colorado        CO 104247           Mountain          West
## Connecticut     CT   5009        New England     Northeast
## Delaware        DE   2057     South Atlantic         South
## Florida         FL  58560     South Atlantic         South
## Georgia         GA  58876     South Atlantic         South
## Hawaii          HI   6450            Pacific          West
## Idaho           ID  83557           Mountain          West
## Illinois        IL  56400 East North Central North Central
## Indiana         IN  36291 East North Central North Central
## Iowa            IA  56290 West North Central North Central
## Kansas          KS  82264 West North Central North Central
## Kentucky        KY  40395 East South Central         South
## Louisiana       LA  48523 West South Central         South
## Maine           ME  33215        New England     Northeast
## Maryland        MD  10577     South Atlantic         South
## Massachusetts   MA   8257        New England     Northeast
## Michigan        MI  58216 East North Central North Central
## Minnesota       MN  84068 West North Central North Central
## Mississippi     MS  47716 East South Central         South
## Missouri        MO  69686 West North Central North Central
## Montana         MT 147138           Mountain          West
## Nebraska        NE  77227 West North Central North Central
## Nevada          NV 110540           Mountain          West
## New Hampshire   NH   9304        New England     Northeast
## New Jersey      NJ   7836    Middle Atlantic     Northeast
## New Mexico      NM 121666           Mountain          West
## New York        NY  49576    Middle Atlantic     Northeast
```

```
## North Carolina  NC  52586     South Atlantic         South
## North Dakota    ND  70665 West North Central North Central
## Ohio            OH  41222 East North Central North Central
## Oklahoma        OK  69919 West South Central         South
## Oregon          OR  96981            Pacific          West
## Pennsylvania    PA  45333    Middle Atlantic     Northeast
## Rhode Island    RI   1214        New England     Northeast
## South Carolina  SC  31055     South Atlantic         South
## South Dakota    SD  77047 West North Central North Central
## Tennessee       TN  42244 East South Central         South
## Texas           TX 267339 West South Central         South
## Utah            UT  84916           Mountain          West
## Vermont         VT   9609        New England     Northeast
## Virginia        VA  40815     South Atlantic         South
## Washington      WA  68192            Pacific          West
## West Virginia   WV  24181     South Atlantic         South
## Wisconsin       WI  56154 East North Central North Central
## Wyoming         WY  97914           Mountain          West
```

-Borra la variable div de df2. Estas borrando una ??nica variable del dataframe

```
df2 = df2[,-3]
```

-Añade por columnas el nuevo dataframe df2 al dataframe state.x77. Elimina las variables Life Exp, HS Grad, Frost, abb, y are.

```
state.x77.data.frame = cbind.data.frame(state.x77,df2)
state.x77.data.frame
```

```
##                Population Income Illiteracy Life Exp Murder HS Grad Frost
## Alabama              3615   3624        2.1    69.05   15.1    41.3    20
## Alaska                365   6315        1.5    69.31   11.3    66.7   152
## Arizona              2212   4530        1.8    70.55    7.8    58.1    15
## Arkansas             2110   3378        1.9    70.66   10.1    39.9    65
## California          21198   5114        1.1    71.71   10.3    62.6    20
## Colorado             2541   4884        0.7    72.06    6.8    63.9   166
## Connecticut          3100   5348        1.1    72.48    3.1    56.0   139
## Delaware              579   4809        0.9    70.06    6.2    54.6   103
## Florida              8277   4815        1.3    70.66   10.7    52.6    11
## Georgia              4931   4091        2.0    68.54   13.9    40.6    60
## Hawaii                868   4963        1.9    73.60    6.2    61.9     0
## Idaho                 813   4119        0.6    71.87    5.3    59.5   126
## Illinois            11197   5107        0.9    70.14   10.3    52.6   127
## Indiana              5313   4458        0.7    70.88    7.1    52.9   122
## Iowa                 2861   4628        0.5    72.56    2.3    59.0   140
## Kansas               2280   4669        0.6    72.58    4.5    59.9   114
## Kentucky             3387   3712        1.6    70.10   10.6    38.5    95
## Louisiana            3806   3545        2.8    68.76   13.2    42.2    12
## Maine                1058   3694        0.7    70.39    2.7    54.7   161
## Maryland             4122   5299        0.9    70.22    8.5    52.3   101
## Massachusetts        5814   4755        1.1    71.83    3.3    58.5   103
## Michigan             9111   4751        0.9    70.63   11.1    52.8   125
```

```
## Minnesota            3921   4675        0.6    72.96    2.3    57.6   160
## Mississippi          2341   3098        2.4    68.09   12.5    41.0    50
## Missouri             4767   4254        0.8    70.69    9.3    48.8   108
## Montana               746   4347        0.6    70.56    5.0    59.2   155
## Nebraska             1544   4508        0.6    72.60    2.9    59.3   139
## Nevada                590   5149        0.5    69.03   11.5    65.2   188
## New Hampshire         812   4281        0.7    71.23    3.3    57.6   174
## New Jersey           7333   5237        1.1    70.93    5.2    52.5   115
## New Mexico           1144   3601        2.2    70.32    9.7    55.2   120
## New York            18076   4903        1.4    70.55   10.9    52.7    82
## North Carolina       5441   3875        1.8    69.21   11.1    38.5    80
## North Dakota          637   5087        0.8    72.78    1.4    50.3   186
## Ohio                10735   4561        0.8    70.82    7.4    53.2   124
## Oklahoma             2715   3983        1.1    71.42    6.4    51.6    82
## Oregon               2284   4660        0.6    72.13    4.2    60.0    44
## Pennsylvania        11860   4449        1.0    70.43    6.1    50.2   126
## Rhode Island          931   4558        1.3    71.90    2.4    46.4   127
## South Carolina       2816   3635        2.3    67.96   11.6    37.8    65
## South Dakota          681   4167        0.5    72.08    1.7    53.3   172
## Tennessee            4173   3821        1.7    70.11   11.0    41.8    70
## Texas               12237   4188        2.2    70.90   12.2    47.4    35
## Utah                 1203   4022        0.6    72.90    4.5    67.3   137
## Vermont               472   3907        0.6    71.64    5.5    57.1   168
## Virginia             4981   4701        1.4    70.08    9.5    47.8    85
## Washington           3559   4864        0.6    71.72    4.3    63.5    32
## West Virginia        1799   3617        1.4    69.48    6.7    41.6   100
## Wisconsin            4589   4468        0.7    72.48    3.0    54.5   149
## Wyoming               376   4566        0.6    70.29    6.9    62.9   173
##                    Area abb   area        region
## Alabama           50708  AL  51609         South
## Alaska           566432  AK 589757          West
## Arizona          113417  AZ 113909          West
## Arkansas          51945  AR  53104         South
## California       156361  CA 158693          West
## Colorado         103766  CO 104247          West
## Connecticut        4862  CT   5009     Northeast
## Delaware           1982  DE   2057         South
## Florida           54090  FL  58560         South
## Georgia           58073  GA  58876         South
## Hawaii             6425  HI   6450          West
## Idaho             82677  ID  83557          West
## Illinois          55748  IL  56400 North Central
## Indiana           36097  IN  36291 North Central
## Iowa              55941  IA  56290 North Central
## Kansas            81787  KS  82264 North Central
## Kentucky          39650  KY  40395         South
## Louisiana         44930  LA  48523         South
## Maine             30920  ME  33215     Northeast
## Maryland           9891  MD  10577         South
## Massachusetts      7826  MA   8257     Northeast
## Michigan          56817  MI  58216 North Central
## Minnesota         79289  MN  84068 North Central
## Mississippi       47296  MS  47716         South
## Missouri          68995  MO  69686 North Central
```

```
## Montana        145587  MT 147138          West
## Nebraska        76483  NE  77227 North Central
## Nevada         109889  NV 110540          West
## New Hampshire    9027  NH   9304     Northeast
## New Jersey       7521  NJ   7836     Northeast
## New Mexico     121412  NM 121666          West
## New York        47831  NY  49576     Northeast
## North Carolina  48798  NC  52586         South
## North Dakota    69273  ND  70665 North Central
## Ohio            40975  OH  41222 North Central
## Oklahoma        68782  OK  69919         South
## Oregon          96184  OR  96981          West
## Pennsylvania    44966  PA  45333     Northeast
## Rhode Island     1049  RI   1214     Northeast
## South Carolina  30225  SC  31055         South
## South Dakota    75955  SD  77047 North Central
## Tennessee       41328  TN  42244         South
## Texas          262134  TX 267339         South
## Utah            82096  UT  84916          West
## Vermont          9267  VT   9609     Northeast
## Virginia        39780  VA  40815         South
## Washington      66570  WA  68192          West
## West Virginia   24070  WV  24181         South
## Wisconsin       54464  WI  56154 North Central
## Wyoming         97203  WY  97914          West
```

```
state.x77.data.frame =state.x77.data.frame[,-c(4,6,7,9,10)]
state.x77.data.frame
```

```
##               Population Income Illiteracy Murder   Area         region
## Alabama             3615   3624        2.1   15.1  50708          South
## Alaska               365   6315        1.5   11.3 566432           West
## Arizona             2212   4530        1.8    7.8 113417           West
## Arkansas            2110   3378        1.9   10.1  51945          South
## California         21198   5114        1.1   10.3 156361           West
## Colorado            2541   4884        0.7    6.8 103766           West
## Connecticut         3100   5348        1.1    3.1   4862      Northeast
## Delaware             579   4809        0.9    6.2   1982          South
## Florida             8277   4815        1.3   10.7  54090          South
## Georgia             4931   4091        2.0   13.9  58073          South
## Hawaii               868   4963        1.9    6.2   6425           West
## Idaho                813   4119        0.6    5.3  82677           West
## Illinois           11197   5107        0.9   10.3  55748 North Central
## Indiana             5313   4458        0.7    7.1  36097 North Central
## Iowa                2861   4628        0.5    2.3  55941 North Central
## Kansas              2280   4669        0.6    4.5  81787 North Central
## Kentucky            3387   3712        1.6   10.6  39650          South
## Louisiana           3806   3545        2.8   13.2  44930          South
## Maine               1058   3694        0.7    2.7  30920      Northeast
## Maryland            4122   5299        0.9    8.5   9891          South
## Massachusetts       5814   4755        1.1    3.3   7826      Northeast
## Michigan            9111   4751        0.9   11.1  56817 North Central
## Minnesota           3921   4675        0.6    2.3  79289 North Central
## Mississippi         2341   3098        2.4   12.5  47296          South
## Missouri            4767   4254        0.8    9.3  68995 North Central
```

```
## Montana               746   4347        0.6    5.0 145587          West
## Nebraska             1544   4508        0.6    2.9  76483 North Central
## Nevada                590   5149        0.5   11.5 109889          West
## New Hampshire         812   4281        0.7    3.3   9027     Northeast
## New Jersey           7333   5237        1.1    5.2   7521     Northeast
## New Mexico           1144   3601        2.2    9.7 121412          West
## New York            18076   4903        1.4   10.9  47831     Northeast
## North Carolina       5441   3875        1.8   11.1  48798         South
## North Dakota          637   5087        0.8    1.4  69273 North Central
## Ohio                10735   4561        0.8    7.4  40975 North Central
## Oklahoma             2715   3983        1.1    6.4  68782         South
## Oregon               2284   4660        0.6    4.2  96184          West
## Pennsylvania        11860   4449        1.0    6.1  44966     Northeast
## Rhode Island          931   4558        1.3    2.4   1049     Northeast
## South Carolina       2816   3635        2.3   11.6  30225         South
## South Dakota          681   4167        0.5    1.7  75955 North Central
## Tennessee            4173   3821        1.7   11.0  41328         South
## Texas               12237   4188        2.2   12.2 262134         South
## Utah                 1203   4022        0.6    4.5  82096          West
## Vermont               472   3907        0.6    5.5   9267     Northeast
## Virginia             4981   4701        1.4    9.5  39780         South
## Washington           3559   4864        0.6    4.3  66570          West
## West Virginia        1799   3617        1.4    6.7  24070         South
## Wisconsin            4589   4468        0.7    3.0  54464 North Central
## Wyoming               376   4566        0.6    6.9  97203          West
```

-Añade una variable que categorice el nivel de formacion (illiteracy) de manera que [0,1) is low, [1,2) is some, [2, inf) is high.Pista. Hazlo de dos formas usando la función cut() y usando ifelse().

```
#Usando cut
categorizar.cut = cut(state.x77.data.frame$Illiteracy, breaks =c(0,1,2,Inf), labels=(c("low", "some","hi

state.x77.data.frame = data.frame(state.x77.data.frame,categorizar.cut)
state.x77.data.frame
```

```
##                Population Income Illiteracy Murder   Area        region
## Alabama              3615   3624        2.1   15.1  50708         South
## Alaska                365   6315        1.5   11.3 566432          West
## Arizona              2212   4530        1.8    7.8 113417          West
## Arkansas             2110   3378        1.9   10.1  51945         South
## California          21198   5114        1.1   10.3 156361          West
## Colorado             2541   4884        0.7    6.8 103766          West
## Connecticut          3100   5348        1.1    3.1   4862     Northeast
## Delaware              579   4809        0.9    6.2   1982         South
## Florida              8277   4815        1.3   10.7  54090         South
## Georgia              4931   4091        2.0   13.9  58073         South
## Hawaii                868   4963        1.9    6.2   6425          West
## Idaho                 813   4119        0.6    5.3  82677          West
## Illinois            11197   5107        0.9   10.3  55748 North Central
## Indiana              5313   4458        0.7    7.1  36097 North Central
## Iowa                 2861   4628        0.5    2.3  55941 North Central
## Kansas               2280   4669        0.6    4.5  81787 North Central
```

```
## Kentucky             3387   3712        1.6   10.6  39650         South
## Louisiana            3806   3545        2.8   13.2  44930         South
## Maine                1058   3694        0.7    2.7  30920     Northeast
## Maryland             4122   5299        0.9    8.5   9891         South
## Massachusetts        5814   4755        1.1    3.3   7826     Northeast
## Michigan             9111   4751        0.9   11.1  56817 North Central
## Minnesota            3921   4675        0.6    2.3  79289 North Central
## Mississippi          2341   3098        2.4   12.5  47296         South
## Missouri             4767   4254        0.8    9.3  68995 North Central
## Montana               746   4347        0.6    5.0 145587          West
## Nebraska             1544   4508        0.6    2.9  76483 North Central
## Nevada                590   5149        0.5   11.5 109889          West
## New Hampshire         812   4281        0.7    3.3   9027     Northeast
## New Jersey           7333   5237        1.1    5.2   7521     Northeast
## New Mexico           1144   3601        2.2    9.7 121412          West
## New York            18076   4903        1.4   10.9  47831     Northeast
## North Carolina       5441   3875        1.8   11.1  48798         South
## North Dakota          637   5087        0.8    1.4  69273 North Central
## Ohio                10735   4561        0.8    7.4  40975 North Central
## Oklahoma             2715   3983        1.1    6.4  68782         South
## Oregon               2284   4660        0.6    4.2  96184          West
## Pennsylvania        11860   4449        1.0    6.1  44966     Northeast
## Rhode Island          931   4558        1.3    2.4   1049     Northeast
## South Carolina       2816   3635        2.3   11.6  30225         South
## South Dakota          681   4167        0.5    1.7  75955 North Central
## Tennessee            4173   3821        1.7   11.0  41328         South
## Texas               12237   4188        2.2   12.2 262134         South
## Utah                 1203   4022        0.6    4.5  82096          West
## Vermont               472   3907        0.6    5.5   9267     Northeast
## Virginia             4981   4701        1.4    9.5  39780         South
## Washington           3559   4864        0.6    4.3  66570          West
## West Virginia        1799   3617        1.4    6.7  24070         South
## Wisconsin            4589   4468        0.7    3.0  54464 North Central
## Wyoming               376   4566        0.6    6.9  97203          West
##                categorizar.cut
## Alabama                   high
## Alaska                    some
## Arizona                   some
## Arkansas                  some
## California                some
## Colorado                   low
## Connecticut               some
## Delaware                   low
## Florida                   some
## Georgia                   some
## Hawaii                    some
## Idaho                      low
## Illinois                   low
## Indiana                    low
## Iowa                       low
## Kansas                     low
## Kentucky                  some
## Louisiana                 high
## Maine                      low
```

```
## Maryland                   low
## Massachusetts             some
## Michigan                   low
## Minnesota                  low
## Mississippi               high
## Missouri                   low
## Montana                    low
## Nebraska                   low
## Nevada                     low
## New Hampshire              low
## New Jersey                some
## New Mexico                high
## New York                  some
## North Carolina            some
## North Dakota               low
## Ohio                       low
## Oklahoma                  some
## Oregon                     low
## Pennsylvania               low
## Rhode Island              some
## South Carolina            high
## South Dakota               low
## Tennessee                 some
## Texas                     high
## Utah                       low
## Vermont                    low
## Virginia                  some
## Washington                 low
## West Virginia             some
## Wisconsin                  low
## Wyoming                    low
```

```r
#Usando ifelse
categorizar.ifelse = ifelse(state.x77.data.frame$Illiteracy >=0 &
                            state.x77.data.frame$Illiteracy < 1,
                            "low", ifelse(state.x77.data.frame$Illiteracy >=1
                            & state.x77.data.frame$Illiteracy < 2, "some","high"))
state.x77.data.frame = data.frame(state.x77.data.frame,categorizar.ifelse)
state.x77.data.frame
```

```
##                Population Income Illiteracy Murder   Area         region
## Alabama              3615   3624        2.1   15.1  50708          South
## Alaska                365   6315        1.5   11.3 566432           West
## Arizona              2212   4530        1.8    7.8 113417           West
## Arkansas             2110   3378        1.9   10.1  51945          South
## California          21198   5114        1.1   10.3 156361           West
## Colorado             2541   4884        0.7    6.8 103766           West
## Connecticut          3100   5348        1.1    3.1   4862      Northeast
## Delaware              579   4809        0.9    6.2   1982          South
## Florida              8277   4815        1.3   10.7  54090          South
## Georgia              4931   4091        2.0   13.9  58073          South
## Hawaii                868   4963        1.9    6.2   6425           West
## Idaho                 813   4119        0.6    5.3  82677           West
## Illinois            11197   5107        0.9   10.3  55748 North Central
## Indiana              5313   4458        0.7    7.1  36097 North Central
```

```
## Iowa                2861   4628        0.5    2.3  55941 North Central
## Kansas              2280   4669        0.6    4.5  81787 North Central
## Kentucky            3387   3712        1.6   10.6  39650         South
## Louisiana           3806   3545        2.8   13.2  44930         South
## Maine               1058   3694        0.7    2.7  30920     Northeast
## Maryland            4122   5299        0.9    8.5   9891         South
## Massachusetts       5814   4755        1.1    3.3   7826     Northeast
## Michigan            9111   4751        0.9   11.1  56817 North Central
## Minnesota           3921   4675        0.6    2.3  79289 North Central
## Mississippi         2341   3098        2.4   12.5  47296         South
## Missouri            4767   4254        0.8    9.3  68995 North Central
## Montana              746   4347        0.6    5.0 145587          West
## Nebraska            1544   4508        0.6    2.9  76483 North Central
## Nevada               590   5149        0.5   11.5 109889          West
## New Hampshire        812   4281        0.7    3.3   9027     Northeast
## New Jersey          7333   5237        1.1    5.2   7521     Northeast
## New Mexico          1144   3601        2.2    9.7 121412          West
## New York           18076   4903        1.4   10.9  47831     Northeast
## North Carolina      5441   3875        1.8   11.1  48798         South
## North Dakota         637   5087        0.8    1.4  69273 North Central
## Ohio               10735   4561        0.8    7.4  40975 North Central
## Oklahoma            2715   3983        1.1    6.4  68782         South
## Oregon              2284   4660        0.6    4.2  96184          West
## Pennsylvania       11860   4449        1.0    6.1  44966     Northeast
## Rhode Island         931   4558        1.3    2.4   1049     Northeast
## South Carolina      2816   3635        2.3   11.6  30225         South
## South Dakota         681   4167        0.5    1.7  75955 North Central
## Tennessee           4173   3821        1.7   11.0  41328         South
## Texas              12237   4188        2.2   12.2 262134         South
## Utah                1203   4022        0.6    4.5  82096          West
## Vermont              472   3907        0.6    5.5   9267     Northeast
## Virginia            4981   4701        1.4    9.5  39780         South
## Washington          3559   4864        0.6    4.3  66570          West
## West Virginia       1799   3617        1.4    6.7  24070         South
## Wisconsin           4589   4468        0.7    3.0  54464 North Central
## Wyoming              376   4566        0.6    6.9  97203          West
##                categorizar.cut categorizar.ifelse
## Alabama                   high               high
## Alaska                    some               some
## Arizona                   some               some
## Arkansas                  some               some
## California                some               some
## Colorado                   low                low
## Connecticut               some               some
## Delaware                   low                low
## Florida                   some               some
## Georgia                   some               high
## Hawaii                    some               some
## Idaho                      low                low
## Illinois                   low                low
## Indiana                    low                low
## Iowa                       low                low
## Kansas                     low                low
## Kentucky                  some               some
```

```
## Louisiana                high              high
## Maine                     low               low
## Maryland                  low               low
## Massachusetts            some              some
## Michigan                  low               low
## Minnesota                 low               low
## Mississippi              high              high
## Missouri                  low               low
## Montana                   low               low
## Nebraska                  low               low
## Nevada                    low               low
## New Hampshire             low               low
## New Jersey               some              some
## New Mexico               high              high
## New York                 some              some
## North Carolina           some              some
## North Dakota              low               low
## Ohio                      low               low
## Oklahoma                 some              some
## Oregon                    low               low
## Pennsylvania              low              some
## Rhode Island             some              some
## South Carolina           high              high
## South Dakota              low               low
## Tennessee                some              some
## Texas                    high              high
## Utah                      low               low
## Vermont                   low               low
## Virginia                 some              some
## Washington                low               low
## West Virginia            some              some
## Wisconsin                 low               low
## Wyoming                   low               low
```

- Encuentra que estado del oeste (west) tiene la formación mas baja y los mayores ingresos. ¿Que estado es?

```
datos1 = state.x77.data.frame [which(state.x77.data.frame$region == "West"),]
datos1[order(datos1$Illiteracy,order(datos1$Income, decreasing = TRUE)),][1,]
```

```
##        Population Income Illiteracy Murder   Area region categorizar.cut
## Nevada        590   5149        0.5   11.5 109889   West             low
##        categorizar.ifelse
## Nevada                low
```

*** Crea un dataframe df with 40 columns, as follows:(df<-as.data.frame(matrix(sample(1:5, 2000, T), ncol=40))**

```
df <-as.data.frame(matrix(sample(1:5, 2000, T), ncol=40))
df
```

```
##    V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20
```

```
## 1   3  2  5  5  4  4  3  4  4  2  5  4  1  1  4  1  3  5  3  2
## 2   4  3  5  1  1  2  3  5  2  5  3  4  2  4  2  3  2  5  4  3
## 3   2  1  1  3  3  2  3  1  4  1  3  1  2  2  1  3  2  1  3  5
## 4   5  3  4  5  2  2  1  2  2  4  2  4  5  1  1  4  1  2  4  5
## 5   2  3  2  1  5  3  3  5  5  3  4  1  3  5  3  3  5  4  1  1
## 6   5  1  5  4  2  5  3  5  1  2  3  4  3  2  1  4  3  2  3  4
## 7   5  3  1  2  5  3  4  5  4  1  1  2  5  1  2  5  4  3  1  2
## 8   4  5  1  1  5  3  2  3  5  2  5  4  2  4  3  4  3  5  4  4
## 9   2  2  5  2  5  5  5  1  5  1  5  3  1  3  1  3  3  5  3  3
## 10  3  1  5  4  3  4  4  2  4  2  1  2  5  5  5  5  4  3  5  1
## 11  2  3  2  1  4  3  2  4  3  2  4  3  4  2  2  4  4  1  3  4
## 12  4  5  2  5  2  4  4  2  4  4  5  5  5  5  5  2  3  1  3  3
## 13  5  3  2  4  2  4  5  3  3  3  5  3  4  2  5  3  4  2  1  3
## 14  1  4  4  4  2  5  5  4  3  4  2  4  2  5  3  2  5  3  4  4
## 15  2  1  2  3  2  1  1  1  5  4  4  1  1  5  3  2  5  1  5  1
## 16  5  5  1  5  2  3  4  3  3  2  1  3  5  3  3  5  2  1  2  3
## 17  1  5  3  4  3  3  1  2  1  1  4  5  3  3  1  5  5  1  4  5
## 18  1  2  2  1  3  1  5  3  3  2  4  1  3  1  5  2  5  2  3  3
## 19  1  2  2  4  2  3  3  3  4  4  1  1  2  3  5  5  1  3  5  5
## 20  2  2  2  5  4  2  3  2  4  4  4  5  3  3  4  4  4  4  2  2
## 21  4  2  5  3  3  5  5  3  4  2  1  1  3  4  1  4  3  4  1  2
## 22  3  1  1  2  2  1  5  2  2  2  3  1  4  5  3  4  1  1  5  1
## 23  3  4  5  2  1  2  3  3  2  5  4  4  5  2  5  3  1  5  2  3
## 24  2  4  1  5  5  1  1  4  1  3  5  4  5  4  4  2  2  5  5  2
## 25  4  4  4  2  4  1  5  4  1  4  2  4  1  4  2  1  1  4  4  2
## 26  5  5  4  3  1  3  2  5  5  5  3  4  2  5  1  4  2  5  3  5
## 27  3  3  5  5  5  4  2  5  1  5  1  1  2  4  2  3  1  1  5  5
## 28  4  5  5  1  5  5  1  2  5  5  4  5  1  2  4  1  4  1  4  3
## 29  4  1  5  3  5  5  5  3  2  3  5  1  2  3  3  2  3  3  5  3
## 30  1  1  2  2  3  1  4  3  1  5  2  1  5  2  5  2  2  5  1  1
## 31  5  3  3  3  5  5  2  2  5  1  1  3  2  5  2  3  1  5  2  3
## 32  5  1  5  5  5  1  2  1  4  1  3  2  1  2  3  5  4  2  3  3
## 33  5  2  5  1  1  3  4  2  2  5  1  3  1  2  2  5  2  4  1  3
## 34  3  1  3  2  5  4  2  2  4  2  3  1  5  3  4  4  3  1  1  5
## 35  3  4  2  2  5  4  1  3  4  1  1  3  4  5  3  2  4  1  5  4
## 36  3  5  4  4  3  4  1  1  5  4  4  2  5  5  5  2  4  3  5  1
## 37  5  5  5  3  1  5  1  2  1  5  1  5  2  5  1  3  4  4  5  2
## 38  2  3  4  5  4  4  3  4  1  3  5  2  3  3  5  2  5  1  3  1
## 39  1  5  1  3  5  2  2  1  3  1  5  1  4  2  1  2  4  3  2  4
## 40  2  2  4  3  1  4  5  5  4  5  3  2  5  4  2  2  4  4  3  4
## 41  3  5  2  4  5  3  2  3  2  5  3  4  2  5  3  3  1  2  4  3
## 42  2  4  4  5  1  1  4  5  4  3  2  3  3  2  1  5  1  4  5  3
## 43  4  4  2  1  4  1  1  1  4  2  5  2  2  4  5  2  4  4  4  4
## 44  3  2  3  2  4  5  3  3  3  1  1  4  5  2  4  2  3  5  5  3
## 45  3  1  5  2  3  3  4  2  3  4  1  2  2  5  4  3  5  2  3  2
## 46  4  4  2  3  2  5  4  1  4  2  1  5  2  1  3  3  1  1  2  3
## 47  2  4  1  3  4  2  2  2  4  2  2  3  3  1  5  2  1  3  3  2
## 48  3  5  4  2  2  4  2  2  1  4  2  5  3  3  4  1  1  3  2  3
## 49  5  1  5  2  4  3  1  2  3  4  2  2  3  2  1  3  1  1  2  4
## 50  5  5  5  2  2  4  4  1  3  1  1  1  4  5  3  1  2  5  4  2
##     V21 V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32 V33 V34 V35 V36 V37 V38
## 1     5   3   4   2   3   3   3   3   4   5   3   4   4   4   4   1   3   5
## 2     3   4   4   4   3   5   4   3   4   1   2   5   3   1   4   5   1   1
## 3     3   2   3   3   2   1   5   2   3   2   3   3   4   2   2   1   5   3
```

```
## 4    5   3   3   3   2   3   4   2   2   5   2   3   4   5   2   3   1   2
## 5    3   3   3   5   1   1   3   3   3   4   4   3   1   4   2   3   3   2
## 6    4   4   5   1   5   5   1   1   2   4   2   5   2   2   4   1   4   3
## 7    5   1   2   4   4   5   2   2   5   2   2   5   1   3   2   5   1   2
## 8    3   2   5   2   2   1   4   3   3   1   1   5   3   3   2   1   2   2
## 9    5   4   5   5   2   5   1   1   4   5   3   4   1   1   4   5   3   4
## 10   5   1   5   5   4   2   1   5   4   1   3   3   5   1   1   4   3   3
## 11   5   5   3   4   2   5   4   1   4   2   3   2   4   3   3   3   5   3
## 12   5   1   1   2   5   5   2   4   1   3   3   3   5   2   3   2   5   3
## 13   3   1   5   3   5   3   2   5   4   5   2   2   2   5   1   4   3   4
## 14   5   5   1   3   5   3   2   3   4   4   4   2   3   3   4   4   2   5
## 15   3   1   3   4   4   4   1   2   1   4   4   1   2   5   3   1   1   3
## 16   5   4   2   5   4   4   1   1   5   1   4   4   2   1   2   2   2   2
## 17   2   3   3   3   3   2   1   1   4   3   1   1   4   3   1   3   4   1
## 18   4   2   4   2   2   1   3   1   4   1   4   1   4   2   2   5   1   1
## 19   4   1   2   5   1   1   2   2   5   5   1   3   1   2   1   1   1   5
## 20   5   3   3   3   4   1   1   3   5   5   1   1   4   2   2   5   4   5
## 21   2   3   3   1   5   1   5   2   3   1   5   2   2   5   3   2   4   1
## 22   2   1   1   4   5   1   3   1   1   5   3   1   1   5   2   2   5   5
## 23   1   1   5   5   2   1   5   5   1   4   5   5   2   5   3   1   1   5
## 24   3   2   1   3   1   1   4   1   5   5   2   5   4   1   5   4   2   5
## 25   5   5   5   2   5   2   5   2   1   3   1   4   3   3   4   4   4   2
## 26   4   4   5   3   1   4   3   4   1   3   2   4   1   4   4   3   2   2
## 27   4   2   2   5   5   3   2   4   2   5   1   3   2   5   3   5   1   3
## 28   1   4   5   3   2   1   1   5   3   3   1   4   1   5   4   3   2   3
## 29   2   1   2   4   3   1   4   1   2   2   4   5   4   5   2   1   5   1
## 30   2   1   3   3   4   4   3   2   1   4   2   2   5   2   4   5   3   5
## 31   5   5   5   1   5   4   4   1   2   1   2   3   3   3   2   4   2   2
## 32   1   3   1   5   5   3   5   1   2   4   4   2   3   1   1   3   4   2
## 33   3   5   1   2   1   2   5   3   2   3   4   4   3   1   3   1   5   5
## 34   2   1   1   5   4   3   5   5   3   2   1   5   3   5   2   1   3   5
## 35   1   1   2   5   4   1   1   5   1   5   2   1   5   4   4   5   1   3
## 36   4   3   5   5   4   4   1   2   1   4   4   4   3   2   4   4   4   5
## 37   3   1   2   3   2   3   5   1   2   2   5   1   5   5   5   4   3   4
## 38   1   2   3   2   5   5   2   2   3   2   3   5   3   1   5   4   3   3
## 39   2   3   5   2   2   5   2   2   5   2   4   4   4   1   2   2   5   2
## 40   1   5   3   5   1   3   4   5   4   4   4   4   2   1   2   3   3   2
## 41   3   2   1   2   5   2   1   3   2   4   4   2   4   1   1   1   3   4
## 42   4   4   1   4   5   3   1   4   1   5   4   2   3   2   1   3   2   3
## 43   4   1   2   2   3   4   5   1   3   4   3   4   4   3   4   4   5   1
## 44   3   5   4   3   3   5   5   3   4   1   5   5   3   1   4   2   1   2
## 45   2   1   4   4   3   2   1   2   4   5   2   5   5   1   2   1   1   4
## 46   4   1   4   5   1   4   4   2   5   2   5   2   1   5   1   5   4   2
## 47   1   2   1   2   3   5   2   1   1   1   3   1   5   2   5   1   2   1
## 48   3   1   2   4   2   5   4   1   1   2   3   5   1   4   5   4   3   5
## 49   5   1   4   5   2   3   2   4   2   4   1   4   3   4   5   1   2   2
## 50   1   1   5   5   3   2   2   2   4   5   5   2   2   4   3   1   2   4
##    V39 V40
## 1    4   3
## 2    4   3
## 3    4   4
## 4    3   4
## 5    3   2
## 6    2   5
```

```
## 7    1   2
## 8    2   5
## 9    3   1
## 10   4   4
## 11   5   4
## 12   1   2
## 13   3   3
## 14   3   4
## 15   3   1
## 16   2   1
## 17   1   1
## 18   1   3
## 19   5   2
## 20   4   2
## 21   5   2
## 22   3   2
## 23   4   5
## 24   3   5
## 25   5   4
## 26   5   4
## 27   2   2
## 28   5   1
## 29   4   2
## 30   4   5
## 31   3   1
## 32   5   4
## 33   4   2
## 34   5   4
## 35   5   2
## 36   3   3
## 37   1   5
## 38   5   3
## 39   4   2
## 40   2   1
## 41   3   5
## 42   3   5
## 43   2   3
## 44   4   4
## 45   2   3
## 46   4   5
## 47   5   3
## 48   2   1
## 49   2   3
## 50   3   1
```

a. Ordena el dataframe por columnas, de izquierda a derecha en orden creciente

```
df <- df[do.call(order, df), ]
df
```

```
##    V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20
## 30  1  1  2  2  3  1  4  3  1   5   2   1   5   2   5   2   2   5   1   1
## 18  1  2  2  1  3  1  5  3  3   2   4   1   3   1   5   2   5   2   3   3
```

```
## 19  1  2  2  4  2  3  3  3  4  4  1  1  2  3  5  5  1  3  5  5
## 14  1  4  4  4  2  5  5  4  3  4  2  4  2  5  3  2  5  3  4  4
## 39  1  5  1  3  5  2  2  1  3  1  5  1  4  2  1  2  4  3  2  4
## 17  1  5  3  4  3  3  1  2  1  1  4  5  3  3  1  5  5  1  4  5
## 3   2  1  1  3  3  2  3  1  4  1  3  1  2  2  1  3  2  1  3  5
## 15  2  1  2  3  2  1  1  1  5  4  4  1  1  5  3  2  5  1  5  1
## 20  2  2  2  5  4  2  3  2  4  4  4  5  3  3  4  4  4  4  2  2
## 40  2  2  4  3  1  4  5  5  4  5  3  2  5  4  2  2  4  4  3  4
## 9   2  2  5  2  5  5  5  1  5  1  5  3  1  3  1  3  3  5  3  3
## 11  2  3  2  1  4  3  2  4  3  2  4  3  4  2  2  4  4  1  3  4
## 5   2  3  2  1  5  3  3  5  5  3  4  1  3  5  3  3  5  4  1  1
## 38  2  3  4  5  4  4  3  4  1  3  5  2  3  3  5  2  5  1  3  1
## 47  2  4  1  3  4  2  2  2  4  2  2  3  3  1  5  2  1  3  3  2
## 24  2  4  1  5  5  1  1  4  1  3  5  4  5  4  4  2  2  5  5  2
## 42  2  4  4  5  1  1  4  5  4  3  2  3  3  2  1  5  1  4  5  3
## 22  3  1  1  2  2  1  5  2  2  2  3  1  4  5  3  4  1  1  5  1
## 34  3  1  3  2  5  4  2  2  4  2  3  1  5  3  4  4  3  1  1  5
## 45  3  1  5  2  3  3  4  2  3  4  1  2  2  5  4  3  5  2  3  2
## 10  3  1  5  4  3  4  4  2  4  2  1  2  5  5  5  5  4  3  5  1
## 44  3  2  3  2  4  5  3  3  3  1  1  4  5  2  4  2  3  5  5  3
## 1   3  2  5  5  4  4  3  4  4  2  5  4  1  1  4  1  3  5  3  2
## 27  3  3  5  5  5  4  2  5  1  5  1  1  2  4  2  3  1  1  5  5
## 35  3  4  2  2  5  4  1  3  4  1  1  3  4  5  3  2  4  1  5  4
## 23  3  4  5  2  1  2  3  3  2  5  4  4  5  2  5  3  1  5  2  3
## 41  3  5  2  4  5  3  2  3  2  5  3  4  2  5  3  3  1  2  4  3
## 48  3  5  4  2  2  4  2  2  1  4  2  5  3  3  4  1  1  3  2  3
## 36  3  5  4  4  3  4  1  1  5  4  4  2  5  5  5  2  4  3  5  1
## 29  4  1  5  3  5  5  5  3  2  3  5  1  2  3  3  2  3  3  5  3
## 21  4  2  5  3  3  5  5  3  4  2  1  1  3  4  1  4  3  4  1  2
## 2   4  3  5  1  1  2  3  5  2  5  3  4  2  4  2  3  2  5  4  3
## 43  4  4  2  1  4  1  1  1  4  2  5  2  2  4  5  2  4  4  4  4
## 46  4  4  2  3  2  5  4  1  4  2  1  5  2  1  3  3  1  1  2  3
## 25  4  4  4  2  4  1  5  4  1  4  2  4  1  4  2  1  1  4  4  2
## 8   4  5  1  1  5  3  2  3  5  2  5  4  2  4  3  4  3  5  4  4
## 12  4  5  2  5  2  4  4  2  4  4  5  5  5  5  5  2  3  1  3  3
## 28  4  5  5  1  5  5  1  2  5  5  4  5  1  2  4  1  4  1  4  3
## 49  5  1  5  2  4  3  1  2  3  4  2  2  3  2  1  3  1  1  2  4
## 6   5  1  5  4  2  5  3  5  1  2  3  4  3  2  1  4  3  2  3  4
## 32  5  1  5  5  5  1  2  1  4  1  3  2  1  2  3  5  4  2  3  3
## 33  5  2  5  1  1  3  4  2  2  5  1  3  1  2  2  5  2  4  1  3
## 7   5  3  1  2  5  3  4  5  4  1  1  2  5  1  2  5  4  3  1  2
## 13  5  3  2  4  2  4  5  3  3  3  5  3  4  2  5  3  4  2  1  3
## 31  5  3  3  3  5  5  2  2  5  1  1  3  2  5  2  3  1  5  2  3
## 4   5  3  4  5  2  2  1  2  2  4  2  4  5  1  1  4  1  2  4  5
## 16  5  5  1  5  2  3  4  3  3  2  1  3  5  3  3  5  2  1  2  3
## 26  5  5  4  3  1  3  2  5  5  5  3  4  2  5  1  4  2  5  3  5
## 50  5  5  5  2  2  4  4  1  3  1  1  1  4  5  3  1  2  5  4  2
## 37  5  5  5  3  1  5  1  2  1  5  1  5  2  5  1  3  4  4  5  2
##     V21 V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32 V33 V34 V35 V36 V37 V38
## 30   2   1   3   3   4   4   3   2   1   4   2   2   5   2   4   5   3   5
## 18   4   2   4   2   2   1   3   1   4   1   4   1   4   2   2   5   1   1
## 19   4   1   2   5   1   1   2   2   5   5   1   3   1   2   1   1   1   5
## 14   5   5   1   3   5   3   2   3   4   4   4   2   3   3   4   4   2   5
## 39   2   3   5   2   2   5   2   2   5   2   4   4   4   1   2   2   5   2
```

```
## 17   2   3   3   3   3   2   1   1   4   3   1   1   4   3   1   3   4   1
## 3    3   2   3   3   2   1   5   2   3   2   3   3   4   2   2   1   5   3
## 15   3   1   3   4   4   4   1   2   1   4   4   1   2   5   3   1   1   3
## 20   5   3   3   3   4   1   1   3   5   5   1   1   4   2   2   5   4   5
## 40   1   5   3   5   1   3   4   5   4   4   4   4   2   1   2   3   3   2
## 9    5   4   5   5   2   5   1   1   4   5   3   4   1   1   4   5   3   4
## 11   5   5   3   4   2   5   4   1   4   2   3   2   4   3   3   3   5   3
## 5    3   3   3   5   1   1   3   3   3   4   4   3   1   4   2   3   3   2
## 38   1   2   3   2   5   5   2   2   3   2   3   5   3   1   5   4   3   3
## 47   1   2   1   2   3   5   2   1   1   1   3   1   5   2   5   1   2   1
## 24   3   2   1   3   1   1   4   1   5   5   2   5   4   1   5   4   2   5
## 42   4   4   1   4   5   3   1   4   1   5   4   2   3   2   1   3   2   3
## 22   2   1   1   4   5   1   3   1   1   5   3   1   1   5   2   2   5   5
## 34   2   1   1   5   4   3   5   5   3   2   1   5   3   5   2   1   3   5
## 45   2   1   4   4   3   2   1   2   4   5   2   5   5   1   2   1   1   4
## 10   5   1   5   5   4   2   1   5   4   1   3   3   5   1   1   4   3   3
## 44   3   5   4   3   3   5   5   3   4   1   5   5   3   1   4   2   1   2
## 1    5   3   4   2   3   3   3   3   4   5   3   4   4   4   4   1   3   5
## 27   4   2   2   5   5   3   2   4   2   5   1   3   2   5   3   5   1   3
## 35   1   1   2   5   4   1   1   5   1   5   2   1   5   4   4   5   1   3
## 23   1   1   5   5   2   1   5   5   1   4   5   5   2   5   3   1   1   5
## 41   3   2   1   2   5   2   1   3   2   4   4   2   4   1   1   1   3   4
## 48   3   1   2   4   2   5   4   1   1   2   3   5   1   4   5   4   3   5
## 36   4   3   5   5   4   4   1   2   1   4   4   4   3   2   4   4   4   5
## 29   2   1   2   4   3   1   4   1   2   2   4   5   4   5   2   1   5   1
## 21   2   3   3   1   5   1   5   2   3   1   5   2   2   5   3   2   4   1
## 2    3   4   4   4   3   5   4   3   4   1   2   5   3   1   4   5   1   1
## 43   4   1   2   2   3   4   5   1   3   4   3   4   4   3   4   4   5   1
## 46   4   1   4   5   1   4   4   2   5   2   5   2   1   5   1   5   4   2
## 25   5   5   5   2   5   2   5   2   1   3   1   4   3   3   4   4   4   2
## 8    3   2   5   2   2   1   4   3   3   1   1   5   3   3   2   1   2   2
## 12   5   1   1   2   5   5   2   4   1   3   3   3   5   2   3   2   5   3
## 28   1   4   5   3   2   1   1   5   3   3   1   4   1   5   4   3   2   3
## 49   5   1   4   5   2   3   2   4   2   4   1   4   3   4   5   1   2   2
## 6    4   4   5   1   5   5   1   1   2   4   2   5   2   2   4   1   4   3
## 32   1   3   1   5   5   3   5   1   2   4   4   2   3   1   1   3   4   2
## 33   3   5   1   2   1   2   5   3   2   3   4   4   3   1   3   1   5   5
## 7    5   1   2   4   4   5   2   2   5   2   2   5   1   3   2   5   1   2
## 13   3   1   5   3   5   3   2   5   4   5   2   2   2   5   1   4   3   4
## 31   5   5   5   1   5   4   4   1   2   1   2   3   3   3   2   4   2   2
## 4    5   3   3   3   2   3   4   2   2   5   2   3   4   5   2   3   1   2
## 16   5   4   2   5   4   4   1   1   5   1   4   4   2   1   2   2   2   2
## 26   4   4   5   3   1   4   3   4   1   3   2   4   1   4   4   3   2   2
## 50   1   1   5   5   3   2   2   2   4   5   5   2   2   4   3   1   2   4
## 37   3   1   2   3   2   3   5   1   2   2   5   1   5   5   5   4   3   4
##     V39 V40
## 30   4   5
## 18   1   3
## 19   5   2
## 14   3   4
## 39   4   2
## 17   1   1
## 3    4   4
## 15   3   1
```

```
## 20   4   2
## 40   2   1
## 9    3   1
## 11   5   4
## 5    3   2
## 38   5   3
## 47   5   3
## 24   3   5
## 42   3   5
## 22   3   2
## 34   5   4
## 45   2   3
## 10   4   4
## 44   4   4
## 1    4   3
## 27   2   2
## 35   5   2
## 23   4   5
## 41   3   5
## 48   2   1
## 36   3   3
## 29   4   2
## 21   5   2
## 2    4   3
## 43   2   3
## 46   4   5
## 25   5   4
## 8    2   5
## 12   1   2
## 28   5   1
## 49   2   3
## 6    2   5
## 32   5   4
## 33   4   2
## 7    1   2
## 13   3   3
## 31   3   1
## 4    3   4
## 16   2   1
## 26   5   4
## 50   3   1
## 37   1   5
```

b. Ordena el dataframe por columnas, de izquierda a derecha en orden decreciente

```
df <- df[do.call(order, -df), ]

df
```

```
##    V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20
## 37  5  5  5  3  1  5  1  2  1   5   1   5   2   5   1   3   4   4   5   2
## 50  5  5  5  2  2  4  4  1  3   1   1   1   4   5   3   1   2   5   4   2
## 26  5  5  4  3  1  3  2  5  5   5   3   4   2   5   1   4   2   5   3   5
```

```
## 16  5  5  1  5  2  3  4  3  3  2  1  3  5  3  3  5  2  1  2  3
## 4   5  3  4  5  2  2  1  2  2  4  2  4  5  1  1  4  1  2  4  5
## 31  5  3  3  3  5  5  2  2  5  1  1  3  2  5  2  3  1  5  2  3
## 13  5  3  2  4  2  4  5  3  3  3  5  3  4  2  5  3  4  2  1  3
## 7   5  3  1  2  5  3  4  5  4  1  1  2  5  1  2  5  4  3  1  2
## 33  5  2  5  1  1  3  4  2  2  5  1  3  1  2  2  5  2  4  1  3
## 32  5  1  5  5  5  1  2  1  4  1  3  2  1  2  3  5  4  2  3  3
## 6   5  1  5  4  2  5  3  5  1  2  3  4  3  2  1  4  3  2  3  4
## 49  5  1  5  2  4  3  1  2  3  4  2  2  3  2  1  3  1  1  2  4
## 28  4  5  5  1  5  5  1  2  5  5  4  5  1  2  4  1  4  1  4  3
## 12  4  5  2  5  2  4  4  2  4  4  5  5  5  5  5  2  3  1  3  3
## 8   4  5  1  1  5  3  2  3  5  2  5  4  2  4  3  4  3  5  4  4
## 25  4  4  4  2  4  1  5  4  1  4  2  4  1  4  2  1  1  4  4  2
## 46  4  4  2  3  2  5  4  1  4  2  1  5  2  1  3  3  1  1  2  3
## 43  4  4  2  1  4  1  1  1  4  2  5  2  2  4  5  2  4  4  4  4
## 2   4  3  5  1  1  2  3  5  2  5  3  4  2  4  2  3  2  5  4  3
## 21  4  2  5  3  3  5  5  3  4  2  1  1  3  4  1  4  3  4  1  2
## 29  4  1  5  3  5  5  5  3  2  3  5  1  2  3  3  2  3  3  5  3
## 36  3  5  4  4  3  4  1  1  5  4  4  2  5  5  5  2  4  3  5  1
## 48  3  5  4  2  2  4  2  2  1  4  2  5  3  3  4  1  1  3  2  3
## 41  3  5  2  4  5  3  2  3  2  5  3  4  2  5  3  3  1  2  4  3
## 23  3  4  5  2  1  2  3  3  2  5  4  4  5  2  5  3  1  5  2  3
## 35  3  4  2  2  5  4  1  3  4  1  1  3  4  5  3  2  4  1  5  4
## 27  3  3  5  5  5  4  2  5  1  5  1  1  2  4  2  3  1  1  5  5
## 1   3  2  5  5  4  4  3  4  4  2  5  4  1  1  4  1  3  5  3  2
## 44  3  2  3  2  4  5  3  3  3  1  1  4  5  2  4  2  3  5  5  3
## 10  3  1  5  4  3  4  4  2  4  2  1  2  5  5  5  5  4  3  5  1
## 45  3  1  5  2  3  3  4  2  3  4  1  2  2  5  4  3  5  2  3  2
## 34  3  1  3  2  5  4  2  2  4  2  3  1  5  3  4  4  3  1  1  5
## 22  3  1  1  2  2  1  5  2  2  2  3  1  4  5  3  4  1  1  5  1
## 42  2  4  4  5  1  1  4  5  4  3  2  3  3  2  1  5  1  4  5  3
## 24  2  4  1  5  5  1  1  4  1  3  5  4  5  4  4  2  2  5  5  2
## 47  2  4  1  3  4  2  2  2  4  2  2  3  3  1  5  2  1  3  3  2
## 38  2  3  4  5  4  4  3  4  1  3  5  2  3  3  5  2  5  1  3  1
## 5   2  3  2  1  5  3  3  5  5  3  4  1  3  5  3  3  5  4  1  1
## 11  2  3  2  1  4  3  2  4  3  2  4  3  4  2  2  4  4  1  3  4
## 9   2  2  5  2  5  5  5  1  5  1  5  3  1  3  1  3  3  5  3  3
## 40  2  2  4  3  1  4  5  5  4  5  3  2  5  4  2  2  4  4  3  4
## 20  2  2  2  5  4  2  3  2  4  4  4  5  3  3  4  4  4  4  2  2
## 15  2  1  2  3  2  1  1  1  5  4  4  1  1  5  3  2  5  1  5  1
## 3   2  1  1  3  3  2  3  1  4  1  3  1  2  2  1  3  2  1  3  5
## 17  1  5  3  4  3  3  1  2  1  1  4  5  3  3  1  5  5  1  4  5
## 39  1  5  1  3  5  2  2  1  3  1  5  1  4  2  1  2  4  3  2  4
## 14  1  4  4  4  2  5  5  4  3  4  2  4  2  5  3  2  5  3  4  4
## 19  1  2  2  4  2  3  3  3  4  4  1  1  2  3  5  5  1  3  5  5
## 18  1  2  2  1  3  1  5  3  3  2  4  1  3  1  5  2  5  2  3  3
## 30  1  1  2  2  3  1  4  3  1  5  2  1  5  2  5  2  2  5  1  1
##     V21 V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32 V33 V34 V35 V36 V37 V38
## 37   3   1   2   3   2   3   5   1   2   2   5   1   5   5   5   4   3   4
## 50   1   1   5   5   3   2   2   2   4   5   5   2   2   4   3   1   2   4
## 26   4   4   5   3   1   4   3   4   1   3   2   4   1   4   4   3   2   2
## 16   5   4   2   5   4   4   1   1   5   1   4   4   2   1   2   2   2   2
## 4    5   3   3   3   2   3   4   2   2   5   2   3   4   5   2   3   1   2
## 31   5   5   5   1   5   4   4   1   2   1   2   3   3   3   2   4   2   2
```

```
## 13   3   1   5   3   5   3   2   5   4   5   2   2   2   5   1   4   3   4
## 7    5   1   2   4   4   5   2   2   5   2   2   5   1   3   2   5   1   2
## 33   3   5   1   2   1   2   5   3   2   3   4   4   3   1   3   1   5   5
## 32   1   3   1   5   5   3   5   1   2   4   4   2   3   1   1   3   4   2
## 6    4   4   5   1   5   5   1   1   2   4   2   5   2   2   4   1   4   3
## 49   5   1   4   5   2   3   2   4   2   4   1   4   3   4   5   1   2   2
## 28   1   4   5   3   2   1   1   5   3   3   1   4   1   5   4   3   2   3
## 12   5   1   1   2   5   5   2   4   1   3   3   3   5   2   3   2   5   3
## 8    3   2   5   2   2   1   4   3   3   1   1   5   3   3   2   1   2   2
## 25   5   5   5   2   5   2   5   2   1   3   1   4   3   3   4   4   4   2
## 46   4   1   4   5   1   4   4   2   5   2   5   2   1   5   1   5   4   2
## 43   4   1   2   2   3   4   5   1   3   4   3   4   4   3   4   4   5   1
## 2    3   4   4   4   3   5   4   3   4   1   2   5   3   1   4   5   1   1
## 21   2   3   3   1   5   1   5   2   3   1   5   2   2   5   3   2   4   1
## 29   2   1   2   4   3   1   4   1   2   2   4   5   4   5   2   1   5   1
## 36   4   3   5   5   4   4   1   2   1   4   4   4   3   2   4   4   4   5
## 48   3   1   2   4   2   5   4   1   1   2   3   5   1   4   5   4   3   5
## 41   3   2   1   2   5   2   1   3   2   4   4   2   4   1   1   1   3   4
## 23   1   1   5   5   2   1   5   5   1   4   5   5   2   5   3   1   1   5
## 35   1   1   2   5   4   1   1   5   1   5   2   1   5   4   4   5   1   3
## 27   4   2   2   5   5   3   2   4   2   5   1   3   2   5   3   5   1   3
## 1    5   3   4   2   3   3   3   3   4   5   3   4   4   4   4   1   3   5
## 44   3   5   4   3   3   5   5   3   4   1   5   5   3   1   4   2   1   2
## 10   5   1   5   5   4   2   1   5   4   1   3   3   5   1   1   4   3   3
## 45   2   1   4   4   3   2   1   2   4   5   2   5   5   1   2   1   1   4
## 34   2   1   1   5   4   3   5   5   3   2   1   5   3   5   2   1   3   5
## 22   2   1   1   4   5   1   3   1   1   5   3   1   1   5   2   2   5   5
## 42   4   4   1   4   5   3   1   4   1   5   4   2   3   2   1   3   2   3
## 24   3   2   1   3   1   1   4   1   5   5   2   5   4   1   5   4   2   5
## 47   1   2   1   2   3   5   2   1   1   1   3   1   5   2   5   1   2   1
## 38   1   2   3   2   5   5   2   2   3   2   3   5   3   1   5   4   3   3
## 5    3   3   3   5   1   1   3   3   3   4   4   3   1   4   2   3   3   2
## 11   5   5   3   4   2   5   4   1   4   2   3   2   4   3   3   3   5   3
## 9    5   4   5   5   2   5   1   1   4   5   3   4   1   1   4   5   3   4
## 40   1   5   3   5   1   3   4   5   4   4   4   4   2   1   2   3   3   2
## 20   5   3   3   3   4   1   1   3   5   5   1   1   4   2   2   5   4   5
## 15   3   1   3   4   4   4   1   2   1   4   4   1   2   5   3   1   1   3
## 3    3   2   3   3   2   1   5   2   3   2   3   3   4   2   2   1   5   3
## 17   2   3   3   3   3   2   1   1   4   3   1   1   4   3   1   3   4   1
## 39   2   3   5   2   2   5   2   2   5   2   4   4   4   1   2   2   5   2
## 14   5   5   1   3   5   3   2   3   4   4   4   2   3   3   4   4   2   5
## 19   4   1   2   5   1   1   2   2   5   5   1   3   1   2   1   1   1   5
## 18   4   2   4   2   2   1   3   1   4   1   4   1   4   2   2   5   1   1
## 30   2   1   3   3   4   4   3   2   1   4   2   2   5   2   4   5   3   5
##     V39 V40
## 37   1   5
## 50   3   1
## 26   5   4
## 16   2   1
## 4    3   4
## 31   3   1
## 13   3   3
## 7    1   2
## 33   4   2
```

```
## 32   5   4
## 6    2   5
## 49   2   3
## 28   5   1
## 12   1   2
## 8    2   5
## 25   5   4
## 46   4   5
## 43   2   3
## 2    4   3
## 21   5   2
## 29   4   2
## 36   3   3
## 48   2   1
## 41   3   5
## 23   4   5
## 35   5   2
## 27   2   2
## 1    4   3
## 44   4   4
## 10   4   4
## 45   2   3
## 34   5   4
## 22   3   2
## 42   3   5
## 24   3   5
## 47   5   3
## 38   5   3
## 5    3   2
## 11   5   4
## 9    3   1
## 40   2   1
## 20   4   2
## 15   3   1
## 3    4   4
## 17   1   1
## 39   4   2
## 14   3   4
## 19   5   2
## 18   1   3
## 30   4   5
```

c. Ordena el dataframe por columnas, de derecha a izquierda en orden creciente

```
df <- df[do.call(order, rev(df)), ]
df
```

```
##    V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V20
## 17  1  5  3  4  3  3  1  2  1   1   4   5   3   3   1   5   5   1   4   5
## 16  5  5  1  5  2  3  4  3  3   2   1   3   5   3   3   5   2   1   2   3
## 40  2  2  4  3  1  4  5  5  4   5   3   2   5   4   2   2   4   4   3   4
## 48  3  5  4  2  2  4  2  2  1   4   2   5   3   3   4   1   1   3   2   3
## 31  5  3  3  3  5  5  2  2  5   1   1   3   2   5   2   3   1   5   2   3
```

```
## 15  2  1  2  3  2  1  1  1  5  4  4  1  1  5  3  2  5  1  5  1
## 50  5  5  5  2  2  4  4  1  3  1  1  1  4  5  3  1  2  5  4  2
## 9   2  2  5  2  5  5  5  1  5  1  5  3  1  3  1  3  3  5  3  3
## 28  4  5  5  1  5  5  1  2  5  5  4  5  1  2  4  1  4  1  4  3
## 7   5  3  1  2  5  3  4  5  4  1  1  2  5  1  2  5  4  3  1  2
## 12  4  5  2  5  2  4  4  2  4  4  5  5  5  5  5  2  3  1  3  3
## 27  3  3  5  5  5  4  2  5  1  5  1  1  2  4  2  3  1  1  5  5
## 5   2  3  2  1  5  3  3  5  5  3  4  1  3  5  3  3  5  4  1  1
## 22  3  1  1  2  2  1  5  2  2  2  3  1  4  5  3  4  1  1  5  1
## 29  4  1  5  3  5  5  5  3  2  3  5  1  2  3  3  2  3  3  5  3
## 39  1  5  1  3  5  2  2  1  3  1  5  1  4  2  1  2  4  3  2  4
## 20  2  2  2  5  4  2  3  2  4  4  4  5  3  3  4  4  4  4  2  2
## 33  5  2  5  1  1  3  4  2  2  5  1  3  1  2  2  5  2  4  1  3
## 21  4  2  5  3  3  5  5  3  4  2  1  1  3  4  1  4  3  4  1  2
## 35  3  4  2  2  5  4  1  3  4  1  1  3  4  5  3  2  4  1  5  4
## 19  1  2  2  4  2  3  3  3  4  4  1  1  2  3  5  5  1  3  5  5
## 18  1  2  2  1  3  1  5  3  3  2  4  1  3  1  5  2  5  2  3  3
## 43  4  4  2  1  4  1  1  1  4  2  5  2  2  4  5  2  4  4  4  4
## 49  5  1  5  2  4  3  1  2  3  4  2  2  3  2  1  3  1  1  2  4
## 45  3  1  5  2  3  3  4  2  3  4  1  2  2  5  4  3  5  2  3  2
## 13  5  3  2  4  2  4  5  3  3  3  5  3  4  2  5  3  4  2  1  3
## 36  3  5  4  4  3  4  1  1  5  4  4  2  5  5  5  2  4  3  5  1
## 2   4  3  5  1  1  2  3  5  2  5  3  4  2  4  2  3  2  5  4  3
## 1   3  2  5  5  4  4  3  4  4  2  5  4  1  1  4  1  3  5  3  2
## 47  2  4  1  3  4  2  2  2  4  2  2  3  3  1  5  2  1  3  3  2
## 38  2  3  4  5  4  4  3  4  1  3  5  2  3  3  5  2  5  1  3  1
## 4   5  3  4  5  2  2  1  2  2  4  2  4  5  1  1  4  1  2  4  5
## 14  1  4  4  4  2  5  5  4  3  4  2  4  2  5  3  2  5  3  4  4
## 44  3  2  3  2  4  5  3  3  3  1  1  4  5  2  4  2  3  5  5  3
## 10  3  1  5  4  3  4  4  2  4  2  1  2  5  5  5  5  4  3  5  1
## 3   2  1  1  3  3  2  3  1  4  1  3  1  2  2  1  3  2  1  3  5
## 26  5  5  4  3  1  3  2  5  5  5  3  4  2  5  1  4  2  5  3  5
## 32  5  1  5  5  5  1  2  1  4  1  3  2  1  2  3  5  4  2  3  3
## 25  4  4  4  2  4  1  5  4  1  4  2  4  1  4  2  1  1  4  4  2
## 11  2  3  2  1  4  3  2  4  3  2  4  3  4  2  2  4  4  1  3  4
## 34  3  1  3  2  5  4  2  2  4  2  3  1  5  3  4  4  3  1  1  5
## 37  5  5  5  3  1  5  1  2  1  5  1  5  2  5  1  3  4  4  5  2
## 8   4  5  1  1  5  3  2  3  5  2  5  4  2  4  3  4  3  5  4  4
## 6   5  1  5  4  2  5  3  5  1  2  3  4  3  2  1  4  3  2  3  4
## 42  2  4  4  5  1  1  4  5  4  3  2  3  3  2  1  5  1  4  5  3
## 41  3  5  2  4  5  3  2  3  2  5  3  4  2  5  3  3  1  2  4  3
## 24  2  4  1  5  5  1  1  4  1  3  5  4  5  4  4  2  2  5  5  2
## 46  4  4  2  3  2  5  4  1  4  2  1  5  2  1  3  3  1  1  2  3
## 23  3  4  5  2  1  2  3  3  2  5  4  4  5  2  5  3  1  5  2  3
## 30  1  1  2  2  3  1  4  3  1  5  2  1  5  2  5  2  2  5  1  1
##     V21 V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32 V33 V34 V35 V36 V37 V38
## 17   2   3   3   3   3   2   1   1   4   3   1   1   4   3   1   3   4   1
## 16   5   4   2   5   4   4   1   1   5   1   4   4   2   1   2   2   2   2
## 40   1   5   3   5   1   3   4   5   4   4   4   4   2   1   2   3   3   2
## 48   3   1   2   4   2   5   4   1   1   2   3   5   1   4   5   4   3   5
## 31   5   5   5   1   5   4   4   1   2   1   2   3   3   3   2   4   2   2
## 15   3   1   3   4   4   4   1   2   1   4   4   1   2   5   3   1   1   3
## 50   1   1   5   5   3   2   2   2   4   5   5   2   2   4   3   1   2   4
## 9    5   4   5   5   2   5   1   1   4   5   3   4   1   1   4   5   3   4
```

```
## 28   1   4   5   3   2   1   1   5   3   3   1   4   1   5   4   3   2   3
## 7    5   1   2   4   4   5   2   2   5   2   2   5   1   3   2   5   1   2
## 12   5   1   1   2   5   5   2   4   1   3   3   3   5   2   3   2   5   3
## 27   4   2   2   5   5   3   2   4   2   5   1   3   2   5   3   5   1   3
## 5    3   3   3   5   1   1   3   3   3   4   4   3   1   4   2   3   3   2
## 22   2   1   1   4   5   1   3   1   1   5   3   1   1   5   2   2   5   5
## 29   2   1   2   4   3   1   4   1   2   2   4   5   4   5   2   1   5   1
## 39   2   3   5   2   2   5   2   2   5   2   4   4   4   1   2   2   5   2
## 20   5   3   3   3   4   1   1   3   5   5   1   1   4   2   2   5   4   5
## 33   3   5   1   2   1   2   5   3   2   3   4   4   3   1   3   1   5   5
## 21   2   3   3   1   5   1   5   2   3   1   5   2   2   5   3   2   4   1
## 35   1   1   2   5   4   1   1   5   1   5   2   1   5   4   4   5   1   3
## 19   4   1   2   5   1   1   2   2   5   5   1   3   1   2   1   1   1   5
## 18   4   2   4   2   2   1   3   1   4   1   4   1   4   2   2   5   1   1
## 43   4   1   2   2   3   4   5   1   3   4   3   4   4   3   4   4   5   1
## 49   5   1   4   5   2   3   2   4   2   4   1   4   3   4   5   1   2   2
## 45   2   1   4   4   3   2   1   2   4   5   2   5   5   1   2   1   1   4
## 13   3   1   5   3   5   3   2   5   4   5   2   2   2   5   1   4   3   4
## 36   4   3   5   5   4   4   1   2   1   4   4   4   3   2   4   4   4   5
## 2    3   4   4   4   3   5   4   3   4   1   2   5   3   1   4   5   1   1
## 1    5   3   4   2   3   3   3   3   4   5   3   4   4   4   4   1   3   5
## 47   1   2   1   2   3   5   2   1   1   1   3   1   5   2   5   1   2   1
## 38   1   2   3   2   5   5   2   2   3   2   3   5   3   1   5   4   3   3
## 4    5   3   3   3   2   3   4   2   2   5   2   3   4   5   2   3   1   2
## 14   5   5   1   3   5   3   2   3   4   4   4   2   3   3   4   4   2   5
## 44   3   5   4   3   3   5   5   3   4   1   5   5   3   1   4   2   1   2
## 10   5   1   5   5   4   2   1   5   4   1   3   3   5   1   1   4   3   3
## 3    3   2   3   3   2   1   5   2   3   2   3   3   4   2   2   1   5   3
## 26   4   4   5   3   1   4   3   4   1   3   2   4   1   4   4   3   2   2
## 32   1   3   1   5   5   3   5   1   2   4   4   2   3   1   1   3   4   2
## 25   5   5   5   2   5   2   5   2   1   3   1   4   3   3   4   4   4   2
## 11   5   5   3   4   2   5   4   1   4   2   3   2   4   3   3   3   5   3
## 34   2   1   1   5   4   3   5   5   3   2   1   5   3   5   2   1   3   5
## 37   3   1   2   3   2   3   5   1   2   2   5   1   5   5   5   4   3   4
## 8    3   2   5   2   2   1   4   3   3   1   1   5   3   3   2   1   2   2
## 6    4   4   5   1   5   5   1   1   2   4   2   5   2   2   4   1   4   3
## 42   4   4   1   4   5   3   1   4   1   5   4   2   3   2   1   3   2   3
## 41   3   2   1   2   5   2   1   3   2   4   4   2   4   1   1   1   3   4
## 24   3   2   1   3   1   1   4   1   5   5   2   5   4   1   5   4   2   5
## 46   4   1   4   5   1   4   4   2   5   2   5   2   1   5   1   5   4   2
## 23   1   1   5   5   2   1   5   5   1   4   5   5   2   5   3   1   1   5
## 30   2   1   3   3   4   4   3   2   1   4   2   2   5   2   4   5   3   5
##     V39 V40
## 17   1   1
## 16   2   1
## 40   2   1
## 48   2   1
## 31   3   1
## 15   3   1
## 50   3   1
## 9    3   1
## 28   5   1
## 7    1   2
## 12   1   2
```

```
## 27   2   2
## 5    3   2
## 22   3   2
## 29   4   2
## 39   4   2
## 20   4   2
## 33   4   2
## 21   5   2
## 35   5   2
## 19   5   2
## 18   1   3
## 43   2   3
## 49   2   3
## 45   2   3
## 13   3   3
## 36   3   3
## 2    4   3
## 1    4   3
## 47   5   3
## 38   5   3
## 4    3   4
## 14   3   4
## 44   4   4
## 10   4   4
## 3    4   4
## 26   5   4
## 32   5   4
## 25   5   4
## 11   5   4
## 34   5   4
## 37   1   5
## 8    2   5
## 6    2   5
## 42   3   5
## 41   3   5
## 24   3   5
## 46   4   5
## 23   4   5
## 30   4   5
```

2. Importando información

*** Vamos a trabajar con otro dataframe. Descarga el fichero student.txt de la plataforma PRADO, almacena la información en una variable llamada "students". Ten en cuenta que los datos son tab-delimited y tienen un texto para cada columna. Comprueba que R ha leído correctamente el fichero imprimiendo el objeto en la pantalla**

```
students = read.delim(file = "student.txt")
students
```

```
##    height shoesize gender population
## 1     181       44   male     kuopio
## 2     160       38 female     kuopio
```

```
## 3     174       42 female     kuopio
## 4     170       43   male     kuopio
## 5     172       43   male     kuopio
## 6     165       39 female     kuopio
## 7     161       38 female     kuopio
## 8     167       38 female    tampere
## 9     164       39 female    tampere
## 10    166       38 female    tampere
## 11    162       37 female    tampere
## 12    158       36 female    tampere
## 13    175       42   male    tampere
## 14    181       44   male    tampere
## 15    180       43   male    tampere
## 16    177       43   male    tampere
## 17    173       41   male    tampere
```

Imprime solo los nombres de la columnas

```
colnames(students)
```

```
## [1] "height"     "shoesize"   "gender"     "population"
```

Llama a la columna height solo

```
students$height
```

```
##  [1] 181 160 174 170 172 165 161 167 164 166 162 158 175 181 180 177 173
```

¿Cuantas observaciones hay en cada grupo?. Utiliza la función table(). Este commando se puede utilizar para crear tablas cruzadas (cross-tabulations)

```
table(students$gender)
```

```
##
## female   male
##      9      8
```

```
table(students$gender, students$height)
```

```
##
##          158 160 161 162 164 165 166 167 170 172 173 174 175 177 180 181
##   female   1   1   1   1   1   1   1   1   0   0   0   1   0   0   0   0
##   male     0   0   0   0   0   0   0   0   1   1   1   0   1   1   1   2
```

Crea nuevas variables a partir de los datos que tenemos. Vamos a crear una variable nueva "sym" que contenga M si el genero es masculino y F si el genero es femenino. Busca en la ayuda información sobre la función ifelse(). Crea una segunda variable "colours" cuyo valor ser?? "Blue" si el estudiante es de kuopio y "Red" si es de otro sitio.

```
students$gender
```

```
##  [1] male   female female male   male   female female female female female
## [11] female female male   male   male   male   male
## Levels: female male
```

```
sym = ifelse(students$gender == "male", "M", "F")
sym
```

```
##  [1] "M" "F" "F" "M" "M" "F" "F" "F" "F" "F" "F" "F" "M" "M" "M" "M" "M"
```

```
colours = ifelse(students$population == "kuopio", "Blue", "Red")
colours
```

```
##  [1] "Blue" "Blue" "Blue" "Blue" "Blue" "Blue" "Blue" "Red"  "Red"  "Red"
## [11] "Red"  "Red"  "Red"  "Red"  "Red"  "Red"  "Red"
```

Con los datos anteriores de height y shoesize y las nuevas variables crea un nuevo data.frame que se llame students.new

```
students.new = data.frame(students$height, students$shoesize, sym, colours)
students.new
```

```
##    students.height students.shoesize sym colours
## 1              181                44   M    Blue
## 2              160                38   F    Blue
## 3              174                42   F    Blue
## 4              170                43   M    Blue
## 5              172                43   M    Blue
## 6              165                39   F    Blue
## 7              161                38   F    Blue
## 8              167                38   F     Red
## 9              164                39   F     Red
## 10             166                38   F     Red
## 11             162                37   F     Red
## 12             158                36   F     Red
## 13             175                42   M     Red
## 14             181                44   M     Red
## 15             180                43   M     Red
## 16             177                43   M     Red
## 17             173                41   M     Red
```

Comprueba que la clase de student.new es un dataframe

```
class(students.new)
```

```
## [1] "data.frame"
```

Crea dos subsets a partir del dataset student. Dividelo dependiendo del sexo. Para ello primero comprueba que estudiantes son hombres (male). Pista: busca información sobre la función which.

```
which(students$gender == "male")
```

```
## [1]  1  4  5 13 14 15 16 17
```

Basándote en esa selección dada por which() toma solo esas filas del dataset student para generar el subset stundent.male

- Repite el procedimiento para seleccionar las estudiantes mujeres (females)

```
students.male = students[which(students$gender == "male"),]
students.male
```

```
##    height shoesize gender population
## 1     181       44   male     kuopio
## 4     170       43   male     kuopio
## 5     172       43   male     kuopio
## 13    175       42   male    tampere
## 14    181       44   male    tampere
## 15    180       43   male    tampere
## 16    177       43   male    tampere
## 17    173       41   male    tampere
```

```
students.female = students[which(students$gender == "female"),]
students.female
```

```
##    height shoesize gender population
## 2     160       38 female     kuopio
## 3     174       42 female     kuopio
## 6     165       39 female     kuopio
## 7     161       38 female     kuopio
## 8     167       38 female    tampere
## 9     164       39 female    tampere
## 10    166       38 female    tampere
## 11    162       37 female    tampere
## 12    158       36 female    tampere
```

Utiliza la function write.table() para guarder el contenido de student.new en un archivo.

```
write.table(students.new, file = "student_new.txt", sep = "\t")
```

3. Lists

***Las listas son colecciones de objetos que pueden tener modos diferentes (e.g. numéricos, vectores, arrays..) # Ejemplo de cómo crear una lista. Ejecuta los comandos y describe que es lo que ocurre**

```
# Crea una lista con los atributos que hemos definido y los valores que le hemos indicado
my_list <- list(name="Fred", wife="Mary", no.children=3, child.ages=c(4,7,9))

# Muestran los nombres de los atributos de la lista
attributes(my_list)
```

```
## $names
## [1] "name"        "wife"        "no.children" "child.ages"
```

```
names(my_list)
```

```
## [1] "name"        "wife"        "no.children" "child.ages"
```

```
# Muestra el contenido del segundo atributo de la lista
my_list[2]
```

```
## $wife
## [1] "Mary"
```

```
# Muestra el contenido segundo campo del segundo atributo de la lista
my_list[[2]]
```

```
## [1] "Mary"
```

```
# Muestra el contenido del atributo wife de nuestra lista
my_list$wife
```

```
## [1] "Mary"
```

```
# Muestra el segundo elemento contenido en el cuarto atributo de nuestra lista, child.ages.
my_list[[4]][2]
```

```
## [1] 7
```

```
#Imprime la longitud del cuarto atributo de la lista, child.ages.
length(my_list[[4]])
```

```
## [1] 3
```

```
#Sustituye el contenido del atributo wife de la lista por un array de valores del 1 al 12
my_list$wife <- 1:12

#Sustituye el contenido del atributo wife de la lista por Null
my_list$wife <- NULL

#Añade a nuestra lista un nuevo atributo con el nombre de los meses del año
my_list <- c(my_list, list(my_title2=month.name[1:12]))

#Deshace nuestra lista transform??ndolo en un vector
unlist(my_list)
```

```
##        name no.children child.ages1 child.ages2 child.ages3  my_title21
##      "Fred"         "3"         "4"         "7"         "9"   "January"
##  my_title22  my_title23  my_title24  my_title25  my_title26  my_title27
##  "February"     "March"     "April"       "May"      "June"      "July"
##  my_title28  my_title29 my_title210 my_title211 my_title212
##    "August" "September"   "October"  "November"  "December"
```

```
#Crea un dataframe con el vector resultante de deshacer nuestra lista
data.frame(unlist(my_list))
```

```
##             unlist.my_list.
## name                   Fred
## no.children               3
## child.ages1               4
## child.ages2               7
## child.ages3               9
## my_title21          January
## my_title22         February
## my_title23            March
## my_title24            April
```

```
## my_title25              May
## my_title26             June
## my_title27             July
## my_title28           August
## my_title29        September
## my_title210         October
## my_title211        November
## my_title212        December
```

```
#Crea una matriz con el vector resultante de deshacer nuestra lista
matrix(unlist(my_list))
```

```
##       [,1]
##  [1,] "Fred"
##  [2,] "3"
##  [3,] "4"
##  [4,] "7"
##  [5,] "9"
##  [6,] "January"
##  [7,] "February"
##  [8,] "March"
##  [9,] "April"
## [10,] "May"
## [11,] "June"
## [12,] "July"
## [13,] "August"
## [14,] "September"
## [15,] "October"
## [16,] "November"
## [17,] "December"
```

4. table()

*** La función table() cuenta el numero de elementos repetidos en un vector. Es la función más básica de clustering.**

Cuenta el numero de entradas idénticas en la variable Sepal.Length del dataset iris.

```
table(iris$Sepal.Length)
```

```
##
## 4.3 4.4 4.5 4.6 4.7 4.8 4.9   5 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9   6
##   1   3   1   4   2   5   6  10   9   4   1   6   7   6   8   7   3   6
## 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9   7 7.1 7.2 7.3 7.4 7.6 7.7 7.9
##   6   4   9   7   5   2   8   3   4   1   1   3   1   1   1   4   1
```

5. Como ordenar datos, hacer selecciones con if(), calcular condicionales totales, transponer columnas y filas

Vamos a volver a utilizar el datasets mtcars.

-Ordena este data set de forma ascendente según su valor de hp. PISTA: with()

```
mtcars[with(mtcars, order(mtcars$hp)), ]
```

```
##                    mpg cyl  disp  hp drat    wt  qsec vs am gear carb
## Honda Civic       30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
## Merc 240D         24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Toyota Corolla    33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Fiat 128          32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Fiat X1-9         27.3   4  79.0  66 4.08 1.935 18.90  1  1    4    1
## Porsche 914-2     26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
## Datsun 710        22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Merc 230          22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
## Toyota Corona     21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
## Valiant           18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
## Volvo 142E        21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
## Mazda RX4         21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
## Hornet 4 Drive    21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
## Lotus Europa      30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Merc 280          19.2   6 167.6 123 3.92 3.440 18.30  1  0    4    4
## Merc 280C         17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
## Dodge Challenger  15.5   8 318.0 150 2.76 3.520 16.87  0  0    3    2
## AMC Javelin       15.2   8 304.0 150 3.15 3.435 17.30  0  0    3    2
## Hornet Sportabout 18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
## Pontiac Firebird  19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
## Ferrari Dino      19.7   6 145.0 175 3.62 2.770 15.50  0  1    5    6
## Merc 450SE        16.4   8 275.8 180 3.07 4.070 17.40  0  0    3    3
## Merc 450SL        17.3   8 275.8 180 3.07 3.730 17.60  0  0    3    3
## Merc 450SLC       15.2   8 275.8 180 3.07 3.780 18.00  0  0    3    3
## Cadillac Fleetwood 10.4  8 472.0 205 2.93 5.250 17.98  0  0    3    4
## Lincoln Continental 10.4 8 460.0 215 3.00 5.424 17.82  0  0    3    4
## Chrysler Imperial 14.7   8 440.0 230 3.23 5.345 17.42  0  0    3    4
## Duster 360        14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
## Camaro Z28        13.3   8 350.0 245 3.73 3.840 15.41  0  0    3    4
## Ford Pantera L    15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
## Maserati Bora     15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
```

-Hazlo ahora de forma descendente

```
mtcars[with(mtcars, order(mtcars$hp, decreasing = TRUE)), ]
```

```
##                    mpg cyl  disp  hp drat    wt  qsec vs am gear carb
## Maserati Bora     15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
## Ford Pantera L    15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
## Duster 360        14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
## Camaro Z28        13.3   8 350.0 245 3.73 3.840 15.41  0  0    3    4
```

```
## Chrysler Imperial   14.7   8 440.0 230 3.23 5.345 17.42  0  0    3    4
## Lincoln Continental 10.4   8 460.0 215 3.00 5.424 17.82  0  0    3    4
## Cadillac Fleetwood  10.4   8 472.0 205 2.93 5.250 17.98  0  0    3    4
## Merc 450SE          16.4   8 275.8 180 3.07 4.070 17.40  0  0    3    3
## Merc 450SL          17.3   8 275.8 180 3.07 3.730 17.60  0  0    3    3
## Merc 450SLC         15.2   8 275.8 180 3.07 3.780 18.00  0  0    3    3
## Hornet Sportabout   18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
## Pontiac Firebird    19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
## Ferrari Dino        19.7   6 145.0 175 3.62 2.770 15.50  0  1    5    6
## Dodge Challenger    15.5   8 318.0 150 2.76 3.520 16.87  0  0    3    2
## AMC Javelin         15.2   8 304.0 150 3.15 3.435 17.30  0  0    3    2
## Merc 280            19.2   6 167.6 123 3.92 3.440 18.30  1  0    4    4
## Merc 280C           17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
## Lotus Europa        30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Mazda RX4           21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag       21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
## Hornet 4 Drive      21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
## Volvo 142E          21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
## Valiant             18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
## Toyota Corona       21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
## Merc 230            22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
## Datsun 710          22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Porsche 914-2       26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
## Fiat 128            32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Fiat X1-9           27.3   4  79.0  66 4.08 1.935 18.90  1  1    4    1
## Toyota Corolla      33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Merc 240D           24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Honda Civic         30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
```

Calcula la media de la columna mpg

```
mean(mtcars$mpg)
```

```
## [1] 20.09062
```

Calcula la media de mpg para aquellos datos cuyo valor de hp sea menor que 150 y por separado para aquellos cuyo valor de hp sea mayor o igual a 150

```
#Media menor que 150
mean(mtcars[which(mtcars$hp < 150),]$mpg)
```

```
## [1] 24.22353
```

```
#Media mayor o igual que 150
mean(mtcars[which(mtcars$hp >= 150),]$mpg)
```

```
## [1] 15.40667
```

Busca los valores únicos de la columna cyl de mtcars. PISTA unique()

```
unique(mtcars$cyl)
```

```
## [1] 6 4 8
```

Obten los datos de mpg cyl disp hp para "Toyota Corolla"

```
mtcars["Toyota Corolla",c(1:4)]
```

```
##                 mpg cyl disp hp
## Toyota Corolla 33.9   4 71.1 65
```

Crea una nueva variable mpgClass de tipo categórico cuyo valor es "Low" si el valor de mpg es menor que la media de la columna mpg y "High" si es mayor que la media de mpg. PISTA ifelse(). Combina ese comando con with() para añadir la nueva variable a mtcars.

```
mpg.new = data.frame(mtcars, mpgClass= with(mtcars, ifelse(mpg < mean(mpg), "Low", "High")))
```

¿qué pasa cuando ejecutas este comando?

Cuando ejecutas el comando with evalua la expresión que pongamos sobre el data frame pudiendo modificar una copia del data frame original. En el ejercicio anterior, hemos usado with para evaular la función ifelse sobre el data frame mtcars, obteniendo el resultado que hemos concatenado con el dataframe original para crear un nuevo data frame.