Manipulación de datos en R con dplyr

@jrcajide

```
# Cargamos la librerías necesarias
list.of.packages <- c("tidyverse", "maps")
new.packages <- list.of.packages[!(list.of.packages %in% installed.packages()[,"Package"])]
if(length(new.packages)) install.packages(new.packages)
lapply(list.of.packages, require, character.only = TRUE)
```

```
## Loading required package: tidyverse
```

```
## Warning: package 'tidyverse' was built under R version 3.3.2
```

```
## Loading tidyverse: ggplot2
## Loading tidyverse: tibble
## Loading tidyverse: tidyr
## Loading tidyverse: readr
## Loading tidyverse: purrr
## Loading tidyverse: dplyr
```

```
## Warning: package 'ggplot2' was built under R version 3.3.2
```

```
## Conflicts with tidy packages ----------------------------------------------
```

```
## filter(): dplyr, stats
## lag():    dplyr, stats
```

```
## Loading required package: maps
```

```
##
## Attaching package: 'maps'
```

```
## The following object is masked from 'package:purrr':
##
##     map
```

```
## [[1]]
## [1] TRUE
##
## [[2]]
## [1] TRUE
```

¿Porqué dplyr?

- Facilita enormemente el análisis exploratorio de datos así como su transformación
- Muy intituitiva, debido sobre todo al uso de pipes: `%>%`
- Muy rápida incluso con grandes datasets

Funcionalidades

- 5 verbos básicos: `filter`, `select`, `arrange`, `mutate`, `summarise` (y `group_by`)
- Puede trabjar con datos almacenados en en bases de datos o en data tables
- Joins: inner join, left join, semi-join, etc.
- Funciones para cálculo de rankings, evoluciones, etc.

Cargando dplyr y el conjunto de datos

- Echemos un vistado a los datos Flights
- Con `tbl_df` convertiremos los datos a "local data frame"

```
# Cargamos el fichero de datos
flights <- read_csv("data/669307277_T_ONTIME.csv.zip")
```

```
## Multiple files in zip: reading '669307277_T_ONTIME.csv'
```

```
## Warning: Missing column names filled in: 'X18' [18]
```

```
## Parsed with column specification:
## cols(
##   YEAR = col_integer(),
##   QUARTER = col_integer(),
##   MONTH = col_integer(),
##   DAY_OF_MONTH = col_integer(),
##   CARRIER = col_character(),
##   TAIL_NUM = col_character(),
##   FL_NUM = col_integer(),
##   ORIGIN = col_character(),
##   DEST = col_character(),
##   DEP_TIME = col_character(),
##   DEP_DELAY = col_double(),
##   ARR_TIME = col_character(),
##   ARR_DELAY = col_double(),
##   CANCELLED = col_double(),
##   DIVERTED = col_double(),
##   AIR_TIME = col_double(),
##   DISTANCE = col_double(),
##   X18 = col_character()
## )
```

```
print(object.size(get('flights')), units='auto')
```

```
## 57 Mb
```

```
# explora
head(flights)
```

```
## # A tibble: 6 × 18
##    YEAR QUARTER MONTH DAY_OF_MONTH CARRIER TAIL_NUM FL_NUM ORIGIN  DEST
##   <int>   <int> <int>        <int>   <chr>    <chr>  <int>  <chr> <chr>
## 1  2015       4    12            1      AA   N783AA      1    JFK   LAX
## 2  2015       4    12            2      AA   N785AA      1    JFK   LAX
## 3  2015       4    12            3      AA   N795AA      1    JFK   LAX
## 4  2015       4    12            5      AA   N787AA      1    JFK   LAX
## 5  2015       4    12            7      AA   N784AA      1    JFK   LAX
## 6  2015       4    12            8      AA   N799AA      1    JFK   LAX
## # ... with 9 more variables: DEP_TIME <chr>, DEP_DELAY <dbl>,
## #   ARR_TIME <chr>, ARR_DELAY <dbl>, CANCELLED <dbl>, DIVERTED <dbl>,
## #   AIR_TIME <dbl>, DISTANCE <dbl>, X18 <chr>
```

```
dim(flights)
```

```
## [1] 479230     18
```

```r
# estructura del dataframe en con R
str(flights)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':    479230 obs. of  18 variables:
##  $ YEAR        : int  2015 2015 2015 2015 2015 2015 2015 2015 2015 2015 ...
##  $ QUARTER     : int  4 4 4 4 4 4 4 4 4 4 ...
##  $ MONTH       : int  12 12 12 12 12 12 12 12 12 12 ...
##  $ DAY_OF_MONTH: int  1 2 3 5 7 8 9 10 12 14 ...
##  $ CARRIER     : chr  "AA" "AA" "AA" "AA" ...
##  $ TAIL_NUM    : chr  "N783AA" "N785AA" "N795AA" "N787AA" ...
##  $ FL_NUM      : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ ORIGIN      : chr  "JFK" "JFK" "JFK" "JFK" ...
##  $ DEST        : chr  "LAX" "LAX" "LAX" "LAX" ...
##  $ DEP_TIME    : chr  "0857" "0854" "0855" "0856" ...
##  $ DEP_DELAY   : num  -3 -6 -5 -4 -8 -3 -3 -5 -2 -3 ...
##  $ ARR_TIME    : chr  "1159" "1207" "1213" "1153" ...
##  $ ARR_DELAY   : num  -26 -18 -12 -32 -40 -15 -32 -13 -5 16 ...
##  $ CANCELLED   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ DIVERTED    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ AIR_TIME    : num  322 324 330 332 322 339 321 349 360 338 ...
##  $ DISTANCE    : num  2475 2475 2475 2475 2475 ...
##  $ X18         : chr  NA NA NA NA ...
##  - attr(*, "spec")=List of 2
##   ..$ cols   :List of 18
##   .. ..$ YEAR        : list()
##   .. .. ..- attr(*, "class")= chr  "collector_integer" "collector"
##   .. ..$ QUARTER     : list()
##   .. .. ..- attr(*, "class")= chr  "collector_integer" "collector"
##   .. ..$ MONTH       : list()
##   .. .. ..- attr(*, "class")= chr  "collector_integer" "collector"
##   .. ..$ DAY_OF_MONTH: list()
##   .. .. ..- attr(*, "class")= chr  "collector_integer" "collector"
##   .. ..$ CARRIER     : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ TAIL_NUM    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ FL_NUM      : list()
##   .. .. ..- attr(*, "class")= chr  "collector_integer" "collector"
##   .. ..$ ORIGIN      : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ DEST        : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ DEP_TIME    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ DEP_DELAY   : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
##   .. ..$ ARR_TIME    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   .. ..$ ARR_DELAY   : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
##   .. ..$ CANCELLED   : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
##   .. ..$ DIVERTED    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
```

```
##   .. ..$ AIR_TIME    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
##   .. ..$ DISTANCE    : list()
##   .. .. ..- attr(*, "class")= chr  "collector_double" "collector"
##   .. ..$ X18         : list()
##   .. .. ..- attr(*, "class")= chr  "collector_character" "collector"
##   ..$ default: list()
##   .. ..- attr(*, "class")= chr  "collector_guess" "collector"
##   ..- attr(*, "class")= chr "col_spec"
```

```
# con dplyr
glimpse(flights)
```

```
## Observations: 479,230
## Variables: 18
## $ YEAR         <int> 2015, 2015, 2015, 2015, 2015, 2015, 2015, 2015, 2...
## $ QUARTER      <int> 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4...
## $ MONTH        <int> 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 12, 1...
## $ DAY_OF_MONTH <int> 1, 2, 3, 5, 7, 8, 9, 10, 12, 14, 15, 16, 17, 19, ...
## $ CARRIER      <chr> "AA", "AA", "AA", "AA", "AA", "AA", "AA", "AA", "...
## $ TAIL_NUM     <chr> "N783AA", "N785AA", "N795AA", "N787AA", "N784AA",...
## $ FL_NUM       <int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1...
## $ ORIGIN       <chr> "JFK", "JFK", "JFK", "JFK", "JFK", "JFK", "JFK", ...
## $ DEST         <chr> "LAX", "LAX", "LAX", "LAX", "LAX", "LAX", "LAX", ...
## $ DEP_TIME     <chr> "0857", "0854", "0855", "0856", "0852", "0857", "...
## $ DEP_DELAY    <dbl> -3, -6, -5, -4, -8, -3, -3, -5, -2, -3, -8, -5, -...
## $ ARR_TIME     <chr> "1159", "1207", "1213", "1153", "1145", "1210", "...
## $ ARR_DELAY    <dbl> -26, -18, -12, -32, -40, -15, -32, -13, -5, 16, -...
## $ CANCELLED    <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ DIVERTED     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ AIR_TIME     <dbl> 322, 324, 330, 332, 322, 339, 321, 349, 360, 338,...
## $ DISTANCE     <dbl> 2475, 2475, 2475, 2475, 2475, 2475, 2475, 2475, 2...
## $ X18          <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N...
```

```
flights$X18 <- NULL
```

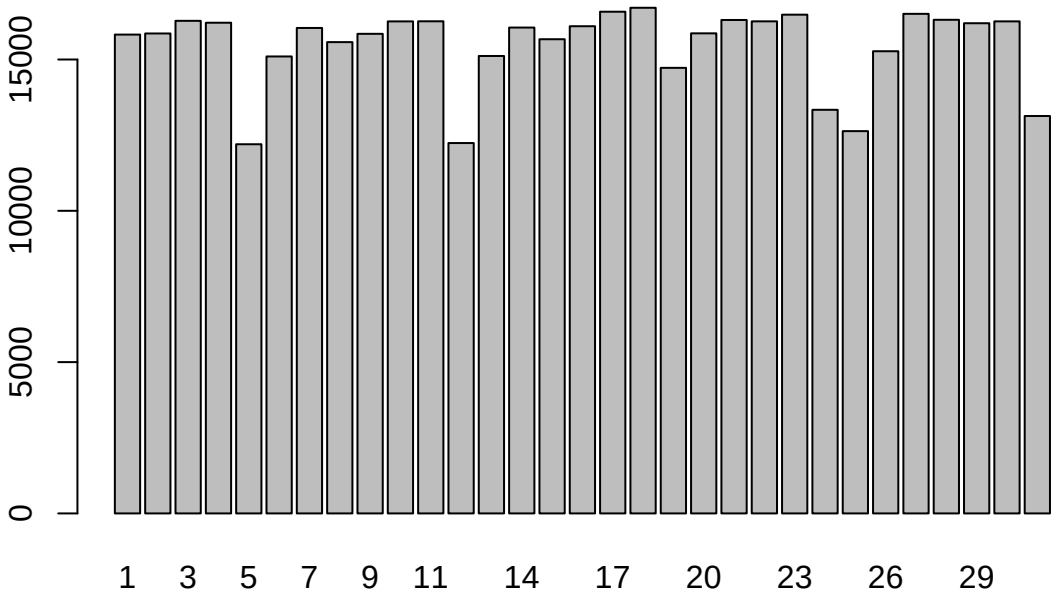
```
# Para ver más filas
print(flights, n=20)

# Y si queremos ver todas las variables
data.frame(head(flights))
```

filter: Filtrado de observaciones

```
# Vuelos del 31/12/2015
flights
str(flights)

barplot(table(flights$DAY_OF_MONTH))
```




```
# dplyr
# nota: , = AND
filter(flights, MONTH==12, DAY_OF_MONTH==31)
```

```
## # A tibble: 13,133 × 17
##     YEAR QUARTER MONTH DAY_OF_MONTH CARRIER TAIL_NUM FL_NUM ORIGIN  DEST
##    <int>   <int> <int>        <int>   <chr>    <chr>  <int>  <chr> <chr>
## 1   2015       4    12           31      AA   N785AA      1    JFK   LAX
## 2   2015       4    12           31      AA   N787AA      4    LAX   JFK
## 3   2015       4    12           31      AA   N367AA      5    DFW   HNL
## 4   2015       4    12           31      AA   N4YBAA      5    OKC   DFW
## 5   2015       4    12           31      AA   N383AA      6    OGG   DFW
## 6   2015       4    12           31      AA   N383AA      7    DFW   OGG
## 7   2015       4    12           31      AA   N367AA      8    HNL   DFW
## 8   2015       4    12           31      AA   N858AA     14    OGG   LAX
## 9   2015       4    12           31      AA   N791AA     17    JFK   SFO
## 10  2015       4    12           31      AA   N788AA     19    JFK   LAX
## # ... with 13,123 more rows, and 8 more variables: DEP_TIME <chr>,
## #   DEP_DELAY <dbl>, ARR_TIME <chr>, ARR_DELAY <dbl>, CANCELLED <dbl>,
## #   DIVERTED <dbl>, AIR_TIME <dbl>, DISTANCE <dbl>
```

```
# nota: | = OR
filter(flights, CARRIER=="AA" | CARRIER=="UA")
```

```
## # A tibble: 120,005 × 17
##     YEAR QUARTER MONTH DAY_OF_MONTH CARRIER TAIL_NUM FL_NUM ORIGIN  DEST
##    <int>   <int> <int>        <int>   <chr>    <chr>  <int>  <chr> <chr>
## 1   2015       4    12            1      AA   N783AA      1    JFK   LAX
## 2   2015       4    12            2      AA   N785AA      1    JFK   LAX
## 3   2015       4    12            3      AA   N795AA      1    JFK   LAX
## 4   2015       4    12            5      AA   N787AA      1    JFK   LAX
## 5   2015       4    12            7      AA   N784AA      1    JFK   LAX
## 6   2015       4    12            8      AA   N799AA      1    JFK   LAX
## 7   2015       4    12            9      AA   N795AA      1    JFK   LAX
## 8   2015       4    12           10      AA   N793AA      1    JFK   LAX
## 9   2015       4    12           12      AA   N791AA      1    JFK   LAX
```

```
## 10  2015       4    12           14      AA   N785AA      1    JFK   LAX
## # ... with 119,995 more rows, and 8 more variables: DEP_TIME <chr>,
## #   DEP_DELAY <dbl>, ARR_TIME <chr>, ARR_DELAY <dbl>, CANCELLED <dbl>,
## #   DIVERTED <dbl>, AIR_TIME <dbl>, DISTANCE <dbl>
```

```
filter(flights, CARRIER %in% c("AA", "UA"))
```

select: Seleccionar variables por nombre

- Como un SELECT en SQL

```
# base R
flights[, c("DEP_TIME", "ARR_TIME", "FL_NUM")]
```

```
# dplyr
select(flights, DEP_TIME, ARR_TIME, FL_NUM)
```

```
## # A tibble: 479,230 × 3
##    DEP_TIME ARR_TIME FL_NUM
##       <chr>    <chr>  <int>
## 1      0857     1159      1
## 2      0854     1207      1
## 3      0855     1213      1
## 4      0856     1153      1
## 5      0852     1145      1
## 6      0857     1210      1
## 7      0857     1153      1
## 8      0855     1212      1
## 9      0858     1220      1
## 10     0857     1241      1
## # ... with 479,220 more rows
```

```
# Nota: `starts_with`, `ends_with`, y `matches` (para RegEx) buscan columnas por nombre
select(flights, YEAR:DAY_OF_MONTH, contains("DELAY"), matches("TIME$"))
```

```
## # A tibble: 479,230 × 9
##     YEAR QUARTER MONTH DAY_OF_MONTH DEP_DELAY ARR_DELAY DEP_TIME ARR_TIME
##    <int>   <int> <int>        <int>     <dbl>     <dbl>    <chr>    <chr>
## 1   2015       4    12            1        -3       -26     0857     1159
## 2   2015       4    12            2        -6       -18     0854     1207
## 3   2015       4    12            3        -5       -12     0855     1213
## 4   2015       4    12            5        -4       -32     0856     1153
## 5   2015       4    12            7        -8       -40     0852     1145
## 6   2015       4    12            8        -3       -15     0857     1210
## 7   2015       4    12            9        -3       -32     0857     1153
## 8   2015       4    12           10        -5       -13     0855     1212
## 9   2015       4    12           12        -2        -5     0858     1220
## 10  2015       4    12           14        -3        16     0857     1241
## # ... with 479,220 more rows, and 1 more variables: AIR_TIME <dbl>
```

"Encadenamiento" o "Pipes"

- Forma de usar múltiples operaciones en una línea en vez de usar un método de anidamiento
- Nota `%>%` puede ser interpretado como un *después*

```r
# Anidamiento:
filter(select(flights, CARRIER, DEP_DELAY), DEP_DELAY > 60)
```

```r
# Encadenamiento:
flights %>%
    select(CARRIER, DEP_DELAY) %>%
    filter(DEP_DELAY > 60)
```

```
## # A tibble: 31,376 × 2
##    CARRIER DEP_DELAY
##      <chr>     <dbl>
## 1       AA       156
## 2       AA       368
## 3       AA       105
## 4       AA        70
## 5       AA       201
## 6       AA        74
## 7       AA        61
## 8       AA       181
## 9       AA       135
## 10      AA        86
## # ... with 31,366 more rows
```

arrange: Ordenar filas

```r
# base R
flights[order(flights$DEP_DELAY), c("CARRIER", "DEP_DELAY")]
```

```r
# dplyr
flights %>%
    select(CARRIER, DEP_DELAY) %>%
    arrange(DEP_DELAY)
```

```
## # A tibble: 479,230 × 2
##    CARRIER DEP_DELAY
##      <chr>     <dbl>
## 1       AS       -82
## 2       EV       -55
## 3       OO       -45
## 4       AS       -43
## 5       OO       -42
## 6       AS       -41
## 7       AS       -40
## 8       AS       -40
## 9       EV       -40
## 10      OO       -39
## # ... with 479,220 more rows
```

```r
# nota: usar `desc` para descendente
flights %>%
    select(CARRIER, DEP_DELAY) %>%
    arrange(desc(DEP_DELAY))
```

mutate: Crear nuevas variables

- Permite crear variables a partir de variables existentes en nuestro conjunto de datos

```
# dplyr: comprobamos que es correcto
flights %>% select(DISTANCE, AIR_TIME) %>%
  mutate(SPEED = DISTANCE/AIR_TIME*60)
```

```
## # A tibble: 479,230 × 3
##    DISTANCE AIR_TIME    SPEED
##       <dbl>    <dbl>    <dbl>
## 1      2475      322 461.1801
## 2      2475      324 458.3333
## 3      2475      330 450.0000
## 4      2475      332 447.2892
## 5      2475      322 461.1801
## 6      2475      339 438.0531
## 7      2475      321 462.6168
## 8      2475      349 425.5014
## 9      2475      360 412.5000
## 10     2475      338 439.3491
## # ... with 479,220 more rows
```

```
# lo guardamos
flights %>% mutate(SPEED = DISTANCE/AIR_TIME*60)
```

```
## # A tibble: 479,230 × 18
##     YEAR QUARTER MONTH DAY_OF_MONTH CARRIER TAIL_NUM FL_NUM ORIGIN  DEST
##    <int>   <int> <int>        <int>   <chr>    <chr>  <int>  <chr> <chr>
## 1   2015       4    12            1      AA   N783AA      1    JFK   LAX
## 2   2015       4    12            2      AA   N785AA      1    JFK   LAX
## 3   2015       4    12            3      AA   N795AA      1    JFK   LAX
## 4   2015       4    12            5      AA   N787AA      1    JFK   LAX
## 5   2015       4    12            7      AA   N784AA      1    JFK   LAX
## 6   2015       4    12            8      AA   N799AA      1    JFK   LAX
## 7   2015       4    12            9      AA   N795AA      1    JFK   LAX
## 8   2015       4    12           10      AA   N793AA      1    JFK   LAX
## 9   2015       4    12           12      AA   N791AA      1    JFK   LAX
## 10  2015       4    12           14      AA   N785AA      1    JFK   LAX
## # ... with 479,220 more rows, and 9 more variables: DEP_TIME <chr>,
## #   DEP_DELAY <dbl>, ARR_TIME <chr>, ARR_DELAY <dbl>, CANCELLED <dbl>,
## #   DIVERTED <dbl>, AIR_TIME <dbl>, DISTANCE <dbl>, SPEED <dbl>
```

summarise: Reducción de variables a valores

- Se usa principalmente tras una agrupación de datos
- `group_by` crea los grupos sobre los que vamos a trabajar
- `summarise` resume cada grupo

```
# dplyr:
flights %>%
    group_by(DEST) %>%
    summarise(AVG_DELAY = mean(ARR_DELAY, na.rm=TRUE))
```

```
## # A tibble: 307 × 2
##     DEST AVG_DELAY
```

```
##    <chr>     <dbl>
## 1    ABE  5.466216
## 2    ABI  2.481865
## 3    ABQ  7.888959
## 4    ABR -2.803279
## 5    ABY 11.360000
## 6    ACT -1.726667
## 7    ACV 19.898305
## 8    ACY  4.535593
## 9    ADK -6.500000
## 10   ADQ -3.269231
## # ... with 297 more rows
```

- `summarise_each` permite aplicar la misma función a múltiples variables a la vez
- NOta: También existe un `mutate_each`

```
# media de vuelos cancelados o desviados por compañía
flights %>%
    group_by(CARRIER) %>%
    summarise_each(funs(mean), CANCELLED, DIVERTED)
```

```
## # A tibble: 13 × 3
##    CARRIER   CANCELLED    DIVERTED
##      <chr>       <dbl>       <dbl>
## 1       AA 0.016692354 0.002690630
## 2       AS 0.006431980 0.003873020
## 3       B6 0.002827400 0.003427152
## 4       DL 0.002618950 0.002349977
## 5       EV 0.034367920 0.004372451
## 6       F9 0.010467980 0.002093596
## 7       HA 0.000798722 0.000000000
## 8       MQ 0.038346115 0.004620588
## 9       NK 0.017055571 0.001499391
## 10      OO 0.029312881 0.004433705
## 11      UA 0.018092673 0.002370923
## 12      VX 0.007950849 0.003614022
## 13      WN 0.015091741 0.002651755
```

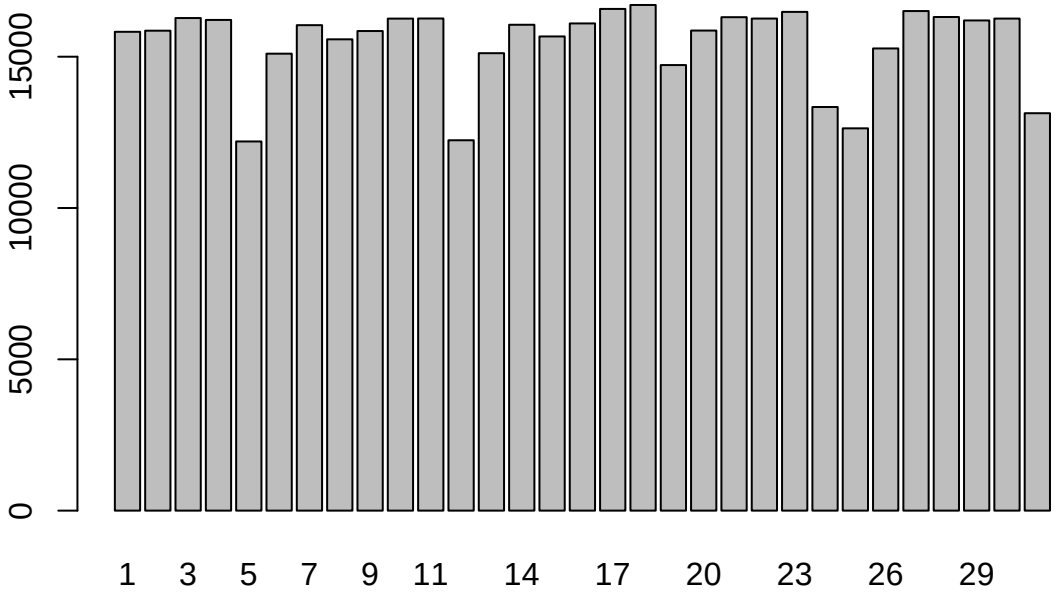
```
# retrasos máximos y mínimos de salida y llegada por cada compañía
flights %>%
    group_by(CARRIER) %>%
    summarise_each(funs(min(., na.rm=TRUE), max(., na.rm=TRUE)), matches("DELAY"))
```

```
## # A tibble: 13 × 5
##    CARRIER DEP_DELAY_min ARR_DELAY_min DEP_DELAY_max ARR_DELAY_max
##      <chr>         <dbl>         <dbl>         <dbl>         <dbl>
## 1       AA           -31           -76          1649          1636
## 2       AS           -82           -80           803           791
## 3       B6           -24           -56          1006          1002
## 4       DL           -23           -67          1228          1211
## 5       EV           -55           -60          1274          1223
## 6       F9           -34           -52           781           776
## 7       HA           -27           -67          1095          1051
## 8       MQ           -24           -57          1278          1272
## 9       NK           -35           -55           723           724
## 10      OO           -45           -62          1378          1372
```

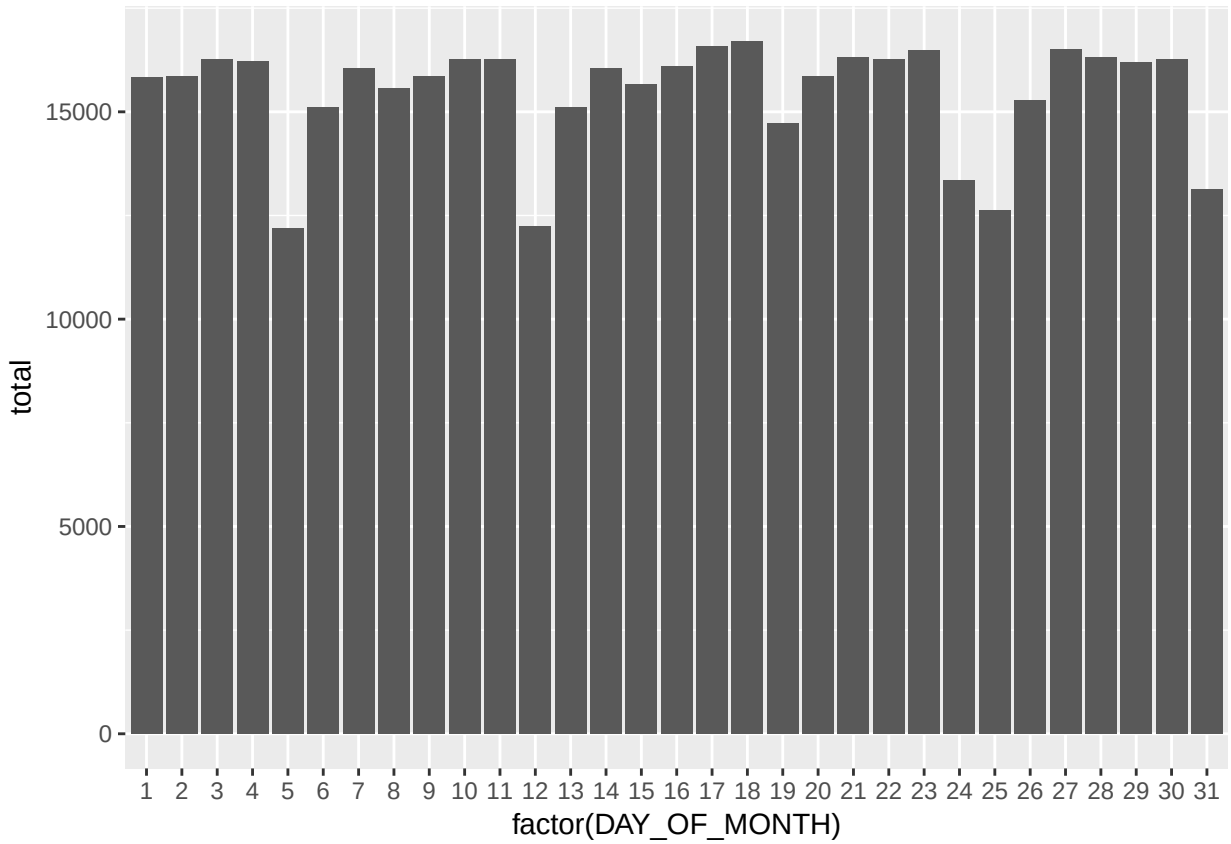
```
## 11      UA           -21           -67          1194          1185
## 12      VX           -20           -56           363           339
## 13      WN           -20           -63           562           547
```

- `n()` nos dice el número de observaciones por grupo
- `n_distinct(vector)` nos dice el número de elementos únicos que hay en un vector

```r
# Número de vuelos por cada día del mes ordenados descendentemente
barplot(table(flights$DAY_OF_MONTH))
```




```r
flights %>%
    group_by(DAY_OF_MONTH) %>%
    summarise(total = n()) %>%
    arrange(desc(total)) %>% ggplot(aes(x = factor(DAY_OF_MONTH), y = total)) + geom_bar(stat = "identi
```




```
# número total de vuelos y número de aviones distintos que han volado a cada destino
flights %>%
    group_by(DEST) %>%
    summarise(total = n(), aviones = n_distinct(TAIL_NUM))
```

```
## # A tibble: 307 × 3
##     DEST total aviones
##    <chr> <int>   <int>
## 1    ABE   153     104
## 2    ABI   210      63
## 3    ABQ  1624     899
## 4    ABR    62      31
## 5    ABY    75      36
## 6    ACT   151      27
## 7    ACV   125      79
## 8    ACY   298      30
## 9    ADK     9       8
## 10   ADQ    30      10
## # ... with 297 more rows
```

Funciones de ventana ("Window")

- Son funciones que toman n inputs y devuelven n valores, no como la media(que toma n inputs y devuelve 1 valor)
- Funciones de ranking y orden (como `min_rank`), de balance (`lead` y `lag`), y agregados (como `cummean`).

```r
# Calcular, para cada compañía, que dos días del mes que han tenido mayores retrasos en la salida
flights %>%
    group_by(CARRIER) %>%
    select(DAY_OF_MONTH, DEP_DELAY) %>%
    top_n(2) %>%
    arrange(CARRIER, desc(DEP_DELAY))
```

```
## Adding missing grouping variables: `CARRIER`
```

```
## Selecting by DEP_DELAY
```

```
## Source: local data frame [26 x 3]
## Groups: CARRIER [13]
##
##    CARRIER DAY_OF_MONTH DEP_DELAY
##      <chr>        <int>     <dbl>
## 1       AA           31      1649
## 2       AA           14      1576
## 3       AS           23       803
## 4       AS           13       571
## 5       B6           28      1006
## 6       B6           30       892
## 7       DL           20      1228
## 8       DL           24      1137
## 9       EV           26      1274
## 10      EV           26      1236
## # ... with 16 more rows
```

```r
# Número de vuelos por mes y cambio respecto al dia anterior
flights %>%
    group_by(DAY_OF_MONTH) %>%
    summarise(flight_count = n()) %>%
    mutate(change = flight_count - lag(flight_count))
```

```
## # A tibble: 31 × 3
##    DAY_OF_MONTH flight_count change
##           <int>        <int>  <int>
## 1             1        15823     NA
## 2             2        15860     37
## 3             3        16278    418
## 4             4        16215    -63
## 5             5        12200  -4015
## 6             6        15101   2901
## 7             7        16043    942
## 8             8        15575   -468
## 9             9        15849    274
## 10           10        16259    410
## # ... with 21 more rows
```

```r
# delta

pct <- function(x) {x/lag(x)}

flights %>%
    group_by(DAY_OF_MONTH) %>%
    summarise(flight_count = n()) %>%
```

```
    mutate_each(funs(pct), flight_count)
```

```
## # A tibble: 31 × 2
##    DAY_OF_MONTH flight_count
##           <int>        <dbl>
## 1             1           NA
## 2             2    1.0023384
## 3             3    1.0263556
## 4             4    0.9961297
## 5             5    0.7523898
## 6             6    1.2377869
## 7             7    1.0623800
## 8             8    0.9708284
## 9             9    1.0175923
## 10           10    1.0258691
## # ... with 21 more rows
```

Otras funciones útiles

```
# muestra aleatoria
flights %>% sample_n(5)
```

```
## # A tibble: 5 × 17
##    YEAR QUARTER MONTH DAY_OF_MONTH CARRIER TAIL_NUM FL_NUM ORIGIN  DEST
##   <int>   <int> <int>        <int>   <chr>    <chr>  <int>  <chr> <chr>
## 1  2015       4    12            8      DL   N908DA   2341    MSP   OMA
## 2  2015       4    12           13      WN   N287WN    540    CAK   ATL
## 3  2015       4    12            1      AA   N869AA    370    PHX   MIA
## 4  2015       4    12           18      F9   N923FR    558    SAN   DEN
## 5  2015       4    12           27      WN   N959WN   1935    BOS   MCI
## # ... with 8 more variables: DEP_TIME <chr>, DEP_DELAY <dbl>,
## #   ARR_TIME <chr>, ARR_DELAY <dbl>, CANCELLED <dbl>, DIVERTED <dbl>,
## #   AIR_TIME <dbl>, DISTANCE <dbl>
```

Joins

```
#Cargamos un nuevo conjunot de datos
airports <- read_csv("data/airports.csv")
```

```
## Parsed with column specification:
## cols(
##   iata = col_character(),
##   airport = col_character(),
##   city = col_character(),
##   state = col_character(),
##   country = col_character(),
##   lat = col_double(),
##   long = col_double()
## )
```

```
## Warning: 2 parsing failures.
##  row     col           expected actual
```

```
## 1252 airport delimiter or quote      B
## 1252 airport delimiter or quote
```

```
airports
```

```
## # A tibble: 3,376 × 7
##     iata              airport             city state country      lat
##    <chr>                <chr>            <chr> <chr>   <chr>    <dbl>
## 1    00M              Thigpen      Bay Springs    MS     USA 31.95376
## 2    00R Livingston Municipal       Livingston    TX     USA 30.68586
## 3    00V          Meadow Lake Colorado Springs    CO     USA 38.94575
## 4    01G         Perry-Warsaw            Perry    NY     USA 42.74135
## 5    01J     Hilliard Airpark         Hilliard    FL     USA 30.68801
## 6    01M    Tishomingo County          Belmont    MS     USA 34.49167
## 7    02A           Gragg-Wade          Clanton    AL     USA 32.85049
## 8    02C              Capitol       Brookfield    WI     USA 43.08751
## 9    02G    Columbiana County   East Liverpool    OH     USA 40.67331
## 10   03D     Memphis Memorial          Memphis    MO     USA 40.44726
## # ... with 3,366 more rows, and 1 more variables: long <dbl>
```

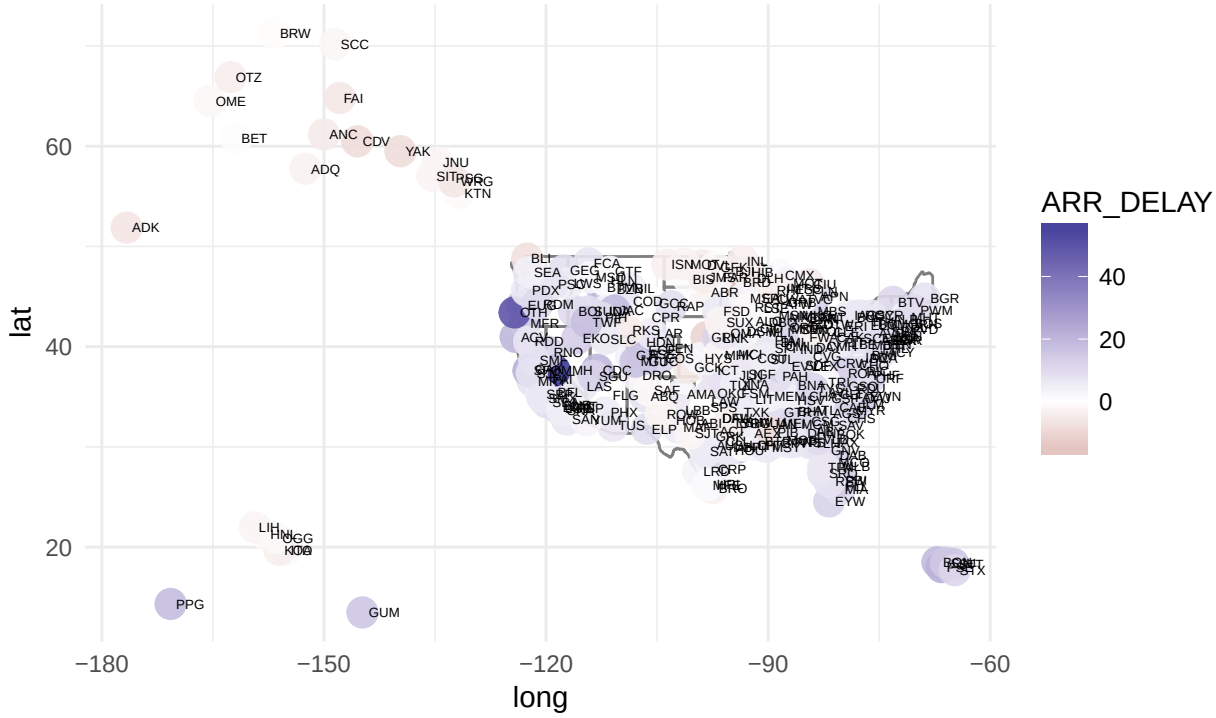
```
location <- airports %>%
  select(DEST = iata, name = airport, lat, long)
location
```

```
## # A tibble: 3,376 × 4
##     DEST                 name      lat       long
##    <chr>                <chr>    <dbl>      <dbl>
## 1    00M              Thigpen 31.95376  -89.23450
## 2    00R Livingston Municipal 30.68586  -95.01793
## 3    00V          Meadow Lake 38.94575 -104.56989
## 4    01G         Perry-Warsaw 42.74135  -78.05208
## 5    01J     Hilliard Airpark 30.68801  -81.90594
## 6    01M    Tishomingo County 34.49167  -88.20111
## 7    02A           Gragg-Wade 32.85049  -86.61145
## 8    02C              Capitol 43.08751  -88.17787
## 9    02G    Columbiana County 40.67331  -80.64141
## 10   03D     Memphis Memorial 40.44726  -92.22696
## # ... with 3,366 more rows
```

```
delays <- flights %>%
  group_by(DEST) %>%
  summarise(ARR_DELAY = mean(ARR_DELAY, na.rm = TRUE), n = n()) %>%
  arrange(desc(ARR_DELAY))

final <- inner_join(location, delays, by=c("DEST"))
# final %>% View()


ggplot(final, aes(long, lat)) +
  borders("state") +
  geom_point(aes(colour = ARR_DELAY), size = 5, alpha = 0.9) +
  geom_text(aes(label=DEST, hjust=-.2), size=1.9) +
  scale_colour_gradient2() +
  theme_minimal() +
  coord_quickmap()
```




```
delays <- delays %>% filter(ARR_DELAY < 0)
```