R programming basics: coding etiquette

Ecological Systems Modeling

Jan 22-26, 2024

Active participation (optional)

- Open RStudio in Jupyter Hub
- In the Files/Plots/etc. pane, navigate to: `$HOME/Labs/Intro_R_part3/`
- Click on `Intro_to_R_part3_codingEtiquette.rmd`
- File should open in the Source pane
- Run the code chunks, add to chunks, or type code in Console

Learning objectives

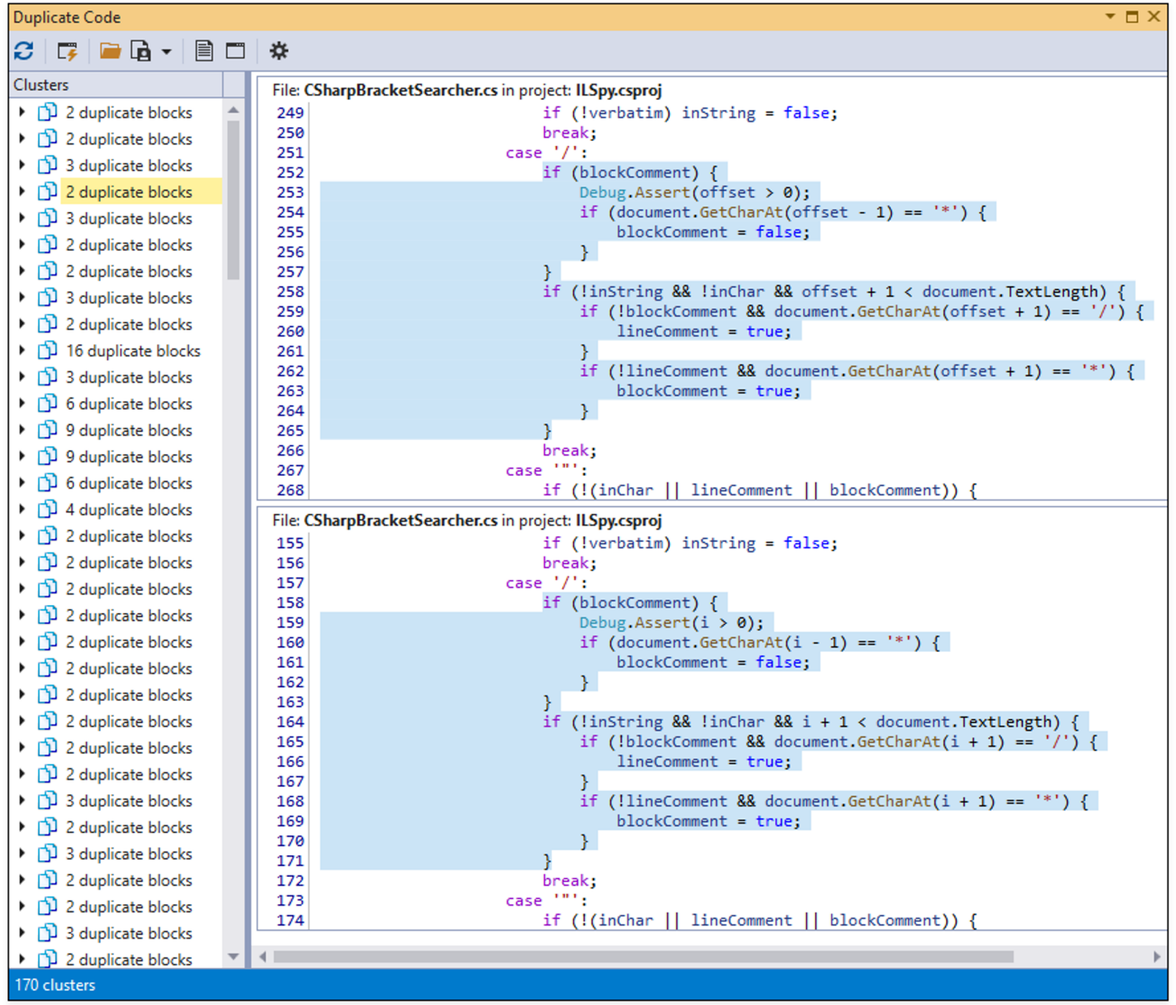
- Describe several types of best coding practices
- Apply this knowledge in your code for this course
  - Lab assignments
  - Class project

Overview: best coding practices

1. Abide by the DRY (Don’t Repeat Yourself) principle
2. Follow some easy-to-remember naming convention
3. Keep the code as straightforward as possible
4. Limit the length of a line of code
5. Use comments frequently
6. Use consistent indentation
7. Whenever and wherever possible, avoid deep nesting

1. DRY: Don’t Repeat Yourself

- Don’t write the same code repeatedly
- Example shows duplicate C# code
- Instead, write and re-use functions (more on this later)



2. Easy-to-remember naming convention

- Use descriptive and succinct names for all objects
- Good: Underscores (“_”), periods (“.”), or combo of upper and lower case
- Avoid: Uninformative names
- Fail: Spaces and certain symbols such as “/”

Good name	Good alternative	Avoid or fail
Max_temp_C	MaxTemp	Maximum Temp (°C)
Precipitation_mm	Precipitation	precmm
Mean_year_growth	MeanYearGrowth	Mean growth/year
sex	sex	M/F
weight	weight	w.
cell_type	CellType	Cell type
Observation_01	first_observation	1st Obs.

3. Straightforward and succint code

- Nobody want to read messy code, including your future self
- Would you want to look at this?

```r
# Not-so-good
for (i in 1:nrow(df <- data.frame(x=c(1, 2, 3, 4)))) { print(df[i,])}
  lst = list(data.frame(y=c(6, 7, 8, 9, 10), z = c(2,2,2,2,2)),
             m = matrix(5,5, nrow=5))

# Better
df <- data.frame(x = c(1:4))
for (i in 1:nrow(df)) {
  print(df[i,])
}
df2 <- data.frame(y = c(6, 7, 8, 9, 10), z = c(rep(2, 5)))
mat <- matrix(5, 5, nrow = 5)
lst <- list(df2, mat)
```

3. Straightforward and succint code

- Use multiple lines to create new objects, etc.
- Reduce text using operators and functions (e.g., `:` and `rep()`)

```r
# Not-so-good
for (i in 1:nrow(df <- data.frame(x=c(1,2,3,4)))) { print(df[i,])}
  lst = list(data.frame(y=c(6,7,8,9,10), z = c(2,2,2,2,2)),
             m = matrix(5,5, nrow=5))

# Better
df <- data.frame(x = c(1:4))
for (i in 1:nrow(df)) {
  print(df[i,])
}
df2 <- data.frame(y = c(6:10), z = c(rep(2, 5)))
mat <- matrix(5, 5, nrow = 5)
lst <- list(df2, mat)
```

4. Limit the length of a line of code

- Again, short lines of code are easier to read and understand

```r
# Not-so-good
for (i in 1:nrow(df <- data.frame(x=c(1,2,3,4)))) { print(df[i,])}
  lst = list(data.frame(y=c(6,7,8,9,10), z = c(2,2,2,2,2)),
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# Better
df <- data.frame(x = c(1:4))
for (i in 1:nrow(df)) {
  print(df[i,])
}
df2 <- data.frame(y = c(6:10), z = c(rep(2, 5)))
mat <- matrix(5, 5, nrow = 5)
lst <- list(df2, mat)
```

5. Use comments frequently

- Allows for explanations, instructions, etc. for analyses
- Your future self and others who review your code will thank you
- Especially important if code is in a script (rather than R Markdown)

```
# This is a script for degree-day modeling
# Author: Brittany Barker
# Last updated: Jan 13, 2024
library(here) # Useful for project-relevant paths

# Lower developmental threshold (base 50F)
LDT50 <- 50

# Create an empty data frame to store results
out_all <- data.frame(matrix(ncol = 4, nrow = 0))

# Etc, etc.
```

6. Use consistent indentation

- Use tabs, not spaces
- Helps keep track of nested code blocks
- RStudio will auto-indent!

```
# Notice the 4 levels of indentation
years <- 2022:2023
days <- 1:3
# Loop through each year in `years`
for (year in years) {
  if (year %% 2 == 0) {
    # Next loop through each day
    for (day in days) {
      msg <- paste("Day", day, "in", year)
      print(msg)
    }
  }
}
```

7. Avoid deep nesting

- Keep control structures short
- Easier to trouble-shoot when code breaks
- Increases readability and helps avoid unwanted results
- Pyramid Of Doom: an unwieldy number of nested conditional statements or functions

```php
<?php

// Bad

$cats = [];

foreach ($taxonomy['Kingdoms'] as $kingdom) {
    if ($kingdom['Name'] === 'Animalia') {
        foreach ($kingdom['Phyla'] as $phylum) {
            if ($phylum['Name'] === 'Chordata') {
                foreach ($phylum['Classes'] as $class) {
                    if ($class['Name'] === 'Mammalia') {
                        foreach ($class['Orders'] as $order) {
                            if ($order['Name'] === 'Carnivora') {
                                foreach ($order['Families'] as $family) {
                                    if ($family['Name'] === 'Felidae') {
                                        foreach ($family['Genera'] as $genus) {
                                            if ($genus['Name'] === 'Felis') {
                                                foreach ($genus['Species'] as $species) {
                                                    if ($species['Name'] === 'F. catus') {
                                                        // Found a cat! Add it to our $cats array
                                                        $cats[] = $animal;
                                                    }
                                                }
                                            }
                                        }
                                    }
                                }
                            }
                        }
                    }
                }
            }
        }
    }
}
```