String manipulation with stringr

stringr

apple	FALSE
banana	TRUE
pear	FALSE
persimmon	FALSE
kiwi	FALSE
mango	TRUE
orange	TRUE

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Syntax

'stringr' is an R package with functions that handle the most common string manipulations. It is build on top of another R package – 'stringi'.

Basic syntax:

str_*fname*(*string*,…)

All 'stringr' functions are vectorized.

Let's make a vector of strings:

```
fruits <- c("apple", "banana", "pear", "persimmon", "kiwi", "mango", "orange")
```

Basic functions

str_length() – number of characters in the string - same as nchar()

str_c() – combine two strings - like paste0()

str_c(*string*, sep="", collapse=NULL)

str_c(*string*, collapse=",") - collapse a vector of strings into a single string

str_dup() – duplicate a string

str_dup(*string*, times=2)

str_dup(*string*, c(2,1,3,2,1,2))

str_sub() – extracts substring (could be used to replace a substring)

str_sub(*string*, start, end)

str_sub(*string*, start, end) <- *value*

Let's try these on our vector of strings…

Exercises – basic functions

```
fruits <- c("apple", "banana", "pear","persimmon","kiwi", "mango","orange")
str_length(fruits)
str_dup(fruits, c(2,1,3,1,2))
list_fruits <- str_c(fruits, collapse=",")

fcolor <-c("red", "yellow","green","orange","green","reddish",NA)
str_c(fruits, fcolor, sep=", ")
paste(fruits, fcolor, sep=", ")

str_sub(fruits, 1, 3)
str_sub(list_fruits, 1, 3)
str_sub(list_fruits, 21, 29)
str_sub(list_fruits, 1, 3) <- ""
str_sub(fruits, 4, 4) <- "4"
```

Find more exercises on line at:

https://cran.r-project.org/web/packages/stringr/vignettes/stringr.html

whitespace

str_trim() – removes leading and/or trailing whitespace

str_trim(*string*, side=c("both","left","right"))

str_pad() – pads string with extra whitespace either to the left, right or both sides

str_pad(*string*, width ,side=c("both","left","right"), pad=" ")

str_trunc() – truncate a string to a specified width

str_trunc(*string*, width, side=c("both","left","right"), ellipsis="…")

Exercises – whitespace functions

Pad and then trim:

```
fruits <- c("apple", "banana", "pear","persimmon","kiwi","mango","orange")
fruits3 <- str_pad(fruits, 10, "both")

str_trim(fruits3)
str_trim(fruits3, "left")

str_trunc(fruits, 5, ellipsis="..")
```

Find more exercises on line at:

https://cran.r-project.org/web/packages/stringr/vignettes/stringr.html

Functions for case conversion

str_to_upper() - makes all letters upper case

str_to_lower() - makes all letters lower case

str_to_title() - capitalizes first letter of each word

Exercises – case conversion functions

```
str_to_upper(fruits)
greetings <- c("HI", "BYE", "GOOD MORNING", "GOOD EVENING")
str_to_lower(greetings)
str_to_title(greetings)
```

Find more exercises on line at:

https://r4ds.had.co.nz/strings.html

Order functions

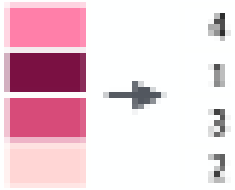
str_order() - returns the indexes of the sorted vector

str_order(*string*, decreasing=FALSE, locale= “en”, na.last=TRUE)

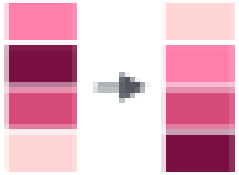
str_sort() - sorts a character vector

str_sort(*string*, decreasing=FALSE, locale= “en”, na.last=TRUE)

order:



sort:



Note: The above ‘stringr’ functions are locale-sensitive – depending on your locale you may get slightly different results.

Exercises – order and sort functions

Sort (and order) the fruits alphabetically:

```
str_order(fruits)
str_sort(fruits)
```

Example of different sorting:

```
str_sort(letters, locale="haw")
```

Find the stringr cheat sheet on line at:
https://www.rdocumentation.org/packages/stringr/versions/1.3.1

Detailed explanation on the above functions can be found here:
https://rdrr.io/cran/stringr/man/str_order.html

Functions for pattern search

str_detect() – detect a pattern (based on grepl) – returns T/F

str_count() – count the number of matches

str_locate() – finds the start and end positions of **the first match** of the pattern in the string - returns a matrix

str_locate_all() – finds the start and end positions of **all matches** of the pattern in the string - returns a list

stringr

apple	0
banana	2
pear	0
persimmon	0
kiwi	0
mango	1
orange	1

Each pattern matching function has the same first two arguments – a character vector of strings to process and a single pattern (regex) to match.

Special characters in regular expressions: **. \ | ( ) [{ ^ $ * + ?** .

Exercises - functions for pattern search

Find the fruits that start with the letter ‘p’:

```
str_detect(fruits,"^p")
```

Find the fruits that don’t start with the letter p:

```
str_detect(fruits,"^[^p]")
```

Find the fruits that don’t contain the letter p:

```
str_detect(fruits,"^[^p]([^p])*[^p]$")
```

Find the number of times ‘an’ appears in each fruit name:

```
str_count(fruits, "an")
```

Find the position of the first match (or all matches) of ‘an’ in each fruit name:

```
str_locate(fruits, "an")
str_locate_all(fruits, "an")
```

Find more exercises on line at:

http://dept.stat.lsa.umich.edu/~jerrick/courses/stat701/notes/stringmanip.html

Exercises - functions for pattern search

Let's look at the school address data and see if each address has a state (two capital letters) and a zip code (five digits).

First read in the data:

```
schools<-read.csv(file="sch_3citiesSTall.csv", header=T, as.is=T)
head(schools)

state_zip <- "[A-Z]{2} [0-9]{5}"
st_z1 <- str_detect(schools$adr,state_zip)
summary(st_z1)
```

Let's try one more pattern – with two spaces between state and zip:

```
state_zip2 <- "[A-Z]{2}  [0-9]{5}"
st_z2 <- str_detect(schools$adr,state_zip2)
summary(st_z2)
```

Let's find the location of the first occurrence in each address of the first pattern preceded by a city:

```
csz <- "[A-Z][a-z]+_ [A-Z]{2} [0-9]{5}"
st_z <- str_locate(schools$adr,csz)
```

Let's see if each school address has only one state, then only one zip code…

Functions for pattern matching

str_extract()	– extracts the text of the first match, returns a vector
str_extract_all()	– extracts the text of the all matches, returns a list
str_match()	– returns the first match in each string, as a matrix with a column for each () group
str_match_all()	– returns all matches as a list (of matrices)
str_subset()	– returns only the strings that that contain the pattern

Each pattern matching function has the same first two arguments – a character vector of strings to process and a single pattern (regex) to match.

Exercises - functions for pattern matching

Let's extract from each address the city, state and zip (two spaces between state and zip):

```
csz <- "[A-Z][a-z]+_ [A-Z]{2}  [0-9]{5}"
adr_end <- str_extract(schools$adr,csz)
head(adr_end)

adr_end2 <- str_match(schools$adr,csz)
head(adr_end2)
```

Extract city, state and zip using groups (compare to the result above):

```
csz_g <- "([A-Z][a-z]+_) ([A-Z]{2})  ([0-9]{5})"
adr_end3 <- str_match(schools$adr,csz_g)
head(adr_end3)
```

Find all of the schools in Maine:

```
schools_ME <- str_subset(dtA$adr, "ME  [0-9]{5}")
```

Find more exercises on line at:

http://dept.stat.lsa.umich.edu/~jerrick/courses/stat701/notes/stringmanip.html

Functions – replace and split

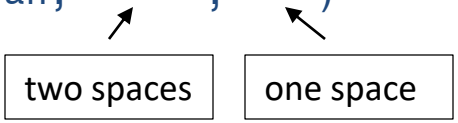
str_replace()	– replaces the first matched pattern
str_replace_all()	– replaces all instances of the matched pattern
str_split()	– splits the string based in a pattern and returns a list
str_split_fixed()	– splits the string based on a pattern and returns a matrix
str_split(…, simplify=TRUE)	– splits the string based on a pattern and returns a matrix

One more useful function: str_replace_na(*string*) – converts NA to "NA" (so you don't lose data when using other stringr functions.

Exercises - functions for replace and split

Let's clean up the addresses – remove first instance of city, state and zip (one space between city_ and state, and between state and zip):

```
csz <- "[A-Z][a-z]+_ [A-Z]{2}  [0-9]{5}"
adr_clean <- str_replace(schools$adr,  csz,"")
adr_clean <- str_replace(adr_clean, "  +", " ")
```



Extract city, state and zip into separate columns:

```
school_csz <- str_split_fixed(str_extract(adr_clean, csz)," ", n=3)
```

This should give the same result as above:

```
school_csz2 <- str_split(str_extract(adr_clean, csz)," ", simplify=TRUE)
```

More exercises

Find the addresses of the schools in NY state.

Find all schools that are only for grades 9-12 (note: use column 'grade'):

```
gr912 <- schools[str_detect(schools$grade,"9-12")==TRUE,]
```

Find all schools that are for grades K-12.

Split each line of the file "yob_notes.csv" (from the REGEX presentation) into columns:

```
names <- str_split(as.character(notes), ",", simplify=TRUE)
```