Data Import

with readr, tibble, and tidyr

Cheat Sheet

R's **tidyverse** is built around **tidy data** stored in **tibbles**, an enhanced version of a data frame.

The front side of this sheet shows how to read text files into R with **readr**.

The reverse side shows how to create tibbles with **tibble** and to layout tidy data with **tidyr**.

Other types of data

Try one of the following packages to import other types of files

- **haven** - SPSS, Stata, and SAS files
- **readxl** - excel files (.xls and .xlsx)
- **DBI** - databases
- **jsonlite** - json
- **xml2** - XML
- **httr** - Web APIs
- **rvest** - HTML (Web Scraping)

Write functions

Save **x**, an R object, to **path**, a file path, with:

write_csv(x, path, na = "NA", append = FALSE, col_names = !append**)**
Tibble/df to comma delimited file.

write_delim(x, path, delim = " ", na = "NA", append = FALSE, col_names = !append**)**
Tibble/df to file with any delimiter.

write_excel_csv(x, path, na = "NA", append = FALSE, col_names = !append**)**
Tibble/df to a CSV for excel

write_file(x, path, append = FALSE**)**
String to file.

write_lines(x, path, na = "NA", append = FALSE**)**
String vector to file, one element per line.

write_rds(x, path, compress = c("none", "gz", "bz2", "xz"), ...**)**
Object to RDS file.

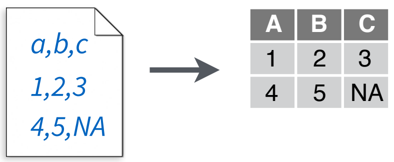
write_tsv(x, path, na = "NA", append = FALSE, col_names = !append**)**
Tibble/df to tab delimited files.

Read functions

Read tabular data to tibbles

These functions share the common arguments:

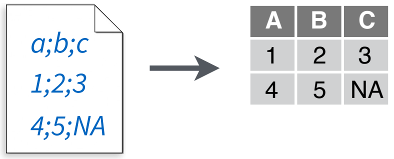
read_*(file, col_names = TRUE, col_types = NULL, locale = default_locale(), na = c("", "NA"), quoted_na = TRUE, comment = "", trim_ws = TRUE, skip = 0, n_max = Inf, guess_max = min(1000, n_max), progress = interactive()**)**



```
a,b,c
1,2,3
4,5,NA
```

A	B	C
1	2	3
4	5	NA

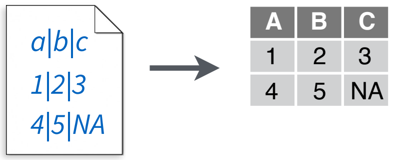
read_csv()
Reads comma delimited files.
read_csv("file.csv")



```
a;b;c
1;2;3
4;5;NA
```

A	B	C
1	2	3
4	5	NA

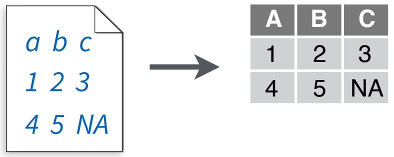
read_csv2()
Reads Semi-colon delimited files.
read_csv2("file2.csv")



```
a|b|c
1|2|3
4|5|NA
```

A	B	C
1	2	3
4	5	NA

read_delim(delim, quote = "\"", escape_backslash = FALSE, escape_double = TRUE**)** Reads files with any delimiter.
read_delim("file.txt", delim = "|")



```
a b c
1 2 3
4 5 NA
```

A	B	C
1	2	3
4	5	NA

read_fwf(col_positions**)**
Reads fixed width files.
read_fwf("file.fwf", col_positions = c(1, 3, 5))

read_tsv()
Reads tab delimited files. Also **read_table().**
read_tsv("file.tsv")

Useful arguments

```
a,b,c
1,2,3
4,5,NA
```

Example file
write_csv (path = "file.csv", x = read_csv("a,b,c\n1,2,3\n4,5,NA"))

A	B	C
1	2	3
4	5	NA

No header
*read_csv("file.csv", **col_names = FALSE**)*

x	y	z
A	B	C
1	2	3
4	5	NA

Provide header
*read_csv("file.csv", **col_names = c("x", "y", "z")**)*

1	2	3
4	5	NA

Skip lines
*read_csv("file.csv", **skip = 1**)*

A	B	C
1	2	3

Read in a subset
*read_csv("file.csv", **n_max = 1**)*

A	B	C
1	2	3
NA	NA	NA

Missing Values
*read_csv("file.csv", **na = c("4", "5", ".")**)*

Read non-tabular data

read_file(file, locale = default_locale()**)**
Read a file into a single string.

read_file_raw(file**)**
Read a file into a raw vector.

read_lines(file, skip = 0, n_max = -1L, locale = default_locale(), na = character(), progress = interactive()**)**
Read each line into its own string.

read_lines_raw(file, skip = 0, n_max = -1L, progress = interactive()**)**
Read each line into a raw vector.

read_log(file, col_names = FALSE, col_types = NULL, skip = 0, n_max = -1, progress = interactive()**)**
Apache style log files.

Parsing data types

readr functions guess the types of each column and convert types when appropriate (but will NOT convert strings to factors automatically).

A message shows the type of each column in the result.

```
## Parsed with column specification:
## cols(
##   age = col_integer(),
##   sex = col_character(),
##   earn = col_double()
## )
```

age is an integer

sex is a character

earn is a double (numeric)

1. Use **problems()** to diagnose problems
   x <- read_csv("file.csv"); problems(x)

2. Use a col_ function to guide parsing
   - **col_guess()** - the default
   - **col_character()**
   - **col_double()**
   - **col_euro_double()**
   - **col_datetime(**format = ""**)** Also **col_date(**format = ""**)** and **col_time(**format = ""**)**
   - **col_factor(**levels, ordered = FALSE**)**
   - **col_integer()**
   - **col_logical()**
   - **col_number()**
   - **col_numeric()**
   - **col_skip()**

   x <- read_csv("file.csv", col_types = cols(
   A = col_double(),
   B = col_logical(),
   C = col_factor()
   ))

3. Else, read in as character vectors then parse with a parse_ function.
   - **parse_guess(**x, na = c("", "NA"), locale = default_locale()**)**
   - **parse_character(**x, na = c("", "NA"), locale = default_locale()**)**
   - **parse_datetime(**x, format = "", na = c("", "NA"), locale = default_locale()**)** Also **parse_date()** and **parse_time()**
   - **parse_double(**x, na = c("", "NA"), locale = default_locale()**)**
   - **parse_factor(**x, levels, ordered = FALSE, na = c("", "NA"), locale = default_locale()**)**
   - **parse_integer(**x, na = c("", "NA"), locale = default_locale()**)**
   - **parse_logical(**x, na = c("", "NA"), locale = default_locale()**)**
   - **parse_number(**x, na = c("", "NA"), locale = default_locale()**)**

   x$A <- parse_number(x$A)

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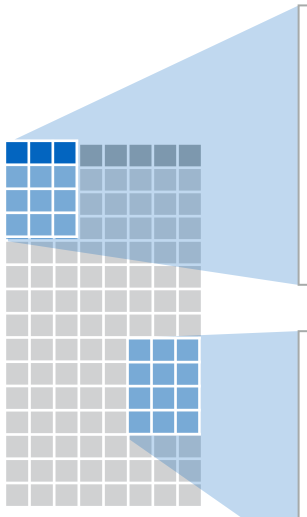
Learn more at browseVignettes(package = c("readr", "tibble", "tidyr")) • readr 1.1.0 • tibble 1.2.12 • tidyr 0.6.0 • Updated: 2017-01

Tibbles - an enhanced data frame

The **tibble** package provides a new S3 class for storing tabular data, the tibble. Tibbles inherit the data frame class, but improve two behaviors:

- **Display** - When you print a tibble, R provides a concise view of the data that fits on one screen.
- **Subsetting** - [always returns a new tibble, [[and $ always return a vector.
- **No partial matching** - You must use full column names when subsetting



```
# A tibble: 234 × 6
   manufacturer      model displ
          <chr>      <chr> <dbl>
1          audi         a4   1.8
2          audi         a4   1.8
3          audi         a4   2.0
4          audi         a4   2.0
5          audi         a4   2.8
6          audi         a4   2.8
7          audi         a4   3.1
8          audi a4 quattro   1.8
9          audi a4 quattro   1.8
10         audi a4 quattro   2.0
# ... with 224 more rows, and 3
#   more variables: year <int>,
#   cyl <int>, trans <chr>
```

tibble display

```
156 1999   6   auto(l4)
157 1999   6   auto(l4)
158 2008   6   auto(l4)
159 2008   8   auto(s4)
160 1999   4 manual(m5)
161 1999   4   auto(l4)
162 2008   4 manual(m5)
163 2008   4 manual(m5)
164 2008   4   auto(l4)
165 2008   4   auto(l4)
166 1999   4   auto(l4)
 [ reached getOption("max.print")
-- omitted 68 rows ]
```

A large table to display

data frame display

- Control the default appearance with options:

  options(tibble.print_max = n,
  tibble.print_min = m, tibble.width = Inf**)**

- View entire data set with **View(**x, title**)** or **glimpse(**x, width = NULL, …**)**
- Revert to data frame with **as.data.frame()** (required for some older packages)

Construct a tibble in two ways

tibble(…**)**
Construct by columns.
tibble(x = 1:3,
y = c("a", "b", "c"))

Both make this tibble

tribble(…**)**
Construct by rows.
tribble(
~x, ~y,
1, "a",
2, "b",
3, "c")

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

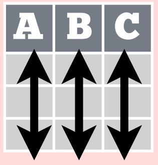
as_tibble(x, …**)** Convert data frame to tibble.

enframe(x, name = "name", value = "value"**)**
Converts named vector to a tibble with a names column and a values column.

is_tibble(x**)** Test whether x is a tibble.

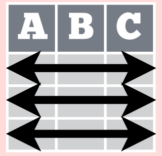
Tidy Data with tidyr

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



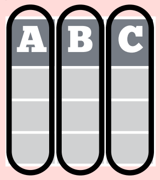
Each **variable** is in its own **column**

&

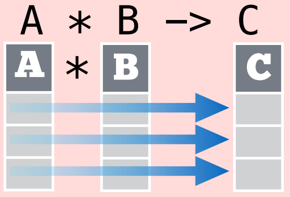


Each **observation**, or **case**, is in its own **row**

Tidy data:



Makes variables easy to access as vectors



Preserves cases during vectorized operations

Reshape Data - change the layout of values in a table

Use **gather()** and **spread()** to reorganize the values of a table into a new layout. Each uses the idea of a key column: value column pair.

gather(data, key, value, ..., na.rm = FALSE, convert = FALSE, factor_key = FALSE**)**

Gather moves column names into a key column, gathering the column values into a single value column.

table4a

country	1999	2000
A	0.7K	2K
B	37K	80K
C	212K	213K

→

country	year	cases
A	1999	0.7K
B	1999	37K
C	1999	212K
A	2000	2K
B	2000	80K
C	2000	213K

key value

gather(table4a, `1999`, `2000`, key = "year", value = "cases")

spread(data, key, value, fill = NA, convert = FALSE, drop = TRUE, sep = NULL**)**

Spread moves the unique values of a key column into the column names, spreading the values of a value column across the new columns that result.

table2

country	year	type	count
A	1999	cases	0.7K
A	1999	pop	19M
A	2000	cases	2K
A	2000	pop	20M
B	1999	cases	37K
B	1999	pop	172M
B	2000	cases	80K
B	2000	pop	174M
C	1999	cases	212K
C	1999	pop	1T
C	2000	cases	213K
C	2000	pop	1T

key value

→

country	year	cases	pop
A	1999	0.7K	19M
A	2000	2K	20M
B	1999	37K	172M
B	2000	80K	174M
C	1999	212K	1T
C	2000	213K	1T

spread(table2, type, count)

Handle Missing Values

drop_na(data, ...**)**
Drop rows containing NA's in … columns.

x

x1	x2
A	1
B	NA
C	NA
D	3
E	NA

→

x1	x2
A	1
D	3

drop_na(x, x2)

fill(data, ..., .direction = c("down", "up")**)**
Fill in NA's in … columns with most recent non-NA values.

x

x1	x2
A	1
B	NA
C	NA
D	3
E	NA

→

x1	x2
A	1
B	1
C	1
D	3
E	3

fill(x, x2)

replace_na(data, replace = list(), ...**)**
Replace NA's by column.

x

x1	x2
A	1
B	NA
C	NA
D	3
E	NA

→

x1	x2
A	1
B	2
C	2
D	3
E	2

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

Expand Tables - quickly create tables with combinations of values

complete(data, ..., fill = list()**)**
Adds to the data missing combinations of the values of the variables listed in …
complete(mtcars, cyl, gear, carb)

expand(data, ...**)**
Create new tibble with all possible combinations of the values of the variables listed in …
expand(mtcars, cyl, gear, carb)

Split and Combine Cells

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

separate(data, col, into, sep = "[^[:alnum:]]+", remove = TRUE, convert = FALSE, extra = "warn", fill = "warn", ...**)**

Separate each cell in a column to make several columns.

table3

country	year	rate
A	1999	0.7K/19M
A	2000	2K/20M
B	1999	37K/172M
B	2000	80K/174M
C	1999	212K/1T
C	2000	213K/1T

→

country	year	cases	pop
A	1999	0.7K	19M
A	2000	2K	20M
B	1999	37K	172
B	2000	80K	174
C	1999	212K	1T
C	2000	213K	1T

separate_rows(table3, rate, into = c("cases", "pop"))

separate_rows(data, ..., sep = "[^[:alnum:].]+", convert = FALSE**)**

Separate each cell in a column to make several rows. Also **separate_rows_()**.

table3

country	year	rate
A	1999	0.7K/19M
A	2000	2K/20M
B	1999	37K/172M
B	2000	80K/174M
C	1999	212K/1T
C	2000	213K/1T

→

country	year	rate
A	1999	0.7K
A	1999	19M
A	2000	2K
A	2000	20M
B	1999	37K
B	1999	172M
B	2000	80K
B	2000	174M
C	1999	212K
C	1999	1T
C	2000	213K
C	2000	1T

separate_rows(table3, rate)

unite(data, col, ..., sep = "_", remove = TRUE**)**

Collapse cells across several columns to make a single column.

table5

country	century	year
Afghan	19	99
Afghan	20	0
Brazil	19	99
Brazil	20	0
China	19	99
China	20	0

→

country	year
Afghan	1999
Afghan	2000
Brazil	1999
Brazil	2000
China	1999
China	2000

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

Learn more at browseVignettes(package = c("readr", "tibble", "tidyr")) • readr 1.1.0 • tibble 1.2.12 • tidyr 0.6.0 • Updated: 2017-01