Universidade Federal do Rio Grande do Norte
Instituto Metrópole Digital
IMD0601 - Bioestatística

Organização dos dados em R

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Baixe a aula (e os arquivos)

- Para aqueles que não clonaram o repositório:

```
> git clone https://github.com/tetsufmbio/IMD0601.git
```

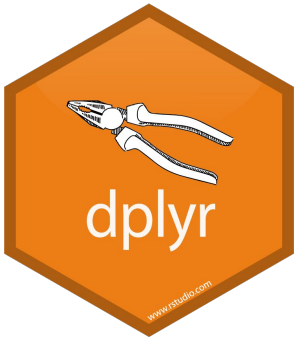
- Para aqueles que já tem o repositório local:

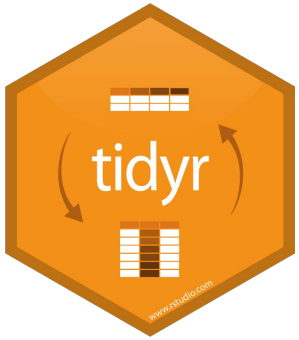
```
> cd /path/to/IMD0601
```

```
> git pull
```

Revisão

Entender e arrumar os dados

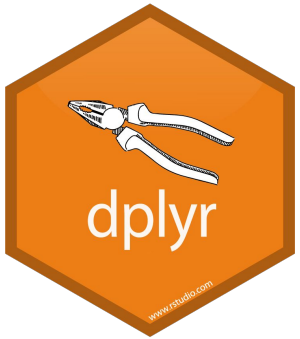




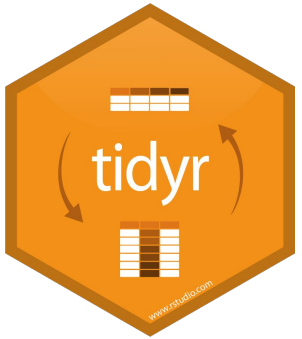
Conceito de uma tabela arrumada:

- Cada variável deve estar em uma coluna;
- Cada observação forma uma linha;
- Cada tipo de unidade observacional forma uma tabela.

Revisão



- **select**(<tbl_df>, <var1>, <var2>, ...)
- **filter**(<tbl_df>, <condition1>, <condition2>, ...)
- **arrange**(<tbl_df>, <var1>, desc(<var2>),...)
- **mutate**(<tbl_df>, <new_var1> = <value>, <new_var2> = <value>,...)
- **summarize**(<tbl_df>, <column> = <function>)



- **gather**(<tbl_df>, <col1>, <col2>, ...)
- **separate**(<tbl_df>, <col>, into = <vector>)
- **spread**(<tbl_df>, <col>, <col_value>)
- **unique**(<tbl_df>)
- **bind_rows**(<tbl_df1>,<tbl_df2>)

Revisão

Messy data:

- Valores representando colunas de uma tabela;
- Múltiplas variáveis em uma coluna;
- Variáveis armazenadas tanto em linhas quanto em colunas;
- Múltiplas unidades observacionais em uma única tabela. Dados redundantes na tabela.
- Duas tabelas separadas com a mesma unidade observacional.

https://makingnoiseandhearingthings.com/2018/04/19/datasets-for-data-cleaning-practice/

Exercício

Trabalhe com o dados de iris e manipule os dados de forma que ele apresente as seguintes estruturas:

a)

	Species	Part	Measure	Value
1	setosa	Sepal	Length	5.1
2	setosa	Sepal	Length	4.9
3	setosa	Sepal	Length	4.7
4	setosa	Sepal	Length	4.6
5	setosa	Sepal	Length	5.0
6	setosa	Sepal	Length	5.4

b)

	Species	Flower	Part	Length	Width
1	setosa	1	Petal	1.4	0.2
2	setosa	1	Sepal	5.1	3.5
3	setosa	2	Petal	1.4	0.2
4	setosa	2	Sepal	4.9	3.0
5	setosa	3	Petal	1.3	0.2
6	setosa	3	Sepal	4.7	3.2

as.<class>()

```
# logical
class(TRUE)

# character
class("8484.00")

# numeric
class(99)

# character
class("factor")

# character
class("FALSE")
```

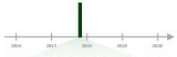
```
# Converter para "character"
class(as.character(TRUE))

# Converter para "numeric"
class(as.numeric("8484.00"))

# Converter para "integer"
class(as.integer(99))

# Converter para "factor"
class(as.factor("factor"))

# Converter para "logical"
class(as.logical("FALSE"))
```

lubridate


```
# Pacote que lida com dados temporais em R

library(lubridate)

ymd("2012, Aug 13") # "2012-08-13"

ymd_hm("2012-08-13 12:43") # "2012-08-13 12:43:00 UTC"

hms("12:43:54") # "12H 43M 54S"
```

Dates and times with lubridate : : CHEAT SHEET

Date-times



`2017-11-28 12:00:00`

`2017-11-28 12:00:00`
A **date-time** is a point on the timeline, stored as the number of seconds since 1970-01-01 00:00:00 UTC

dt <- ***as_datetime****(1511870400)*
"2017-11-28 12:00:00 UTC"

`2017-11-28`
A **date** is a day stored as the number of days since 1970-01-01

d <- ***as_date****(17498)*
"2017-11-28"

`12:00:00`
An hms is a **time** stored as the number of seconds since 00:00:00

*t <- hms::****as.hms****(85)*
00:01:25

PARSE DATE-TIMES (Convert strings or numbers to date-times)

1. Identify the order of the year (**y**), month (**m**), day (**d**), hour (**h**), minute (**m**) and second (**s**) elements in your data.
2. Use the function below whose name replicates the order. Each accepts a wide variety of input formats.

`2017-11-28T14:02:00` **ymd_hms**(), **ymd_hm**(), **ymd_h**(). *ymd_hms("2017-11-28T14:02:00")*

`2017-22-12 10:00:00` **ydm_hms**(), **ydm_hm**(), **ydm_h**(). *ydm_hms("2017-22-12 10:00:00")*

`11/28/2017 1:02:03` **mdy_hms**(), **mdy_hm**(), **mdy_h**(). *mdy_hms("11/28/2017 1:02:03")*

`1 Jan 2017 23:59:59` **dmy_hms**(), **dmy_hm**(), **dmy_h**(). *dmy_hms("1 Jan 2017 23:59:59")*

`20170131` **ymd**(), **ydm**(). *ymd(20170131)*

`July 4th, 2000` **mdy**(), **myd**(). *mdy("July 4th, 2000")*

`4th of July '99` **dmy**(), **dym**(). *dmy("4th of July '99")*

`2001: Q3` **yq**() Q for quarter. *yq("2001: Q3")*

`2:01` hms::**hms**() Also lubridate::**hms**(), **hm**() and **ms**(), which return periods.* *hms::hms(sec = 0, min= 1, hours = 2)*

`2017.5` **date_decimal**(decimal, tz = "UTC") *date_decimal(2017.5)*

now(tzone = "") Current time in tz (defaults to system tz). *now()*

today(tzone = "") Current date in a tz (defaults to system tz). *today()*

fast_strptime() Faster strptime. *fast_strptime('9/1/01', '%y/%m/%d')*

parse_date_time() Easier strptime. *parse_date_time("9/1/01", "ymd")*

GET AND SET COMPONENTS

Use an accessor function to get a component. *d ## "2017-11-28"* *day(d) ## 28*

Assign into an accessor function to change a component in place. *day(d) <- 1* *d ## "2017-11-01"*

`2018-01-31 11:59:59` **date**(x) Date component. *date(dt)*

`2018-01-31 11:59:59` **year**(x) Year. *year(dt)* **isoyear**(x) The ISO 8601 year. **epiyear**(x) Epidemiological year.

`2018-01-31 11:59:59` **month**(x, label, abbr) Month. *month(dt)*

`2018-01-31 11:59:59` **day**(x) Day of month. *day(dt)* **wday**(x,label,abbr) Day of week. **qday**(x) Day of quarter.

`2018-01-31 11:59:59` **hour**(x) Hour. *hour(dt)*

`2018-01-31 11:59:59` **minute**(x) Minutes. *minute(dt)*

`2018-01-31 11:59:59` **second**(x) Seconds. *second(dt)*

week(x) Week of the year. *week(dt)* **isoweek**() ISO 8601 week. **epiweek**() Epidemiological week.

quarter(x, with_year = FALSE) Quarter. *quarter(dt)*

semester(x, with_year = FALSE) Semester. *semester(dt)*

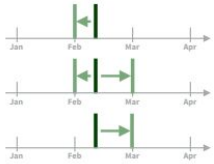
am(x) Is it in the am? *am(dt)* **pm**(x) Is it in the pm? *pm(dt)*

dst(x) Is it daylight savings? *dst(d)*

leap_year(x) Is it a leap year? *leap_year(d)*

update(object, ..., simple = FALSE) *update(dt, mday = 2, hour = 1)*

Round Date-times



floor_date(x, unit = "second") Round down to nearest unit. *floor_date(dt, unit = "month")*

round_date(x, unit = "second") Round to nearest unit. *round_date(dt, unit = "month")*

ceiling_date(x, unit = "second", change_on_boundary = NULL) Round up to nearest unit. *ceiling_date(dt, unit = "month")*

rollback(dates, roll_to_first = FALSE, preserve_hms = TRUE) Roll back to last day of previous month. *rollback(dt)*

Stamp Date-times

stamp() Derive a template from an example string and return a new function that will apply the template to date-times. Also **stamp_date**() and **stamp_time**().

1. Derive a template, create a function
   sf <- stamp("Created Sunday, Jan 17, 1999 3:34")
2. Apply the template to dates
   sf(ymd("2010-04-05"))
   ## [1] "Created Monday, Apr 05, 2010 00:00"

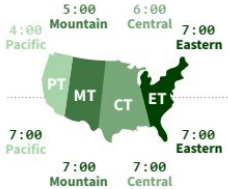
Tip: use a date with day > 12

Time Zones

R recognizes ~600 time zones. Each encodes the time zone, Daylight Savings Time, and historical calendar variations for an area. R assigns *one* time zone per vector.

Use the **UTC** time zone to avoid Daylight Savings.

OlsonNames() Returns a list of valid time zone names. *OlsonNames()*



with_tz(time, tzone = "") Get the **same date-time** in a new time zone (a new clock time). *with_tz(dt, "US/Pacific")*

force_tz(time, tzone = "") Get the **same clock time** in a new time zone (a new date-time). *force_tz(dt, "US/Pacific")*

stringr

```
# Pacote que lida com strings em R

library(stringr)

str_detect(students3$dob, "1997")

str_length("TESTE") # 5

str_replace("Female", "F", "f") # female

str_trim("  T  ") # "T"

str_c("T","E","S","T") # "TEST"

str_pad(x, width = 6, side = "left", pad = ".")
```

String manipulation with stringr : : CHEAT SHEET

The **stringr** package provides a set of internally consistent tools for working with character strings, i.e. sequences of characters surrounded by quotation marks.

Detect Matches

str_detect(string, **pattern**) Detect the presence of a pattern match in a string.
str_detect(fruit, "a")

str_which(string, **pattern**) Find the indexes of strings that contain a pattern match.
str_which(fruit, "a")

str_count(string, **pattern**) Count the number of matches in a string.
str_count(fruit, "a")

str_locate(string, **pattern**) Locate the positions of pattern matches in a string. Also **str_locate_all**.
str_locate(fruit, "a")

Subset Strings

str_sub(string, start = 1L, end = -1L) Extract substrings from a character vector.
str_sub(fruit, 1, 3); str_sub(fruit, -2)

str_subset(string, **pattern**) Return only the strings that contain a pattern match.
str_subset(fruit, "b")

str_extract(string, **pattern**) Return the first pattern match found in each string, as a vector. Also **str_extract_all** to return every pattern match.
str_extract(fruit, "[aeiou]")

str_match(string, **pattern**) Return the first pattern match found in each string, as a matrix with a column for each ( ) group in pattern. Also **str_match_all**.
str_match(sentences, "(a|the) ([^]+)")

Manage Lengths

str_length(string) The width of strings (i.e. number of code points, which generally equals the number of characters).
str_length(fruit)

str_pad(string, width, side = c("left", "right", "both"), pad = " ") Pad strings to constant width.
str_pad(fruit, 17)

str_trunc(string, width, side = c("right", "left", "center"), ellipsis = "...") Truncate the width of strings, replacing content with ellipsis.
str_trunc(fruit, 3)

str_trim(string, side = c("both", "left", "right")) Trim whitespace from the start and/or end of a string.
str_trim(fruit)

Mutate Strings

str_sub() **<-** value. Replace substrings by identifying the substrings with str_sub() and assigning into the results.
str_sub(fruit, 1, 3) <- "str"

str_replace(string, **pattern**, replacement) Replace the first matched pattern in each string.
str_replace(fruit, "a", "-")

str_replace_all(string, **pattern**, replacement) Replace all matched patterns in each string.
str_replace_all(fruit, "a", "-")

str_to_lower(string, locale = "en")[1] Convert strings to lower case.
str_to_lower(sentences)

str_to_upper(string, locale = "en")[1] Convert strings to upper case.
str_to_upper(sentences)

str_to_title(string, locale = "en")[1] Convert strings to title case.
str_to_title(sentences)

Join and Split

str_c(..., sep = "", collapse = NULL) Join multiple strings into a single string.
str_c(letters, LETTERS)

str_c(..., sep = "", **collapse = NULL**) Collapse a vector of strings into a single string.
str_c(letters, collapse = "")

str_dup(string, times) Repeat strings times times.
str_dup(fruit, times = 2)

str_split_fixed(string, **pattern**, n) Split a vector of strings into a matrix of substrings (splitting at occurrences of a pattern match). Also **str_split** to return a list of substrings.
str_split_fixed(fruit, " ", n=2)

str_glue(..., .sep = "", .envir = parent.frame()) Create a string from strings and {expressions} to evaluate.
str_glue("Pi is {pi}")

str_glue_data(.x, ..., .sep = "", .envir = parent.frame(), .na = "NA") Use a data frame, list, or environment to create a string from strings and {expressions} to evaluate.
str_glue_data(mtcars, "{rownames(mtcars)} has {hp} hp")

Order Strings

str_order(x, decreasing = FALSE, na_last = TRUE, locale = "en", numeric = FALSE, ...)[1] Return the vector of indexes that sorts a character vector.
x[str_order(x)]

str_sort(x, decreasing = FALSE, na_last = TRUE, locale = "en", numeric = FALSE, ...)[1] Sort a character vector.
str_sort(x)

Helpers

str_conv(string, encoding) Override the encoding of a string.
str_conv(fruit,"ISO-8859-1")

str_view(string, **pattern**, match = NA) View HTML rendering of first regex match in each string.
str_view(fruit, "[aeiou]")

str_view_all(string, **pattern**, match = NA) View HTML rendering of all regex matches.
str_view_all(fruit, "[aeiou]")

str_wrap(string, width = 80, indent = 0, exdent = 0) Wrap strings into nicely formatted paragraphs.
str_wrap(sentences, 20)

[1] See bit.ly/ISO639-1 for a complete list of locales.

Exercício

Carregue o arquivo data.csv no R(studio). Este arquivo contém dados climatológicos de algumas localidades no Brasil.

Ao explorar os dados, você verificará que os dados estão bagunçados. Utilizando os recursos visto nesta e na aula passada, tente organizar estes dados de forma que cada observação corresponda a cada hora medido.

Descrição sobre as colunas pode ser acessada em: https://www.kaggle.com/PROPPG-PPG/hourly-weather-surface-brazil-southeast-region

Exercício

1. Explore os dados;
2. Divida a tabela de forma que cada tabela tenha dados de uma unidade observacional;
3. Retire colunas redundantes na tabela que contém os dados climatológicos;
4. Formate a coluna que contém a data e a hora utilizando o pacote lubridate;
5. Explore a coluna prcp. O que representa o valor 0 e o NA nesta coluna?
6. Explore a coluna stp. O que representa o valor 0 e o NA nesta coluna?
7. Corrija os valores das colunas prcp, stp, smax e smin em relação aos dados faltantes.

Referência

Esta aula foi baseada no curso “**Cleaning Data in R**” de Nick Carchedi (https://www.datacamp.com/courses/cleaning-data-in-r)