Probability - Tidyverse 2

Reducing duplication - writing functions and introducton to purrr

Introduction to Quantitative Social Science

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Today's Game Plan

1. reducing duplication: **functions**
2. `purrr` package

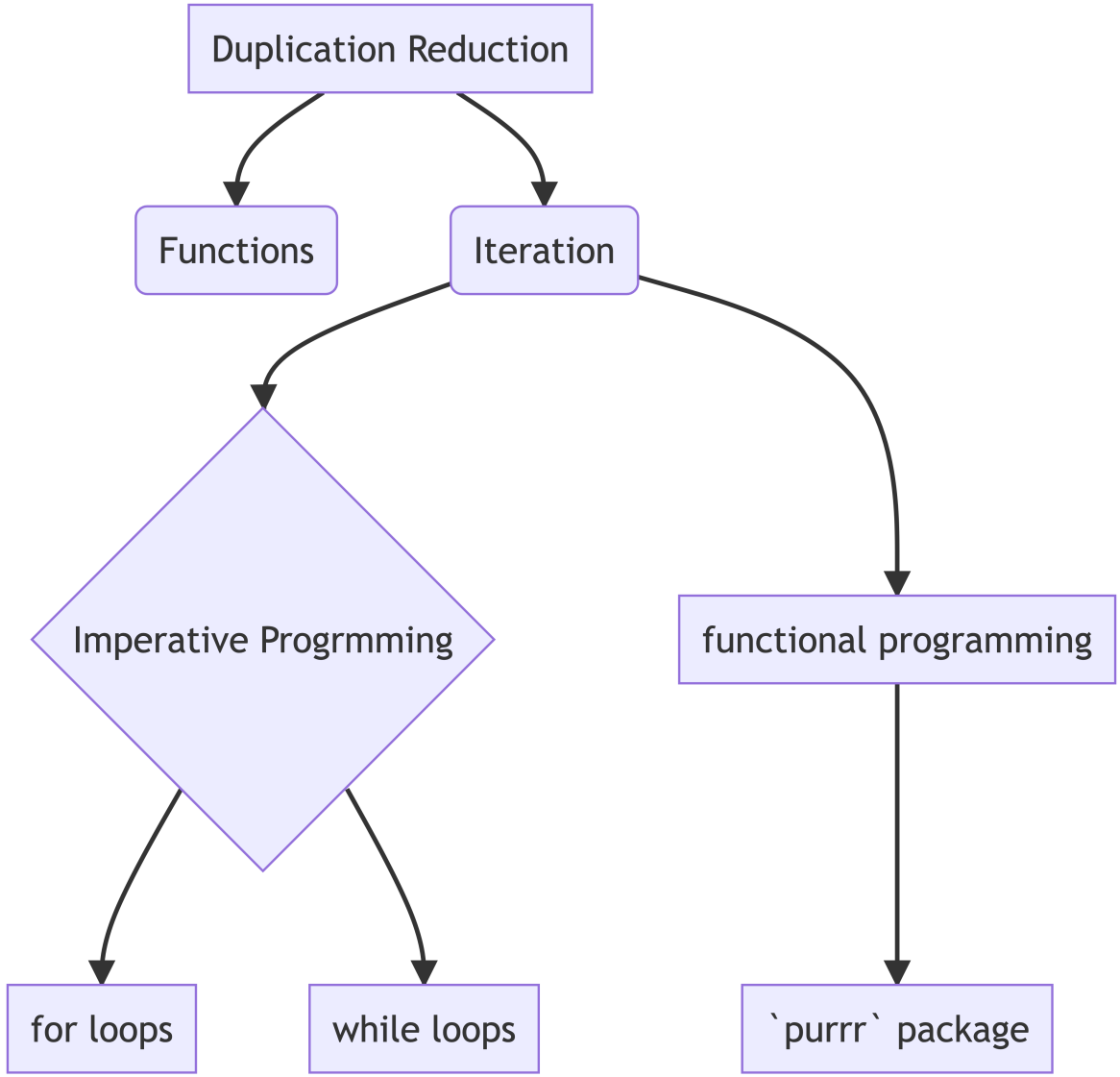
- `purrr`: `map_df()` (introduced in Chapter 6: Probability (sections 6.3-6.4))

> Today's in-class assignment: `intrade-prob`

Section 1

Functions

Landscape of Duplication Reduction in R



Why writing functions?

What does this code chunk do?

```
df$a <- (df$a - min(df$a, na.rm = TRUE)) /
  (max(df$a, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$b <- (df$b - min(df$b, na.rm = TRUE)) /
  (max(df$b, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$c <- (df$c - min(df$c, na.rm = TRUE)) /
  (max(df$c, na.rm = TRUE) - min(df$c, na.rm = TRUE))
df$d <- (df$d - min(df$d, na.rm = TRUE)) /
  (max(df$d, na.rm = TRUE) - min(df$d, na.rm = TRUE))
```

Why writing functions?

- re-scaling each column to have a range from 0 - 1

```
df$a <- (df$a - min(df$a, na.rm = TRUE)) /
  (max(df$a, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$b <- (df$b - min(df$b, na.rm = TRUE)) /
  (max(df$b, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$c <- (df$c - min(df$c, na.rm = TRUE)) /
  (max(df$c, na.rm = TRUE) - min(df$c, na.rm = TRUE))
df$d <- (df$d - min(df$d, na.rm = TRUE)) /
  (max(df$d, na.rm = TRUE) - min(df$d, na.rm = TRUE))
```

Why writing functions?

- re-scaling each column to have a range from 0 - 1
- **But there is a mistake!!**

```
df$a <- (df$a - min(df$a, na.rm = TRUE)) /
  (max(df$a, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$b <- (df$b - min(df$b, na.rm = TRUE)) /
  (max(df$b, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$c <- (df$c - min(df$c, na.rm = TRUE)) /
  (max(df$c, na.rm = TRUE) - min(df$c, na.rm = TRUE))
df$d <- (df$d - min(df$d, na.rm = TRUE)) /
  (max(df$d, na.rm = TRUE) - min(df$d, na.rm = TRUE))
```

Why writing functions?

- re-scaling each column to have a range from 0 - 1
- **But there is a mistake!!**
  - `df$b`: **did not change `a` to `b`**

```
df$a <- (df$a - min(df$a, na.rm = TRUE)) /
  (max(df$a, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$b <- (df$b - min(df$b, na.rm = TRUE)) /
  (max(df$b, na.rm = TRUE) - min(df$a, na.rm = TRUE))
df$c <- (df$c - min(df$c, na.rm = TRUE)) /
  (max(df$c, na.rm = TRUE) - min(df$c, na.rm = TRUE))
df$d <- (df$d - min(df$d, na.rm = TRUE)) /
  (max(df$d, na.rm = TRUE) - min(df$d, na.rm = TRUE))
```

What if we have a function?

```
df$a <- rescale01(df$a)
df$b <- rescale01(df$b)
df$c <- rescale01(df$c)
df$d <- rescale01(df$d)
```

Advantages of functions over copy-paste

1. easier to see the intent of your code: eyes on **difference** not **similarity**
2. easier to respond to changes in requirements
3. fewer bugs (i.e. updating a variable name in one place, but not in another).

You should consider writing a function whenever you've copied and pasted a block of code more than twice (i.e. you now have three copies of the same code).

3 key steps to create a function

1. pick a name for the function

```
square
```

3 key steps to create a function

1. pick a name for the function
2. list the inputs, or arguments, to the function inside function

```
square <- function(x) {}
```

3 key steps to create a function

1. pick a name for the function
2. list the inputs, or arguments, to the function inside function
3. place the code you have developed in body of the function

It's easier to start with working code and turn it into a function; it's harder to create a function and then try to make it work

```
square <- function(x) {
  x^2
}

square(13)
```

```
[1] 169
```

Function arguments

- `data` arguments: supplies the data to compute on
- `details` arguments: supplies arguments that control the details of the computation
- `lm()` as an example

`View()` allows you to check the source code of a function

```
function (formula, data, subset, weights, na.action, method =
  model = TRUE, x = FALSE, y = FALSE, qr = TRUE, singular.ok =
  contrasts = NULL, offset, ...)
{ ...
  ...
  ...
}
```

Conditional execution

- an `if` statement allows you to conditionally execute code

```
if (condition) {
  # code executed when condition is TRUE
} else {
  # code executed when condition is FALSE
}
```

Multiple conditions

- chain multiple `if` statements together

```
if (condition 1) {
  # do this if TRUE
} else if (condition 2) {
  # do that if TRUE
} else {
  # do something else if FALSE
}
```

Good practices

Functions are for humans and computers

- `if` and `function` should always be followed by `{}`
  - `{`: never go on its own line
  - `}`: always go on its own line (unless followed by `else`)

```
# Good
if (y == 0) {
  log(x)
} else {
  y ^ x
}
```

```
# Bad
if (y == 0) {
  log(x)
} # with else in this case
else {
  y ^ x
}
```

Good practices

Functions are for humans and computers

- function names: `verbs`
- argument names: `nouns`
- use inline code to explain the "why"
  - avoid the "what" or "how"

```
# Good
input_select()
input_checkbox()
```

```
# Bad
f()
my_awesome_function()
```

Section 2

Brief introduction to purrr

Overview

Figure 1: `purrr`

- R as a functional programming (FP) language
- `purrr` provides complete and consistent tools for working with **functions** and different data types (**vectors**) $\rightarrow$ enhances R's efficiency
  - the family of `map()` function $\rightarrow$ replace many for loops with succinct code

> `purrr` **cheatsheet**

purrr package: map_df()

- transforms the input by applying a function to each variable of a `data frame` or `tibble` (**each element of a list** or **atomic vector**)
- returns a `data frame/tibble`
- arguments
  - `.x` = a `data frame/tibble` (list or atomic vector)
  - `.f` = a function

```
map_df(.x, .f)
```

purrr package: map_df()

Example 1

```
map_df(FLVoters, class)
```

```
# A tibble: 1 x 6
  surname   county  VTD     age     gender    race
  <chr>     <chr>   <chr>   <chr>   <chr>     <chr>
1 character integer integer integer character character
```

```
class(FLVoters)
```

```
[1] "data.frame"
```

purrr package: map_df()

Example 2

```
FLVoters %>%
  map(unique) %>%
  map_df(length)
```

```
# A tibble: 1 x 6
  surname county   VTD   age gender  race
    <int>  <int> <int> <int>  <int> <int>
1    6240     67  1053    82      3     7
```

Summary

What we learnt

- how to write functions
  - how to communicate functions by following good practices
- `purrr` (`map_df()`)

Future Game Plan

- data types in R: `vector`
- reducing duplication: **iteration**
- new functions in **Chapter 7: Uncertainty**

Source

- Quantitative Social Science: An Introduction in tidyverse
- R for Data Sciene
- Advanced R