Uncertainty - Tidyverse lecture 2

For loop and functionals

Introduction to Quantitative Social Science

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Today's Game Plan

1. reducing duplication: **iteration**

- writing a for loop
- for loop v.s. functionals

> ℹ Today's in-class assignment: `file-drawer`

Section 1

Iteration: for loop

Recap: why to avoid copy-paste?

Motivations?

```
mean(FLVoters$county)
mean(FLVoters$age)
mean(FLVoters$VTD)
median(FLVoters$county)
median(FLVoters$age)
median(FLVoters$VTD)
sd(FLVoters$county)
sd(FLVoters$age)
sd(FLVoters$VTD)
```

1. eyes on **difference** not similarity

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2. easier to **respond to changes** in requirements

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2. easier to **respond to changes** in requirements
3. **fewer bugs**

Landscape of Duplication Reduction in R

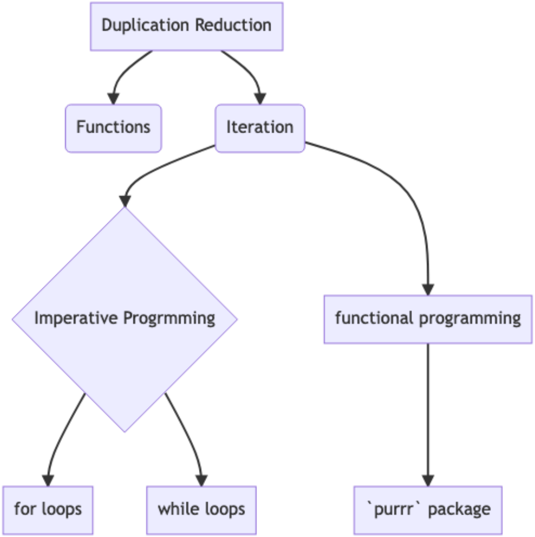


Figure 1: `Duplication reduction in R`

For loops: a motivating example

Compute the mean of each numeric variable in `FLVoters`

```
mean(FLVoters$VTD)
```

```
[1] 234.725
```

```
mean(FLVoters$age)
```

```
[1] 52.42522
```

```
mean(FLVoters$county)
```

```
[1] 70.41479
```

Compute the mean of each numeric variable in FLVoters

```
FLVoters  <- FLVoters %>%
  select(where(is.numeric)) # keep numeric

output <- rep(NA, length(FLVoters))          # 1. output
for (i in seq_along(FLVoters)) {             # 2. sequence
  output[[i]] <- mean(FLVoters[[i]])         # 3. body
}
output
```

```
[1]  70.41479 234.72501  52.42522
```

3 components for every for loop: 1

1. The **output**: create a empty vector as container beforehand
   - `rep(NA, length)`
   - `vector(type, length)`

```r
output <- rep(NA, length(FLVoters)) # 1. output
```

```r
# alternatively
output <- vector("double", length(FLVoters))
```

3 components for every for loop: 2

2. The **sequence**: what to loop over
   - each run `i` is assigned a different value from `seq_along(df)`
   - `i` as **it**

```
seq_along(FLVoters)
```

```
[1] 1 2 3
```

```
for (i in seq_along(FLVoters)) {}        # 2. sequence
```

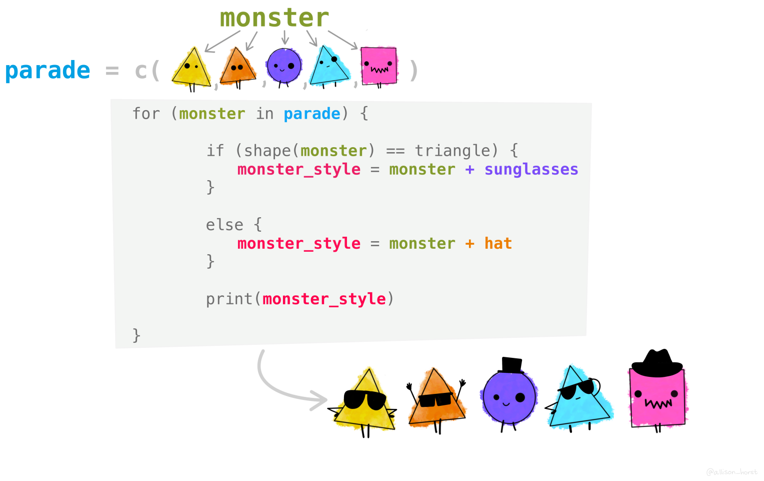
3 components for every for loop: 3

3. The **body**: code that run repeatedly, each time with a different `i`

```
for (i in seq_along(FLVoters)) {
  output[[i]] <- mean(FLVoters[[i]])          # 3. body
}
```

- `output[[1]] <- mean(FLVoters[[1]])`
- `output[[2]] <- mean(FLVoters[[2]])`
- ...

Subsetting R objects: `[]`, `[[]]`, `$` (**link**)



```
for (monster in parade) {

        if (shape(monster) == triangle) {
            monster_style = monster + sunglasses
        }

        else {
            monster_style = monster + hat
        }

        print(monster_style)

}
```

Figure 2: Monster for loop

For loops v.s. functionals

- R as functional programming language: one can **wrap for loops in a function**, and call that function instead

Figure 3: `For loops in R`

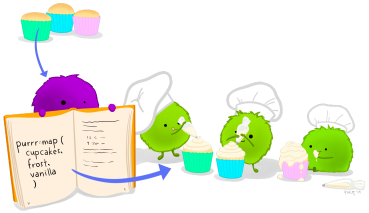


Figure 4: `Functionals in R`

For loops v.s. functionals

Consider a simple motivating example

- **compute the mean of every numeric variable (every column)**

```
output <- rep(NA, length(FLVoters))             # 1. output
for (i in seq_along(FLVoters)) {                # 2. sequence
  output[[i]] <- mean(FLVoters[[i]])            # 3. body
}
output
```

For loops v.s. functionals

Since we do this so frequently, how about **extracting it into a function**?

```
col_mean <- function(df) {
  output <- rep(NA, length(df))
  for (i in seq_along(df)) {
    output[[i]] <- mean(df[[i]])
  }
  output
}

col_mean(FLVoters)
```

```
[1]  70.41479 234.72501  52.42522
```

For loops v.s. functionals

But wait, surely **median**, **standard deviation** matter too!

For loops v.s. functionals

```
col_median <- function(df) {
  output <- rep(NA, length(df))
  for (i in seq_along(df)) {
    output[[i]] <- median(df[[i]])
  }
  output
}
```

```
col_sd <- function(df) {
  output <- rep(NA, length(df))
  for (i in seq_along(df)) {
    output[[i]] <- sd(df[[i]])
  }
  output
}
```

Side effects: hard to see the difference; bug → **generalize**

Generalizing for loops by writing functions

Add an argument to supply different functions to each column

- create a `col_summary()` with `df` and `fn` arguments

```r
col_summary <- function(df, fn) {
  out <- rep(NA, length(df))
  for (i in seq_along(df)) {
    out[[i]] <- fn(df[[i]])
  }
  out
}

col_summary(FLVoters, median)
```

```
[1]  86 121  53
```

```r
col_summary(FLVoters, sd)
```

```
[1]  37.19531 281.61961  18.48903
```

Summary

What we learnt

- iteration
  - for loop
  - generalize for loop with functionals (`purrr`)

Final Game Plan

- iteration: **for loop variations**
- tidyverse wrap-up
- new functions in **chapter 7: Uncertainty (7.3)**

Reference

- R for Data Science
- Artwork by @allison_horst