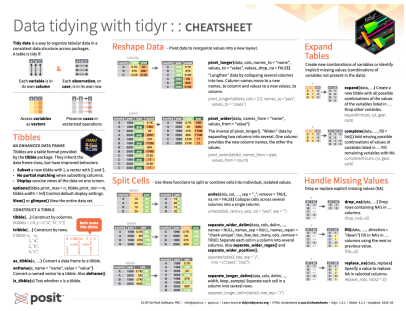
Data tidying with tidyr :: Cheatsheet

Tidy data is a way to organize tabular data in a consistent data structure across packages. A table is tidy if:

- Each **variable** is in its own **column**
- Each **observation**, or **case**, is in its own **row**
- Access **variables** as **vectors**
- Preserve **cases** in vectorized operations

```
library(tidyr)
library(tibble)
```

Download PDF



Translations (PDF)

- Chinese
- Portuguese

Tibbles

An Enhanced Data Frame

Tibbles are a table format provided by the **tibble** package. They inherit the data frame class, but have improved behaviors:

- **Subset** a new tibble with `]`, a vector with `[[` and `$`.
- **No partial matching** when subsetting columns.
- **Display** concise views of the data on one screen.
- `options(tibble.print_max = n, tibble.print_min = m, tibble.width = Inf)`: Control default display settings.

- `View()` or `glimpse()`: View the entire data set.

Construct a Tibble

- `tibble(...)`: Construct by columns.

```
tibble(
  x = 1:3,
  y = c("a", "b", "c")
)
```

```
# A tibble: 3 × 2
      x y
  <int> <chr>
1     1 a
2     2 b
3     3 c
```

- `tribble(...)`: Construct by rows.

```
tribble(
  ~x, ~y,
   1, "a",
   2, "b",
   3, "c"
)
```

- `as_tibble(x, ...)`: Convert a data frame to a tibble.
- `enframe(x, name = "name", value = "value")`: Convert a named vector to a tibble. Also `deframe()`.
- `is_tibble(x)`: Test whether x is a tibble.

Reshape Data

Pivot data to reorganize values into a new layout.

- `pivot_longer(data, cols, name_to = "name", values_to = "value", values_drop_na = FALSE)`: "Lengthen" data by collapsing several columns into two.
  - The initial `table4a` looks like the following:

```
table4a
```

```
# A tibble: 3 × 3
  country     `1999` `2000`
  <chr>        <dbl>  <dbl>
1 Afghanistan    745   2666
2 Brazil       37737  80488
3 China       212258 213766
```

  - Column names move to a new `names_to` column and values to a new `values_to` column. The output of `pivot_longer()` will look like the following:

```
pivot_longer(table4a, cols = 2:3, names_to = "year", values_to = "cases")
```

```
# A tibble: 6 × 3
  country     year   cases
  <chr>       <chr>  <dbl>
1 Afghanistan 1999     745
2 Afghanistan 2000    2666
3 Brazil      1999   37737
4 Brazil      2000   80488
5 China       1999  212258
6 China       2000  213766
```

- `pivot_wider(data, name_from = "name", values_from = "value")`: The inverse of `pivot_longer()`. "Widen" data by expanding two columns into several.
  - The initial `table2` looks like the following:

```
table2
```

```
# A tibble: 12 × 4
   country      year type            count
   <chr>       <dbl> <chr>           <dbl>
 1 Afghanistan  1999 cases             745
 2 Afghanistan  1999 population   19987071
 3 Afghanistan  2000 cases            2666
 4 Afghanistan  2000 population   20595360
 5 Brazil       1999 cases           37737
 6 Brazil       1999 population  172006362
 7 Brazil       2000 cases           80488
 8 Brazil       2000 population  174504898
 9 China        1999 cases          212258
10 China        1999 population 1272915272
11 China        2000 cases          213766
12 China        2000 population 1280428583
```

- One column provides the new column names, the other the values. The output of `pivot_wider()` will look like the following:

```
pivot_wider(table2, names_from = type, values_from = count)
```

```
# A tibble: 6 × 4
  country      year  cases population
  <chr>       <dbl>  <dbl>      <dbl>
1 Afghanistan  1999    745   19987071
2 Afghanistan  2000   2666   20595360
3 Brazil       1999  37737  172006362
4 Brazil       2000  80488  174504898
5 China        1999 212258 1272915272
6 China        2000 213766 1280428583
```

Split Cells

Use these functions to split or combine cells into individual, isolated values.

- `unite(data, col, ..., sep = "_", remove = TRUE, na.rm = FALSE)`: Collapse cells across several columns into a single column.
  - The initial `table5` looks like the following:

```
table5
```

```
# A tibble: 6 × 4
  country     century year  rate
  <chr>       <chr>   <chr> <chr>
1 Afghanistan 19      99    745/19987071
2 Afghanistan 20      00    2666/20595360
3 Brazil      19      99    37737/172006362
4 Brazil      20      00    80488/174504898
5 China       19      99    212258/1272915272
6 China       20      00    213766/1280428583
```

  - The output of `unite()` will look like the following:

```
unite(table5, century, year, col = "year", sep = "")
```

```
# A tibble: 6 × 3
  country     year  rate
  <chr>       <chr> <chr>
1 Afghanistan 1999  745/19987071
2 Afghanistan 2000  2666/20595360
3 Brazil      1999  37737/172006362
4 Brazil      2000  80488/174504898
5 China       1999  212258/1272915272
6 China       2000  213766/1280428583
```

- `separate_wider_delim(data, cols, delim, ..., names = NULL, names_sep = NULL, names_repair = "check unique", too_few, too_many, cols_remove = TRUE)`: Separate each cell in a column into several columns. Also `extract()`.

- The initial `table3` looks like the following:

```
table3
```

```
# A tibble: 6 × 3
  country      year rate
  <chr>       <dbl> <chr>
1 Afghanistan  1999 745/19987071
2 Afghanistan  2000 2666/20595360
3 Brazil       1999 37737/172006362
4 Brazil       2000 80488/174504898
5 China        1999 212258/1272915272
6 China        2000 213766/1280428583
```

- The output of `separate_wider_delim()` will look like the following:

```
separate_wider_delim(table3, rate, delim = "/", names = c("cases", "pop"))
```

```
# A tibble: 6 × 4
  country      year cases  pop
  <chr>       <dbl> <chr>  <chr>
1 Afghanistan  1999 745    19987071
2 Afghanistan  2000 2666   20595360
3 Brazil       1999 37737  172006362
4 Brazil       2000 80488  174504898
5 China        1999 212258 1272915272
6 China        2000 213766 1280428583
```

- `separate_longer_delim(data, cols, delim, .., width, keep_empty)`: Separate each cell in a column into several rows.

  - The initial `table3` looks like the following:

```
table3
```

```
# A tibble: 6 × 3
  country      year rate
```

```
  <chr>       <dbl> <chr>
1 Afghanistan  1999 745/19987071
2 Afghanistan  2000 2666/20595360
3 Brazil       1999 37737/172006362
4 Brazil       2000 80488/174504898
5 China        1999 212258/1272915272
6 China        2000 213766/1280428583
```

- The output of `separate_longer_delim()` will look like the following:

```
separate_longer_delim(table3, rate, delim = "/")
```

```
# A tibble: 12 × 3
   country      year rate
   <chr>       <dbl> <chr>
 1 Afghanistan  1999 745
 2 Afghanistan  1999 19987071
 3 Afghanistan  2000 2666
 4 Afghanistan  2000 20595360
 5 Brazil       1999 37737
 6 Brazil       1999 172006362
 7 Brazil       2000 80488
 8 Brazil       2000 174504898
 9 China        1999 212258
10 China        1999 1272915272
11 China        2000 213766
12 China        2000 1280428583
```

Expand Tables

Create new combinations of variables or identify implicit missing values (combinations of variables not present in the data).

- `expand(data, ...)`: Create a new tibble with all possible combinations of the values of the variables listed in ... Drop other variables.

```
expand(mtcars, cyl, gear, carb)
```

- `complete(data, ..., fill = list())`: Add missing possible combinations of values of variables listed in ... Fill remaining variables with NA.

```
complete(mtcars, cyl, gear, carb)
```

Handle Missing Values

Drop or replace explicit missing values (`NA`).

```
x <- tribble(
  ~x1, ~x2,
  "A",   1,
  "B",  NA,
  "C",  NA,
  "D",   3,
  "E",  NA
)
```

- `drop_na(data, ...)`: Drop rows containing `NA`s in ... columns.

```
drop_na(x, x2)
```

- `fill(data, ..., .direction = "down")`: Fill in `NA`s in ... columns using the next or previous value.

```
fill(x, x2)
```

- `replace_na(data, replace)`: Specify a value to replace `NA` in selected columns.

```
replace_na(x, list(x2 = 2))
```

Nested Data

A **nested data frame** stores individual tables as a list-column of data frames within a larger organizing data frame. List-columns can also be lists of vectors or lists of varying data types. Use a nested data frame to:

- Preserve relationships between observations and subsets of data. Preserve the type of the variables being nested (factors and datetimes aren't coerced to character).
- Manipulate many sub-tables are once with **purrr** functions like `map()`, `map2()`, or `pmap()` or with **dplyr** `rowwise()` grouping.

Create Nested Data

- `nest(data, ...)`: Moves groups of cells into a list-column of a data frame. Use alone or with `dplyr::group_by()`.

1. Group the data frame with `group_by()` and use `nest()` to move the groups into a list-column.

```
n_storms <- storms |>
  group_by(name) |>
  nest()
```

2. Use `nest(new_col = c(x,y))` to specify the columns to group using `dplyr::select()` syntax.

```
n_storms <- storms |>
  nest(data = c(year:long))
```

- Index list-columns with `[[]]`.

```
n_storms$data[[1]]
```

Create Tibbles With List-Columns

- `tibble::tribble(...)`: Makes list-columns when needed.

```
tribble(
  ~max, ~seq,
     3,  1:3,
     4,  1:4,
     5,  1:5
)
```

- `tibble::tibble(...)`: Saves list input as list-columns.

```
tibble(
  max = c(3,4,5),
  seq = list(1:3, 1:4, 1:5)
)
```

- `tibble::enframe(x, name = "name", value = "value")`: Convert multi-level list to a tibble with list-cols.

```
enframe(list("3" = 1:3, "4" = 1:4, "5" = 1:5), "max", "seq")
```

Output List-Columns From Other Functions

- `dplyr::mutate()`, `transmute()`, and `summarise()` will output list-columns if they return a list.

```
mtcars |>
  group_by(cyl) |>
  summarise(q = list(quantile(mpg)))
```

Reshape Nested Data

- `unnest(data, cols, ..., keep_empty = FALSE)`: Flatten nested columns back to regular columns. The inverse of `nest()`.

```
n_storms |> unnest(data)
```

- `unnest_longer(data, col, values_to = NULL, indices_to = NULL)`: Turn each element of a list-column into a row.

```
starwars |>
  select(name, films) |>
  unnest_longer(films)
```

- `unnest_wider(data, col)`: Turn each element of a list-column into a regular column.

```
starwars |>
  select(name, films) |>
  unnest_wider(films, names_sep = "_")
```

- `hoist(.data, .col, ..., remove = TRUE)`: Selectively pull list components out into their own top-level columns. Uses `purrr::pluck()` syntax for selecting from lists.

```
starwars |>
  select(name, films) |>
  hoist(films, first_film = 1, second_film = 2)
```

Transform Nested Data

A vectorized function takes a vector, transforms each element in parallel, and returns a vector of the same length. By themselves vectorized functions cannot work with lists, such as list-columns.

- `dplyr::rowwise(.data, ...)`: Group data so that each row is one group, and within the groups, elements of list-columns appear directly (accessed with `[[`), not as lists of length one. **When you use rowwise(), dplyr functions will seem to apply functions to list-columns in a vectorized fashion.**

- Apply a function to a list-column and **create a new list-column.** In this example, `dim()` returns two values per row and so is wrapped with `list()` to tell `mutate()` to create a list-column.

```
n_storms |>
  rowwise() |>
```

```
  mutate(n = list(dim(data))) # dim() returns two values per row, wrap with list to tell mut
```

- Apply a function to a list-column and **create a regular column.** In this example, `nrow()` returns one integer per row.

```
n_storms |>
  rowwise() |>
  mutate(n = nrow(data)) # nrow() returns one integer per row
```

- Collapse **multiple list-columns** into a single list-column. In this example, `append()` returns a list for each row, so col type must be list.

```
starwars |>
  rowwise() |>
  mutate(transport = list(append(vehicles, starships))) # append() returns a list for each r
```

- Apply a function to **multiple list-columns.** In this example, `length()` returns one integer per row.

```
starwars |>
  rowwise() |>
  mutate(n_transports = length(c(vehicles, starships)))
  # length() returns one integer per row
```

- See **purrr** package for more list functions.

Learn more at tidyr.tidyverse.org.

Updated: 2024-05.

```
packageVersion("tidyr")
```

```
[1] '1.3.1'
```

```
packageVersion("tibble")
```

```
[1] '3.2.1'
```