Ejercicios 3 R

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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.

```
beaver1$ID = 1
beaver2$ID = 2
beavers = rbind(beaver1,beaver2)
active_beavers = subset(beavers,activ == 1); active_beavers
```

```
##     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

```
nrow(USArrests)
```

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

- Numero de columnas

```r
ncol(USArrests)
```

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

- ¿Cómo calcularías el número de filas?

```r
nrow(USArrests)
```

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

- Obtén el nombre de las filas y las columnas para este dataframe.

```r
# El primer elemento es el nombre de la filas, el segundo elemento es el nombre de las columnas.
dimnames(USArrests)
```

```
## [[1]]
##  [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"
##
## [[2]]
## [1] "Murder"   "Assault"  "UrbanPop" "Rape"
```

- échale un vistazo a los datos, por ejemplo a las seis primeras filas.

```r
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
```

- Ordena de forma decreciente las filas de nuestro dataframe según el porcentaje de población en el área urbana. Para ello investiga order() y sus parámetros.

```r
ord_usarrests = USArrests[order(USArrests[,"UrbanPop"],decreasing = T),]
ord_usarrests
```

```
##                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?

```r
ord_usarrests2 = USArrests[order(USArrests$Murder,USArrests$UrbanPop,decreasing = T),]
ord_usarrests2
```

```
##                Murder Assault UrbanPop Rape
## Georgia          17.4     211       60 25.8
## Mississippi      16.1     259       44 17.1
## Florida          15.4     335       80 31.9
## Louisiana        15.4     249       66 22.2
## South Carolina   14.4     279       48 22.5
```

```
## Tennessee         13.2     188       59 26.9
## Alabama           13.2     236       58 21.2
## North Carolina    13.0     337       45 16.1
## Texas             12.7     201       80 25.5
## Nevada            12.2     252       81 46.0
## Michigan          12.1     255       74 35.1
## New Mexico        11.4     285       70 32.1
## Maryland          11.3     300       67 27.8
## New York          11.1     254       86 26.1
## Illinois          10.4     249       83 24.0
## Alaska            10.0     263       48 44.5
## Kentucky           9.7     109       52 16.3
## California         9.0     276       91 40.6
## Missouri           9.0     178       70 28.2
## Arkansas           8.8     190       50 19.5
## Virginia           8.5     156       63 20.7
## Arizona            8.1     294       80 31.0
## Colorado           7.9     204       78 38.7
## New Jersey         7.4     159       89 18.8
## Ohio               7.3     120       75 21.4
## Indiana            7.2     113       65 21.0
## Wyoming            6.8     161       60 15.6
## Oklahoma           6.6     151       68 20.0
## Pennsylvania       6.3     106       72 14.9
## Kansas             6.0     115       66 18.0
## Montana            6.0     109       53 16.4
## Delaware           5.9     238       72 15.8
## West Virginia      5.7      81       39  9.3
## Hawaii             5.3      46       83 20.2
## Oregon             4.9     159       67 29.3
## Massachusetts      4.4     149       85 16.3
## Nebraska           4.3     102       62 16.5
## Washington         4.0     145       73 26.2
## South Dakota       3.8      86       45 12.8
## Rhode Island       3.4     174       87  8.3
## Connecticut        3.3     110       77 11.1
## Utah               3.2     120       80 22.9
## Minnesota          2.7      72       66 14.9
## Wisconsin          2.6      53       66 10.8
## Idaho              2.6     120       54 14.2
## Iowa               2.2      56       57 11.3
## Vermont            2.2      48       32 11.2
## New Hampshire      2.1      57       56  9.5
## Maine              2.1      83       51  7.8
## North Dakota       0.8      45       44  7.3
```

- Muestra por pantalla la columna con los datos de asesinato.

```r
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 todas las filas para las dos primeras columnas.

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

```
##         Murder Assault UrbanPop Rape
## Alabama   13.2     236       58 21.2
## Alaska    10.0     263       48 44.5
```

- Muestra todas las filas de la columnas 1 y 3.

```r
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 pirmeras 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 índice 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
```

- ¿Qué estado tiene la menor tasa de asesinatos?¿Qué línea contiene esa información? Obtén esa información.

```
USArrests[which.min(USArrests[,"Murder"]),]
```

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

```
which.min(USArrests[,"Murder"])
```

```
## [1] 34
```

- ¿Qué estados tienen una tasa inferior al 4%?, obtén esa información.

```
USArrests[which(USArrests[,"Murder"] < 4.0),]
```

```
##               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
```

- ¿Qué estados están en el cuartil superior(75) en lo que a población en zonas urbanas se refiere?

```
USArrests[USArrests$UrbanPop >= 75,]
```

```
##                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
## Connecticut       3.3      110       77 11.1
## 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
## Ohio              7.3      120       75 21.4
## 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.

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

```r
str(CO2)
```

```
## Classes 'nfnGroupedData', 'nfGroupedData', 'groupedData' and 'data.frame':   84 obs. of  5 variables
##  $ Plant    : Ord.factor w/ 12 levels "Qn1"<"Qn2"<"Qn3"<..: 1 1 1 1 1 1 1 2 2 2 ...
##  $ Type     : Factor w/ 2 levels "Quebec","Mississippi": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Treatment: Factor w/ 2 levels "nonchilled","chilled": 1 1 1 1 1 1 1 1 1 1 ...
##  $ conc     : num  95 175 250 350 500 675 1000 95 175 250 ...
##  $ uptake   : num  16 30.4 34.8 37.2 35.3 39.2 39.7 13.6 27.3 37.1 ...
##  - attr(*, "formula")=Class 'formula'  language uptake ~ conc | Plant
##   .. ..- attr(*, ".Environment")=<environment: R_EmptyEnv>
##  - attr(*, "outer")=Class 'formula'  language ~Treatment * Type
##   .. ..- attr(*, ".Environment")=<environment: R_EmptyEnv>
##  - attr(*, "labels")=List of 2
##   ..$ x: chr "Ambient carbon dioxide concentration"
##   ..$ y: chr "CO2 uptake rate"
##  - attr(*, "units")=List of 2
##   ..$ x: chr "(uL/L)"
##   ..$ y: chr "(umol/m^2 s)"
```

```r
CO2[order(CO2$Plant,decreasing = F),]
```

```
##    Plant        Type  Treatment conc uptake
## 1    Qn1      Quebec nonchilled   95   16.0
## 2    Qn1      Quebec nonchilled  175   30.4
## 3    Qn1      Quebec nonchilled  250   34.8
## 4    Qn1      Quebec nonchilled  350   37.2
## 5    Qn1      Quebec nonchilled  500   35.3
## 6    Qn1      Quebec nonchilled  675   39.2
## 7    Qn1      Quebec nonchilled 1000   39.7
## 8    Qn2      Quebec nonchilled   95   13.6
## 9    Qn2      Quebec nonchilled  175   27.3
## 10   Qn2      Quebec nonchilled  250   37.1
## 11   Qn2      Quebec nonchilled  350   41.8
```

```
## 12   Qn2      Quebec nonchilled  500   40.6
## 13   Qn2      Quebec nonchilled  675   41.4
## 14   Qn2      Quebec nonchilled 1000   44.3
## 15   Qn3      Quebec nonchilled   95   16.2
## 16   Qn3      Quebec nonchilled  175   32.4
## 17   Qn3      Quebec nonchilled  250   40.3
## 18   Qn3      Quebec nonchilled  350   42.1
## 19   Qn3      Quebec nonchilled  500   42.9
## 20   Qn3      Quebec nonchilled  675   43.9
## 21   Qn3      Quebec nonchilled 1000   45.5
## 22   Qc1      Quebec    chilled   95   14.2
## 23   Qc1      Quebec    chilled  175   24.1
## 24   Qc1      Quebec    chilled  250   30.3
## 25   Qc1      Quebec    chilled  350   34.6
## 26   Qc1      Quebec    chilled  500   32.5
## 27   Qc1      Quebec    chilled  675   35.4
## 28   Qc1      Quebec    chilled 1000   38.7
## 36   Qc3      Quebec    chilled   95   15.1
## 37   Qc3      Quebec    chilled  175   21.0
## 38   Qc3      Quebec    chilled  250   38.1
## 39   Qc3      Quebec    chilled  350   34.0
## 40   Qc3      Quebec    chilled  500   38.9
## 41   Qc3      Quebec    chilled  675   39.6
## 42   Qc3      Quebec    chilled 1000   41.4
## 29   Qc2      Quebec    chilled   95    9.3
## 30   Qc2      Quebec    chilled  175   27.3
## 31   Qc2      Quebec    chilled  250   35.0
## 32   Qc2      Quebec    chilled  350   38.8
## 33   Qc2      Quebec    chilled  500   38.6
## 34   Qc2      Quebec    chilled  675   37.5
## 35   Qc2      Quebec    chilled 1000   42.4
## 57   Mn3 Mississippi nonchilled   95   11.3
## 58   Mn3 Mississippi nonchilled  175   19.4
## 59   Mn3 Mississippi nonchilled  250   25.8
## 60   Mn3 Mississippi nonchilled  350   27.9
## 61   Mn3 Mississippi nonchilled  500   28.5
## 62   Mn3 Mississippi nonchilled  675   28.1
## 63   Mn3 Mississippi nonchilled 1000   27.8
## 50   Mn2 Mississippi nonchilled   95   12.0
## 51   Mn2 Mississippi nonchilled  175   22.0
## 52   Mn2 Mississippi nonchilled  250   30.6
## 53   Mn2 Mississippi nonchilled  350   31.8
## 54   Mn2 Mississippi nonchilled  500   32.4
## 55   Mn2 Mississippi nonchilled  675   31.1
## 56   Mn2 Mississippi nonchilled 1000   31.5
## 43   Mn1 Mississippi nonchilled   95   10.6
## 44   Mn1 Mississippi nonchilled  175   19.2
## 45   Mn1 Mississippi nonchilled  250   26.2
## 46   Mn1 Mississippi nonchilled  350   30.0
## 47   Mn1 Mississippi nonchilled  500   30.9
## 48   Mn1 Mississippi nonchilled  675   32.4
## 49   Mn1 Mississippi nonchilled 1000   35.5
## 71   Mc2 Mississippi    chilled   95    7.7
## 72   Mc2 Mississippi    chilled  175   11.4
```

```
## 73   Mc2 Mississippi    chilled  250   12.3
## 74   Mc2 Mississippi    chilled  350   13.0
## 75   Mc2 Mississippi    chilled  500   12.5
## 76   Mc2 Mississippi    chilled  675   13.7
## 77   Mc2 Mississippi    chilled 1000   14.4
## 78   Mc3 Mississippi    chilled   95   10.6
## 79   Mc3 Mississippi    chilled  175   18.0
## 80   Mc3 Mississippi    chilled  250   17.9
## 81   Mc3 Mississippi    chilled  350   17.9
## 82   Mc3 Mississippi    chilled  500   17.9
## 83   Mc3 Mississippi    chilled  675   18.9
## 84   Mc3 Mississippi    chilled 1000   19.9
## 64   Mc1 Mississippi    chilled   95   10.5
## 65   Mc1 Mississippi    chilled  175   14.9
## 66   Mc1 Mississippi    chilled  250   18.1
## 67   Mc1 Mississippi    chilled  350   18.9
## 68   Mc1 Mississippi    chilled  500   19.5
## 69   Mc1 Mississippi    chilled  675   22.2
## 70   Mc1 Mississippi    chilled 1000   21.9
```

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

```
# Ordenamos según incremento de uptake
new_co2 = CO2
new_co2 = new_co2[order(new_co2$uptake),]
new_co2
```

```
##    Plant        Type  Treatment conc uptake
## 71   Mc2 Mississippi    chilled   95    7.7
## 29   Qc2      Quebec    chilled   95    9.3
## 64   Mc1 Mississippi    chilled   95   10.5
## 43   Mn1 Mississippi nonchilled   95   10.6
## 78   Mc3 Mississippi    chilled   95   10.6
## 57   Mn3 Mississippi nonchilled   95   11.3
## 72   Mc2 Mississippi    chilled  175   11.4
## 50   Mn2 Mississippi nonchilled   95   12.0
## 73   Mc2 Mississippi    chilled  250   12.3
## 75   Mc2 Mississippi    chilled  500   12.5
## 74   Mc2 Mississippi    chilled  350   13.0
## 8    Qn2      Quebec nonchilled   95   13.6
## 76   Mc2 Mississippi    chilled  675   13.7
## 22   Qc1      Quebec    chilled   95   14.2
## 77   Mc2 Mississippi    chilled 1000   14.4
## 65   Mc1 Mississippi    chilled  175   14.9
## 36   Qc3      Quebec    chilled   95   15.1
## 1    Qn1      Quebec nonchilled   95   16.0
## 15   Qn3      Quebec nonchilled   95   16.2
## 80   Mc3 Mississippi    chilled  250   17.9
## 81   Mc3 Mississippi    chilled  350   17.9
## 82   Mc3 Mississippi    chilled  500   17.9
## 79   Mc3 Mississippi    chilled  175   18.0
## 66   Mc1 Mississippi    chilled  250   18.1
## 67   Mc1 Mississippi    chilled  350   18.9
## 83   Mc3 Mississippi    chilled  675   18.9
```

```
## 44   Mn1 Mississippi nonchilled  175   19.2
## 58   Mn3 Mississippi nonchilled  175   19.4
## 68   Mc1 Mississippi    chilled  500   19.5
## 84   Mc3 Mississippi    chilled 1000   19.9
## 37   Qc3      Quebec    chilled  175   21.0
## 70   Mc1 Mississippi    chilled 1000   21.9
## 51   Mn2 Mississippi nonchilled  175   22.0
## 69   Mc1 Mississippi    chilled  675   22.2
## 23   Qc1      Quebec    chilled  175   24.1
## 59   Mn3 Mississippi nonchilled  250   25.8
## 45   Mn1 Mississippi nonchilled  250   26.2
## 9    Qn2      Quebec nonchilled  175   27.3
## 30   Qc2      Quebec    chilled  175   27.3
## 63   Mn3 Mississippi nonchilled 1000   27.8
## 60   Mn3 Mississippi nonchilled  350   27.9
## 62   Mn3 Mississippi nonchilled  675   28.1
## 61   Mn3 Mississippi nonchilled  500   28.5
## 46   Mn1 Mississippi nonchilled  350   30.0
## 24   Qc1      Quebec    chilled  250   30.3
## 2    Qn1      Quebec nonchilled  175   30.4
## 52   Mn2 Mississippi nonchilled  250   30.6
## 47   Mn1 Mississippi nonchilled  500   30.9
## 55   Mn2 Mississippi nonchilled  675   31.1
## 56   Mn2 Mississippi nonchilled 1000   31.5
## 53   Mn2 Mississippi nonchilled  350   31.8
## 16   Qn3      Quebec nonchilled  175   32.4
## 48   Mn1 Mississippi nonchilled  675   32.4
## 54   Mn2 Mississippi nonchilled  500   32.4
## 26   Qc1      Quebec    chilled  500   32.5
## 39   Qc3      Quebec    chilled  350   34.0
## 25   Qc1      Quebec    chilled  350   34.6
## 3    Qn1      Quebec nonchilled  250   34.8
## 31   Qc2      Quebec    chilled  250   35.0
## 5    Qn1      Quebec nonchilled  500   35.3
## 27   Qc1      Quebec    chilled  675   35.4
## 49   Mn1 Mississippi nonchilled 1000   35.5
## 10   Qn2      Quebec nonchilled  250   37.1
## 4    Qn1      Quebec nonchilled  350   37.2
## 34   Qc2      Quebec    chilled  675   37.5
## 38   Qc3      Quebec    chilled  250   38.1
## 33   Qc2      Quebec    chilled  500   38.6
## 28   Qc1      Quebec    chilled 1000   38.7
## 32   Qc2      Quebec    chilled  350   38.8
## 40   Qc3      Quebec    chilled  500   38.9
## 6    Qn1      Quebec nonchilled  675   39.2
## 41   Qc3      Quebec    chilled  675   39.6
## 7    Qn1      Quebec nonchilled 1000   39.7
## 17   Qn3      Quebec nonchilled  250   40.3
## 12   Qn2      Quebec nonchilled  500   40.6
## 13   Qn2      Quebec nonchilled  675   41.4
## 42   Qc3      Quebec    chilled 1000   41.4
## 11   Qn2      Quebec nonchilled  350   41.8
## 18   Qn3      Quebec nonchilled  350   42.1
## 35   Qc2      Quebec    chilled 1000   42.4
```

```
## 19   Qn3      Quebec nonchilled  500   42.9
## 20   Qn3      Quebec nonchilled  675   43.9
## 14   Qn2      Quebec nonchilled 1000   44.3
## 21   Qn3      Quebec nonchilled 1000   45.5
```

```
# Ordenamos alfabéticamente.
nuevo_factor = factor(new_co2$Plant,levels = levels(new_co2$Plant)[order(levels(new_co2$Plant))],ordere
new_co2 = new_co2[order(nuevo_factor),]
new_co2
```

```
##    Plant        Type  Treatment conc uptake
## 64   Mc1 Mississippi    chilled   95   10.5
## 65   Mc1 Mississippi    chilled  175   14.9
## 66   Mc1 Mississippi    chilled  250   18.1
## 67   Mc1 Mississippi    chilled  350   18.9
## 68   Mc1 Mississippi    chilled  500   19.5
## 70   Mc1 Mississippi    chilled 1000   21.9
## 69   Mc1 Mississippi    chilled  675   22.2
## 71   Mc2 Mississippi    chilled   95    7.7
## 72   Mc2 Mississippi    chilled  175   11.4
## 73   Mc2 Mississippi    chilled  250   12.3
## 75   Mc2 Mississippi    chilled  500   12.5
## 74   Mc2 Mississippi    chilled  350   13.0
## 76   Mc2 Mississippi    chilled  675   13.7
## 77   Mc2 Mississippi    chilled 1000   14.4
## 78   Mc3 Mississippi    chilled   95   10.6
## 80   Mc3 Mississippi    chilled  250   17.9
## 81   Mc3 Mississippi    chilled  350   17.9
## 82   Mc3 Mississippi    chilled  500   17.9
## 79   Mc3 Mississippi    chilled  175   18.0
## 83   Mc3 Mississippi    chilled  675   18.9
## 84   Mc3 Mississippi    chilled 1000   19.9
## 43   Mn1 Mississippi nonchilled   95   10.6
## 44   Mn1 Mississippi nonchilled  175   19.2
## 45   Mn1 Mississippi nonchilled  250   26.2
## 46   Mn1 Mississippi nonchilled  350   30.0
## 47   Mn1 Mississippi nonchilled  500   30.9
## 48   Mn1 Mississippi nonchilled  675   32.4
## 49   Mn1 Mississippi nonchilled 1000   35.5
## 50   Mn2 Mississippi nonchilled   95   12.0
## 51   Mn2 Mississippi nonchilled  175   22.0
## 52   Mn2 Mississippi nonchilled  250   30.6
## 55   Mn2 Mississippi nonchilled  675   31.1
## 56   Mn2 Mississippi nonchilled 1000   31.5
## 53   Mn2 Mississippi nonchilled  350   31.8
## 54   Mn2 Mississippi nonchilled  500   32.4
## 57   Mn3 Mississippi nonchilled   95   11.3
## 58   Mn3 Mississippi nonchilled  175   19.4
## 59   Mn3 Mississippi nonchilled  250   25.8
## 63   Mn3 Mississippi nonchilled 1000   27.8
## 60   Mn3 Mississippi nonchilled  350   27.9
## 62   Mn3 Mississippi nonchilled  675   28.1
## 61   Mn3 Mississippi nonchilled  500   28.5
## 22   Qc1      Quebec    chilled   95   14.2
## 23   Qc1      Quebec    chilled  175   24.1
```

```
## 24   Qc1      Quebec    chilled  250   30.3
## 26   Qc1      Quebec    chilled  500   32.5
## 25   Qc1      Quebec    chilled  350   34.6
## 27   Qc1      Quebec    chilled  675   35.4
## 28   Qc1      Quebec    chilled 1000   38.7
## 29   Qc2      Quebec    chilled   95    9.3
## 30   Qc2      Quebec    chilled  175   27.3
## 31   Qc2      Quebec    chilled  250   35.0
## 34   Qc2      Quebec    chilled  675   37.5
## 33   Qc2      Quebec    chilled  500   38.6
## 32   Qc2      Quebec    chilled  350   38.8
## 35   Qc2      Quebec    chilled 1000   42.4
## 36   Qc3      Quebec    chilled   95   15.1
## 37   Qc3      Quebec    chilled  175   21.0
## 39   Qc3      Quebec    chilled  350   34.0
## 38   Qc3      Quebec    chilled  250   38.1
## 40   Qc3      Quebec    chilled  500   38.9
## 41   Qc3      Quebec    chilled  675   39.6
## 42   Qc3      Quebec    chilled 1000   41.4
## 1    Qn1      Quebec nonchilled   95   16.0
## 2    Qn1      Quebec nonchilled  175   30.4
## 3    Qn1      Quebec nonchilled  250   34.8
## 5    Qn1      Quebec nonchilled  500   35.3
## 4    Qn1      Quebec nonchilled  350   37.2
## 6    Qn1      Quebec nonchilled  675   39.2
## 7    Qn1      Quebec nonchilled 1000   39.7
## 8    Qn2      Quebec nonchilled   95   13.6
## 9    Qn2      Quebec nonchilled  175   27.3
## 10   Qn2      Quebec nonchilled  250   37.1
## 12   Qn2      Quebec nonchilled  500   40.6
## 13   Qn2      Quebec nonchilled  675   41.4
## 11   Qn2      Quebec nonchilled  350   41.8
## 14   Qn2      Quebec nonchilled 1000   44.3
## 15   Qn3      Quebec nonchilled   95   16.2
## 16   Qn3      Quebec nonchilled  175   32.4
## 17   Qn3      Quebec nonchilled  250   40.3
## 18   Qn3      Quebec nonchilled  350   42.1
## 19   Qn3      Quebec nonchilled  500   42.9
## 20   Qn3      Quebec nonchilled  675   43.9
## 21   Qn3      Quebec nonchilled 1000   45.5
```

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

```
# Ordenamos según incremento de uptake
new_co2 = CO2
new_co2 = new_co2[order(new_co2$uptake),]
new_co2
```

```
##    Plant        Type  Treatment conc uptake
## 71   Mc2 Mississippi    chilled   95    7.7
## 29   Qc2      Quebec    chilled   95    9.3
## 64   Mc1 Mississippi    chilled   95   10.5
## 43   Mn1 Mississippi nonchilled   95   10.6
## 78   Mc3 Mississippi    chilled   95   10.6
```

```
## 57   Mn3 Mississippi nonchilled   95   11.3
## 72   Mc2 Mississippi    chilled  175   11.4
## 50   Mn2 Mississippi nonchilled   95   12.0
## 73   Mc2 Mississippi    chilled  250   12.3
## 75   Mc2 Mississippi    chilled  500   12.5
## 74   Mc2 Mississippi    chilled  350   13.0
## 8    Qn2      Quebec nonchilled   95   13.6
## 76   Mc2 Mississippi    chilled  675   13.7
## 22   Qc1      Quebec    chilled   95   14.2
## 77   Mc2 Mississippi    chilled 1000   14.4
## 65   Mc1 Mississippi    chilled  175   14.9
## 36   Qc3      Quebec    chilled   95   15.1
## 1    Qn1      Quebec nonchilled   95   16.0
## 15   Qn3      Quebec nonchilled   95   16.2
## 80   Mc3 Mississippi    chilled  250   17.9
## 81   Mc3 Mississippi    chilled  350   17.9
## 82   Mc3 Mississippi    chilled  500   17.9
## 79   Mc3 Mississippi    chilled  175   18.0
## 66   Mc1 Mississippi    chilled  250   18.1
## 67   Mc1 Mississippi    chilled  350   18.9
## 83   Mc3 Mississippi    chilled  675   18.9
## 44   Mn1 Mississippi nonchilled  175   19.2
## 58   Mn3 Mississippi nonchilled  175   19.4
## 68   Mc1 Mississippi    chilled  500   19.5
## 84   Mc3 Mississippi    chilled 1000   19.9
## 37   Qc3      Quebec    chilled  175   21.0
## 70   Mc1 Mississippi    chilled 1000   21.9
## 51   Mn2 Mississippi nonchilled  175   22.0
## 69   Mc1 Mississippi    chilled  675   22.2
## 23   Qc1      Quebec    chilled  175   24.1
## 59   Mn3 Mississippi nonchilled  250   25.8
## 45   Mn1 Mississippi nonchilled  250   26.2
## 9    Qn2      Quebec nonchilled  175   27.3
## 30   Qc2      Quebec    chilled  175   27.3
## 63   Mn3 Mississippi nonchilled 1000   27.8
## 60   Mn3 Mississippi nonchilled  350   27.9
## 62   Mn3 Mississippi nonchilled  675   28.1
## 61   Mn3 Mississippi nonchilled  500   28.5
## 46   Mn1 Mississippi nonchilled  350   30.0
## 24   Qc1      Quebec    chilled  250   30.3
## 2    Qn1      Quebec nonchilled  175   30.4
## 52   Mn2 Mississippi nonchilled  250   30.6
## 47   Mn1 Mississippi nonchilled  500   30.9
## 55   Mn2 Mississippi nonchilled  675   31.1
## 56   Mn2 Mississippi nonchilled 1000   31.5
## 53   Mn2 Mississippi nonchilled  350   31.8
## 16   Qn3      Quebec nonchilled  175   32.4
## 48   Mn1 Mississippi nonchilled  675   32.4
## 54   Mn2 Mississippi nonchilled  500   32.4
## 26   Qc1      Quebec    chilled  500   32.5
## 39   Qc3      Quebec    chilled  350   34.0
## 25   Qc1      Quebec    chilled  350   34.6
## 3    Qn1      Quebec nonchilled  250   34.8
## 31   Qc2      Quebec    chilled  250   35.0
```

```
## 5    Qn1      Quebec nonchilled  500   35.3
## 27   Qc1      Quebec    chilled  675   35.4
## 49   Mn1 Mississippi nonchilled 1000   35.5
## 10   Qn2      Quebec nonchilled  250   37.1
## 4    Qn1      Quebec nonchilled  350   37.2
## 34   Qc2      Quebec    chilled  675   37.5
## 38   Qc3      Quebec    chilled  250   38.1
## 33   Qc2      Quebec    chilled  500   38.6
## 28   Qc1      Quebec    chilled 1000   38.7
## 32   Qc2      Quebec    chilled  350   38.8
## 40   Qc3      Quebec    chilled  500   38.9
## 6    Qn1      Quebec nonchilled  675   39.2
## 41   Qc3      Quebec    chilled  675   39.6
## 7    Qn1      Quebec nonchilled 1000   39.7
## 17   Qn3      Quebec nonchilled  250   40.3
## 12   Qn2      Quebec nonchilled  500   40.6
## 13   Qn2      Quebec nonchilled  675   41.4
## 42   Qc3      Quebec    chilled 1000   41.4
## 11   Qn2      Quebec nonchilled  350   41.8
## 18   Qn3      Quebec nonchilled  350   42.1
## 35   Qc2      Quebec    chilled 1000   42.4
## 19   Qn3      Quebec nonchilled  500   42.9
## 20   Qn3      Quebec nonchilled  675   43.9
## 14   Qn2      Quebec nonchilled 1000   44.3
## 21   Qn3      Quebec nonchilled 1000   45.5
```

```
# Ordenamos en orden alfabético reverso
nuevo_factor = factor(new_co2$Plant,levels = levels(new_co2$Plant)[order(levels(new_co2$Plant),decreasi
new_co2 = new_co2[order(nuevo_factor),]
new_co2
```

```
##    Plant        Type  Treatment conc uptake
## 15   Qn3      Quebec nonchilled   95   16.2
## 16   Qn3      Quebec nonchilled  175   32.4
## 17   Qn3      Quebec nonchilled  250   40.3
## 18   Qn3      Quebec nonchilled  350   42.1
## 19   Qn3      Quebec nonchilled  500   42.9
## 20   Qn3      Quebec nonchilled  675   43.9
## 21   Qn3      Quebec nonchilled 1000   45.5
## 8    Qn2      Quebec nonchilled   95   13.6
## 9    Qn2      Quebec nonchilled  175   27.3
## 10   Qn2      Quebec nonchilled  250   37.1
## 12   Qn2      Quebec nonchilled  500   40.6
## 13   Qn2      Quebec nonchilled  675   41.4
## 11   Qn2      Quebec nonchilled  350   41.8
## 14   Qn2      Quebec nonchilled 1000   44.3
## 1    Qn1      Quebec nonchilled   95   16.0
## 2    Qn1      Quebec nonchilled  175   30.4
## 3    Qn1      Quebec nonchilled  250   34.8
## 5    Qn1      Quebec nonchilled  500   35.3
## 4    Qn1      Quebec nonchilled  350   37.2
## 6    Qn1      Quebec nonchilled  675   39.2
## 7    Qn1      Quebec nonchilled 1000   39.7
## 36   Qc3      Quebec    chilled   95   15.1
## 37   Qc3      Quebec    chilled  175   21.0
```

```
## 39   Qc3      Quebec    chilled  350   34.0
## 38   Qc3      Quebec    chilled  250   38.1
## 40   Qc3      Quebec    chilled  500   38.9
## 41   Qc3      Quebec    chilled  675   39.6
## 42   Qc3      Quebec    chilled 1000   41.4
## 29   Qc2      Quebec    chilled   95    9.3
## 30   Qc2      Quebec    chilled  175   27.3
## 31   Qc2      Quebec    chilled  250   35.0
## 34   Qc2      Quebec    chilled  675   37.5
## 33   Qc2      Quebec    chilled  500   38.6
## 32   Qc2      Quebec    chilled  350   38.8
## 35   Qc2      Quebec    chilled 1000   42.4
## 22   Qc1      Quebec    chilled   95   14.2
## 23   Qc1      Quebec    chilled  175   24.1
## 24   Qc1      Quebec    chilled  250   30.3
## 26   Qc1      Quebec    chilled  500   32.5
## 25   Qc1      Quebec    chilled  350   34.6
## 27   Qc1      Quebec    chilled  675   35.4
## 28   Qc1      Quebec    chilled 1000   38.7
## 57   Mn3 Mississippi nonchilled   95   11.3
## 58   Mn3 Mississippi nonchilled  175   19.4
## 59   Mn3 Mississippi nonchilled  250   25.8
## 63   Mn3 Mississippi nonchilled 1000   27.8
## 60   Mn3 Mississippi nonchilled  350   27.9
## 62   Mn3 Mississippi nonchilled  675   28.1
## 61   Mn3 Mississippi nonchilled  500   28.5
## 50   Mn2 Mississippi nonchilled   95   12.0
## 51   Mn2 Mississippi nonchilled  175   22.0
## 52   Mn2 Mississippi nonchilled  250   30.6
## 55   Mn2 Mississippi nonchilled  675   31.1
## 56   Mn2 Mississippi nonchilled 1000   31.5
## 53   Mn2 Mississippi nonchilled  350   31.8
## 54   Mn2 Mississippi nonchilled  500   32.4
## 43   Mn1 Mississippi nonchilled   95   10.6
## 44   Mn1 Mississippi nonchilled  175   19.2
## 45   Mn1 Mississippi nonchilled  250   26.2
## 46   Mn1 Mississippi nonchilled  350   30.0
## 47   Mn1 Mississippi nonchilled  500   30.9
## 48   Mn1 Mississippi nonchilled  675   32.4
## 49   Mn1 Mississippi nonchilled 1000   35.5
## 78   Mc3 Mississippi    chilled   95   10.6
## 80   Mc3 Mississippi    chilled  250   17.9
## 81   Mc3 Mississippi    chilled  350   17.9
## 82   Mc3 Mississippi    chilled  500   17.9
## 79   Mc3 Mississippi    chilled  175   18.0
## 83   Mc3 Mississippi    chilled  675   18.9
## 84   Mc3 Mississippi    chilled 1000   19.9
## 71   Mc2 Mississippi    chilled   95    7.7
## 72   Mc2 Mississippi    chilled  175   11.4
## 73   Mc2 Mississippi    chilled  250   12.3
## 75   Mc2 Mississippi    chilled  500   12.5
## 74   Mc2 Mississippi    chilled  350   13.0
## 76   Mc2 Mississippi    chilled  675   13.7
## 77   Mc2 Mississippi    chilled 1000   14.4
```

```
## 64   Mc1 Mississippi    chilled   95   10.5
## 65   Mc1 Mississippi    chilled  175   14.9
## 66   Mc1 Mississippi    chilled  250   18.1
## 67   Mc1 Mississippi    chilled  350   18.9
## 68   Mc1 Mississippi    chilled  500   19.5
## 70   Mc1 Mississippi    chilled 1000   21.9
## 69   Mc1 Mississippi    chilled  675   22.2
```

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.

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

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

```r
statex77 = as.data.frame(state.x77)
str(statex77)
```

```
## 'data.frame':    50 obs. of  8 variables:
##  $ Population: num  3615 365 2212 2110 21198 ...
##  $ Income    : num  3624 6315 4530 3378 5114 ...
##  $ Illiteracy: num  2.1 1.5 1.8 1.9 1.1 0.7 1.1 0.9 1.3 2 ...
##  $ Life Exp  : num  69 69.3 70.5 70.7 71.7 ...
##  $ Murder    : num  15.1 11.3 7.8 10.1 10.3 6.8 3.1 6.2 10.7 13.9 ...
##  $ HS Grad   : num  41.3 66.7 58.1 39.9 62.6 63.9 56 54.6 52.6 40.6 ...
##  $ Frost     : num  20 152 15 65 20 166 139 103 11 60 ...
##  $ Area      : num  50708 566432 113417 51945 156361 ...
```

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

```r
help("subset")
subset(statex77,statex77$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.

```
statex77[which.max(statex77$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.

```r
new_names = unlist(strsplit(colnames(df2),"state."))
new_names = new_names[new_names != ""]; new_names
```

```
## [1] "abb"      "area"     "division" "region"
```

```r
colnames(df2) = new_names
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
```

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

```
statex77 = cbind(statex77,df2)
drops = c("Life Exp","HS Grad","Frost","abb","area")
statex77 = statex77[,!colnames(statex77) %in% drops]
statex77
```

```
##                Population Income Illiteracy Murder   Area
## Alabama              3615   3624        2.1   15.1  50708
## Alaska                365   6315        1.5   11.3 566432
## Arizona              2212   4530        1.8    7.8 113417
## Arkansas             2110   3378        1.9   10.1  51945
## California          21198   5114        1.1   10.3 156361
## Colorado             2541   4884        0.7    6.8 103766
## Connecticut          3100   5348        1.1    3.1   4862
## Delaware              579   4809        0.9    6.2   1982
## Florida              8277   4815        1.3   10.7  54090
## Georgia              4931   4091        2.0   13.9  58073
## Hawaii                868   4963        1.9    6.2   6425
```

```
## Idaho              813   4119        0.6    5.3  82677
## Illinois         11197   5107        0.9   10.3  55748
## Indiana           5313   4458        0.7    7.1  36097
## Iowa              2861   4628        0.5    2.3  55941
## Kansas            2280   4669        0.6    4.5  81787
## Kentucky          3387   3712        1.6   10.6  39650
## Louisiana         3806   3545        2.8   13.2  44930
## Maine             1058   3694        0.7    2.7  30920
## Maryland          4122   5299        0.9    8.5   9891
## Massachusetts     5814   4755        1.1    3.3   7826
## Michigan          9111   4751        0.9   11.1  56817
## Minnesota         3921   4675        0.6    2.3  79289
## Mississippi       2341   3098        2.4   12.5  47296
## Missouri          4767   4254        0.8    9.3  68995
## Montana            746   4347        0.6    5.0 145587
## Nebraska          1544   4508        0.6    2.9  76483
## Nevada             590   5149        0.5   11.5 109889
## New Hampshire      812   4281        0.7    3.3   9027
## New Jersey        7333   5237        1.1    5.2   7521
## New Mexico        1144   3601        2.2    9.7 121412
## New York         18076   4903        1.4   10.9  47831
## North Carolina    5441   3875        1.8   11.1  48798
## North Dakota       637   5087        0.8    1.4  69273
## Ohio             10735   4561        0.8    7.4  40975
## Oklahoma          2715   3983        1.1    6.4  68782
## Oregon            2284   4660        0.6    4.2  96184
## Pennsylvania     11860   4449        1.0    6.1  44966
## Rhode Island       931   4558        1.3    2.4   1049
## South Carolina    2816   3635        2.3   11.6  30225
## South Dakota       681   4167        0.5    1.7  75955
## Tennessee         4173   3821        1.7   11.0  41328
## Texas            12237   4188        2.2   12.2 262134
## Utah              1203   4022        0.6    4.5  82096
## Vermont            472   3907        0.6    5.5   9267
## Virginia          4981   4701        1.4    9.5  39780
## Washington        3559   4864        0.6    4.3  66570
## West Virginia     1799   3617        1.4    6.7  24070
## Wisconsin         4589   4468        0.7    3.0  54464
## Wyoming            376   4566        0.6    6.9  97203
##                          division        region
## Alabama        East South Central         South
## Alaska                    Pacific          West
## Arizona                  Mountain          West
## Arkansas       West South Central         South
## California                Pacific          West
## Colorado                 Mountain          West
## Connecticut           New England     Northeast
## Delaware           South Atlantic         South
## Florida            South Atlantic         South
## Georgia            South Atlantic         South
## Hawaii                    Pacific          West
## Idaho                    Mountain          West
## Illinois       East North Central North Central
## Indiana        East North Central North Central
```

```
## Iowa           West North Central North Central
## Kansas         West North Central North Central
## Kentucky       East South Central         South
## Louisiana      West South Central         South
## Maine                 New England     Northeast
## Maryland           South Atlantic         South
## Massachusetts         New England     Northeast
## Michigan       East North Central North Central
## Minnesota      West North Central North Central
## Mississippi    East South Central         South
## Missouri       West North Central North Central
## Montana                  Mountain          West
## Nebraska       West North Central North Central
## Nevada                   Mountain          West
## New Hampshire         New England     Northeast
## New Jersey        Middle Atlantic     Northeast
## New Mexico               Mountain          West
## New York          Middle Atlantic     Northeast
## North Carolina     South Atlantic         South
## North Dakota   West North Central North Central
## Ohio           East North Central North Central
## Oklahoma       West South Central         South
## Oregon                    Pacific          West
## Pennsylvania      Middle Atlantic     Northeast
## Rhode Island           New England     Northeast
## South Carolina     South Atlantic         South
## South Dakota   West North Central North Central
## Tennessee      East South Central         South
## Texas          West South Central         South
## Utah                     Mountain          West
## Vermont               New England     Northeast
## Virginia           South Atlantic         South
## Washington                Pacific          West
## West Virginia      South Atlantic         South
## Wisconsin      East North Central North Central
## Wyoming                  Mountain          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()

```r
level_of_illiteracy = cut(statex77$Illiteracy,c(0,1,2,Inf),right = FALSE,labels = c("low","some","high")
statex77 = cbind(statex77,level_of_illiteracy)
statex77
```

```
##                Population Income Illiteracy Murder   Area
## Alabama              3615   3624        2.1   15.1  50708
## Alaska                365   6315        1.5   11.3 566432
## Arizona              2212   4530        1.8    7.8 113417
## Arkansas             2110   3378        1.9   10.1  51945
## California          21198   5114        1.1   10.3 156361
## Colorado             2541   4884        0.7    6.8 103766
## Connecticut          3100   5348        1.1    3.1   4862
## Delaware              579   4809        0.9    6.2   1982
## Florida              8277   4815        1.3   10.7  54090
```

```
## Georgia             4931   4091        2.0   13.9  58073
## Hawaii               868   4963        1.9    6.2   6425
## Idaho                813   4119        0.6    5.3  82677
## Illinois           11197   5107        0.9   10.3  55748
## Indiana             5313   4458        0.7    7.1  36097
## Iowa                2861   4628        0.5    2.3  55941
## Kansas              2280   4669        0.6    4.5  81787
## Kentucky            3387   3712        1.6   10.6  39650
## Louisiana           3806   3545        2.8   13.2  44930
## Maine               1058   3694        0.7    2.7  30920
## Maryland            4122   5299        0.9    8.5   9891
## Massachusetts       5814   4755        1.1    3.3   7826
## Michigan            9111   4751        0.9   11.1  56817
## Minnesota           3921   4675        0.6    2.3  79289
## Mississippi         2341   3098        2.4   12.5  47296
## Missouri            4767   4254        0.8    9.3  68995
## Montana              746   4347        0.6    5.0 145587
## Nebraska            1544   4508        0.6    2.9  76483
## Nevada               590   5149        0.5   11.5 109889
## New Hampshire        812   4281        0.7    3.3   9027
## New Jersey          7333   5237        1.1    5.2   7521
## New Mexico          1144   3601        2.2    9.7 121412
## New York           18076   4903        1.4   10.9  47831
## North Carolina      5441   3875        1.8   11.1  48798
## North Dakota         637   5087        0.8    1.4  69273
## Ohio               10735   4561        0.8    7.4  40975
## Oklahoma            2715   3983        1.1    6.4  68782
## Oregon              2284   4660        0.6    4.2  96184
## Pennsylvania       11860   4449        1.0    6.1  44966
## Rhode Island         931   4558        1.3    2.4   1049
## South Carolina      2816   3635        2.3   11.6  30225
## South Dakota         681   4167        0.5    1.7  75955
## Tennessee           4173   3821        1.7   11.0  41328
## Texas              12237   4188        2.2   12.2 262134
## Utah                1203   4022        0.6    4.5  82096
## Vermont              472   3907        0.6    5.5   9267
## Virginia            4981   4701        1.4    9.5  39780
## Washington          3559   4864        0.6    4.3  66570
## West Virginia       1799   3617        1.4    6.7  24070
## Wisconsin           4589   4468        0.7    3.0  54464
## Wyoming              376   4566        0.6    6.9  97203
##                          division        region level_of_illiteracy
## Alabama        East South Central         South                high
## Alaska                    Pacific          West                some
## Arizona                  Mountain          West                some
## Arkansas       West South Central         South                some
## California                Pacific          West                some
## Colorado                 Mountain          West                 low
## Connecticut           New England     Northeast                some
## Delaware           South Atlantic         South                 low
## Florida            South Atlantic         South                some
## Georgia            South Atlantic         South                high
## Hawaii                    Pacific          West                some
## Idaho                    Mountain          West                 low
```

```
## Illinois       East North Central North Central                 low
## Indiana        East North Central North Central                 low
## Iowa           West North Central North Central                 low
## Kansas         West North Central North Central                 low
## Kentucky       East South Central         South                some
## Louisiana      West South Central         South                high
## Maine                 New England     Northeast                 low
## Maryland           South Atlantic         South                 low
## Massachusetts         New England     Northeast                some
## Michigan       East North Central North Central                 low
## Minnesota      West North Central North Central                 low
## Mississippi    East South Central         South                high
## Missouri       West North Central North Central                 low
## Montana                  Mountain          West                 low
## Nebraska       West North Central North Central                 low
## Nevada                   Mountain          West                 low
## New Hampshire         New England     Northeast                 low
## New Jersey        Middle Atlantic     Northeast                some
## New Mexico               Mountain          West                high
## New York          Middle Atlantic     Northeast                some
## North Carolina     South Atlantic         South                some
## North Dakota   West North Central North Central                 low
## Ohio           East North Central North Central                 low
## Oklahoma       West South Central         South                some
## Oregon                    Pacific          West                 low
## Pennsylvania      Middle Atlantic     Northeast                some
## Rhode Island          New England     Northeast                some
## South Carolina     South Atlantic         South                high
## South Dakota   West North Central North Central                 low
## Tennessee      East South Central         South                some
## Texas          West South Central         South                high
## Utah                     Mountain          West                 low
## Vermont               New England     Northeast                 low
## Virginia           South Atlantic         South                some
## Washington                Pacific          West                 low
## West Virginia      South Atlantic         South                some
## Wisconsin      East North Central North Central                 low
## Wyoming                  Mountain          West                 low
```

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

```
west_states = statex77[grep("West",statex77$division),c("Income","level_of_illiteracy")]
west_states = west_states[order(west_states$Income,decreasing = T),]
west_states = west_states[west_states$level_of_illiteracy == "high",];
row.names(west_states[1,])
```

```
## [1] "Texas"
```

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

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

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

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

```
t(apply(df,1, sort))
```

```
##        [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##   [1,]    1    1    1    1    1    1    1    2    2     2     2     2     2
##   [2,]    1    1    1    1    1    1    1    1    1     1     1     1     1
##   [3,]    1    1    1    1    1    1    1    1    1     1     1     2     2
##   [4,]    1    1    1    1    1    1    1    1    1     1     1     1     2
```

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

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

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

```
## [14,]    5    5    5    5    5
## [15,]    5    5    5    5    5
## [16,]    5    5    5    5    5
## [17,]    5    5    5    5    5
## [18,]    5    5    5    5    5
## [19,]    5    5    5    5    5
## [20,]    5    5    5    5    5
## [21,]    5    5    5    5    5
## [22,]    5    5    5    5    5
## [23,]    5    5    5    5    5
## [24,]    5    5    5    5    5
## [25,]    5    5    5    5    5
## [26,]    5    5    5    5    5
## [27,]    5    5    5    5    5
## [28,]    5    5    5    5    5
## [29,]    5    5    5    5    5
## [30,]    5    5    5    5    5
## [31,]    5    5    5    5    5
## [32,]    5    5    5    5    5
## [33,]    5    5    5    5    5
## [34,]    5    5    5    5    5
## [35,]    5    5    5    5    5
## [36,]    5    5    5    5    5
## [37,]    5    5    5    5    5
## [38,]    5    5    5    5    5
## [39,]    5    5    5    5    5
## [40,]    5    5    5    5    5
## [41,]    4    5    5    5    5
## [42,]    5    5    5    5    5
## [43,]    5    5    5    5    5
## [44,]    5    5    5    5    5
## [45,]    5    5    5    5    5
## [46,]    5    5    5    5    5
## [47,]    5    5    5    5    5
## [48,]    5    5    5    5    5
## [49,]    5    5    5    5    5
## [50,]    4    4    5    5    5
```

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

```r
t(apply(df,1, sort,decreasing=TRUE))
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    5    5    5    5    5    5    5    5    4     4     4     4     4
##  [2,]    5    5    5    5    5    5    5    4    4     4     3     3     3
##  [3,]    5    5    5    5    5    5    5    5    5     4     4     4     4
##  [4,]    5    5    5    5    5    4    4    4    4     4     4     4     4
##  [5,]    5    5    5    5    5    5    4    4    4     4     4     4     4
##  [6,]    5    5    5    5    5    5    5    5    5     5     5     4     4
##  [7,]    5    5    5    5    5    5    5    4    4     4     4     4     4
##  [8,]    5    5    5    5    5    5    4    4    4     4     4     4     4
##  [9,]    5    5    5    5    5    4    4    4    4     4     4     4     4
## [10,]    5    5    5    5    5    5    5    5    5     4     4     4     4
## [11,]    5    5    5    5    5    5    5    5    5     5     5     4     4
## [12,]    5    5    5    5    5    5    4    4    4     4     4     4     4
```

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

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

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

```
## [22,]    1    1    1    1    1
## [23,]    1    1    1    1    1
## [24,]    1    1    1    1    1
## [25,]    1    1    1    1    1
## [26,]    1    1    1    1    1
## [27,]    1    1    1    1    1
## [28,]    1    1    1    1    1
## [29,]    1    1    1    1    1
## [30,]    1    1    1    1    1
## [31,]    1    1    1    1    1
## [32,]    1    1    1    1    1
## [33,]    1    1    1    1    1
## [34,]    1    1    1    1    1
## [35,]    1    1    1    1    1
## [36,]    1    1    1    1    1
## [37,]    1    1    1    1    1
## [38,]    1    1    1    1    1
## [39,]    2    1    1    1    1
## [40,]    1    1    1    1    1
## [41,]    1    1    1    1    1
## [42,]    1    1    1    1    1
## [43,]    1    1    1    1    1
## [44,]    2    1    1    1    1
## [45,]    1    1    1    1    1
## [46,]    1    1    1    1    1
## [47,]    1    1    1    1    1
## [48,]    1    1    1    1    1
## [49,]    1    1    1    1    1
## [50,]    1    1    1    1    1
```

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

```
t(apply(df,1, sort,decreasing=TRUE))
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    5    5    5    5    5    5    5    5    4     4     4     4     4
##  [2,]    5    5    5    5    5    5    5    4    4     4     3     3     3
##  [3,]    5    5    5    5    5    5    5    5    5     4     4     4     4
##  [4,]    5    5    5    5    5    4    4    4    4     4     4     4     4
##  [5,]    5    5    5    5    5    5    4    4    4     4     4     4     4
##  [6,]    5    5    5    5    5    5    5    5    5     5     5     4     4
##  [7,]    5    5    5    5    5    5    5    4    4     4     4     4     4
##  [8,]    5    5    5    5    5    5    4    4    4     4     4     4     4
##  [9,]    5    5    5    5    5    4    4    4    4     4     4     4     4
## [10,]    5    5    5    5    5    5    5    5    5     4     4     4     4
## [11,]    5    5    5    5    5    5    5    5    5     5     5     4     4
## [12,]    5    5    5    5    5    5    4    4    4     4     4     4     4
## [13,]    5    5    5    5    5    5    5    5    4     4     4     4     4
## [14,]    5    5    5    5    5    5    5    5    4     4     4     4     4
## [15,]    5    5    5    5    5    5    5    5    5     4     4     4     4
## [16,]    5    5    5    5    5    5    5    5    5     5     5     5     4
## [17,]    5    5    5    5    5    5    5    5    4     4     4     4     4
## [18,]    5    5    5    5    5    5    5    5    4     4     4     4     4
## [19,]    5    5    5    5    5    5    5    5    5     4     4     4     4
## [20,]    5    5    5    5    5    5    5    5    5     5     4     4     4
```

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

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

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

```
## [30,]    1    1    1    1    1
## [31,]    1    1    1    1    1
## [32,]    1    1    1    1    1
## [33,]    1    1    1    1    1
## [34,]    1    1    1    1    1
## [35,]    1    1    1    1    1
## [36,]    1    1    1    1    1
## [37,]    1    1    1    1    1
## [38,]    1    1    1    1    1
## [39,]    2    1    1    1    1
## [40,]    1    1    1    1    1
## [41,]    1    1    1    1    1
## [42,]    1    1    1    1    1
## [43,]    1    1    1    1    1
## [44,]    2    1    1    1    1
## [45,]    1    1    1    1    1
## [46,]    1    1    1    1    1
## [47,]    1    1    1    1    1
## [48,]    1    1    1    1    1
## [49,]    1    1    1    1    1
## [50,]    1    1    1    1    1
```

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 = as.data.frame(read.table("student.txt",header = TRUE),header=TRUE)
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 las columnas.

```r
colnames(students)
```

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

- Llama a la columna “heigh” solo

```r
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 comando se puede utilizar para crear tablas cruzadas (cross-tabulation)

```r
table(students)
```

```
## , , gender = female, population = kuopio
##
##       shoesize
## height 36 37 38 39 41 42 43 44
##    158  0  0  0  0  0  0  0  0
##    160  0  0  1  0  0  0  0  0
##    161  0  0  1  0  0  0  0  0
##    162  0  0  0  0  0  0  0  0
##    164  0  0  0  0  0  0  0  0
##    165  0  0  0  1  0  0  0  0
##    166  0  0  0  0  0  0  0  0
##    167  0  0  0  0  0  0  0  0
##    170  0  0  0  0  0  0  0  0
##    172  0  0  0  0  0  0  0  0
##    173  0  0  0  0  0  0  0  0
##    174  0  0  0  0  0  1  0  0
##    175  0  0  0  0  0  0  0  0
##    177  0  0  0  0  0  0  0  0
##    180  0  0  0  0  0  0  0  0
##    181  0  0  0  0  0  0  0  0
##
## , , gender = male, population = kuopio
##
##       shoesize
## height 36 37 38 39 41 42 43 44
##    158  0  0  0  0  0  0  0  0
##    160  0  0  0  0  0  0  0  0
##    161  0  0  0  0  0  0  0  0
##    162  0  0  0  0  0  0  0  0
##    164  0  0  0  0  0  0  0  0
##    165  0  0  0  0  0  0  0  0
##    166  0  0  0  0  0  0  0  0
##    167  0  0  0  0  0  0  0  0
##    170  0  0  0  0  0  0  1  0
##    172  0  0  0  0  0  0  1  0
##    173  0  0  0  0  0  0  0  0
##    174  0  0  0  0  0  0  0  0
##    175  0  0  0  0  0  0  0  0
##    177  0  0  0  0  0  0  0  0
##    180  0  0  0  0  0  0  0  0
##    181  0  0  0  0  0  0  0  1
```

```
##
## , , gender = female, population = tampere
##
##       shoesize
## height 36 37 38 39 41 42 43 44
##    158  1  0  0  0  0  0  0  0
##    160  0  0  0  0  0  0  0  0
##    161  0  0  0  0  0  0  0  0
##    162  0  1  0  0  0  0  0  0
##    164  0  0  0  1  0  0  0  0
##    165  0  0  0  0  0  0  0  0
##    166  0  0  1  0  0  0  0  0
##    167  0  0  1  0  0  0  0  0
##    170  0  0  0  0  0  0  0  0
##    172  0  0  0  0  0  0  0  0
##    173  0  0  0  0  0  0  0  0
##    174  0  0  0  0  0  0  0  0
##    175  0  0  0  0  0  0  0  0
##    177  0  0  0  0  0  0  0  0
##    180  0  0  0  0  0  0  0  0
##    181  0  0  0  0  0  0  0  0
##
## , , gender = male, population = tampere
##
##       shoesize
## height 36 37 38 39 41 42 43 44
##    158  0  0  0  0  0  0  0  0
##    160  0  0  0  0  0  0  0  0
##    161  0  0  0  0  0  0  0  0
##    162  0  0  0  0  0  0  0  0
##    164  0  0  0  0  0  0  0  0
##    165  0  0  0  0  0  0  0  0
##    166  0  0  0  0  0  0  0  0
##    167  0  0  0  0  0  0  0  0
##    170  0  0  0  0  0  0  0  0
##    172  0  0  0  0  0  0  0  0
##    173  0  0  0  0  1  0  0  0
##    174  0  0  0  0  0  0  0  0
##    175  0  0  0  0  0  1  0  0
##    177  0  0  0  0  0  0  1  0
##    180  0  0  0  0  0  0  1  0
##    181  0  0  0  0  0  0  0  1
```

Hay 4 observaciones diferentes, dependiendo del sexo y la población, en la que se compara el tamaño del zapato y la altura de los individuos.

- 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 será "Blue" si el estudiante es de kuopio y "Red" si es de otro sitio.

```r
sym = ifelse(students$gender == "male","M","F")
colours = ifelse(students$population == "kuopio","Blue","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 set de datos student. Divídelo 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
```

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

```
## [1]  2  3  6  7  8  9 10 11 12
```

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

```
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
```

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

```
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.

```r
write.table(students.new,"student_new.txt")
```

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

```r
my_list <- list(name="Fred", wife="Mary", no.children=3, child.ages=c(4,7,9))
attributes(my_list)
```

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

```r
names(my_list)= my_list[2]
my_list[[2]]
```

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

```r
my_list$wife
```

```
## NULL
```

```r
my_list[[4]][2]
```

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

```r
length(my_list[[4]])
```

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

```r
my_list$wife <- 1:12
my_list$wife <- NULL
```

La primera sentencia crea una lista con cuatro elemento. La función attributes(x) accede a los atributos de un objeto, en este caso devuelve los nombres de los elementos de la lista. La segunda sentencia cambia los nombres de la lista a al segundo elemento de la lista. La tercera sentencia está accediendo al segundo elemento de la lista. La cuarta sentencia devuelve null ya que el nombre "wife" ha sido eliminado de los nombres de la lista cuando se ha hecho la asignación en la segunda sentencia. La quinta línea accede al segundo elemento del cuarto elemento de la lista. La sexta sentencia devuelve el número de elementos guardados en el cuarto elemento de la lista. Las séptima sentencia añade un elemento más con nombre "wife" a la lista. La última sentencia elimina el elemento añadido justamente en la línea anterior.

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.

```r
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 condiciones totales, transponer columnas y filas

Vamos a volver a utilizar el datasets mtcars.

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

```r
with(mtcars,mtcars[order(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

```r
with(mtcars,mtcars[order(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.

```r
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

```r
# Media para valores menores que 150
with(mtcars,mean(mpg[hp < 150]))
```

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

```r
# Media para valores mayores o iguales que 150
with(mtcars,mean(mpg[hp >= 150]))
```

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

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

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

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

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

```r
mtcars["Toyota Corolla",c("mpg","cyl","disp","hp")]
```

```
##                 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

```r
mtcars.new = within(mtcars,{
                    mpgClass = ifelse(mtcars$mpg < mean(mtcars$mpg),"Low","High")
                    })
mtcars.new
```

```
##                      mpg cyl  disp  hp drat    wt  qsec vs am gear carb
## 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
## Datsun 710          22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive      21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout   18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
## Valiant             18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
## Duster 360          14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
## Merc 240D           24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Merc 230            22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    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
## 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
## Fiat 128            32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Honda Civic         30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
## Toyota Corolla      33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Toyota Corona       21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
## 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
## Camaro Z28          13.3   8 350.0 245 3.73 3.840 15.41  0  0    3    4
## Pontiac Firebird    19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
## 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
## Lotus Europa        30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Ford Pantera L      15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
## Ferrari Dino        19.7   6 145.0 175 3.62 2.770 15.50  0  1    5    6
## Maserati Bora       15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
## Volvo 142E          21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
##                     mpgClass
```

```
## Mazda RX4               High
## Mazda RX4 Wag           High
## Datsun 710              High
## Hornet 4 Drive          High
## Hornet Sportabout        Low
## Valiant                  Low
## Duster 360               Low
## Merc 240D               High
## Merc 230                High
## Merc 280                 Low
## Merc 280C                Low
## Merc 450SE               Low
## Merc 450SL               Low
## Merc 450SLC              Low
## Cadillac Fleetwood       Low
## Lincoln Continental      Low
## Chrysler Imperial        Low
## Fiat 128                High
## Honda Civic             High
## Toyota Corolla          High
## Toyota Corona           High
## Dodge Challenger         Low
## AMC Javelin              Low
## Camaro Z28               Low
## Pontiac Firebird         Low
## Fiat X1-9               High
## Porsche 914-2           High
## Lotus Europa            High
## Ford Pantera L           Low
## Ferrari Dino             Low
## Maserati Bora            Low
## Volvo 142E              High
```