

WEEK 01

Instructor: Yanan Wu
TA: Nisar Khadija

Spring 2025



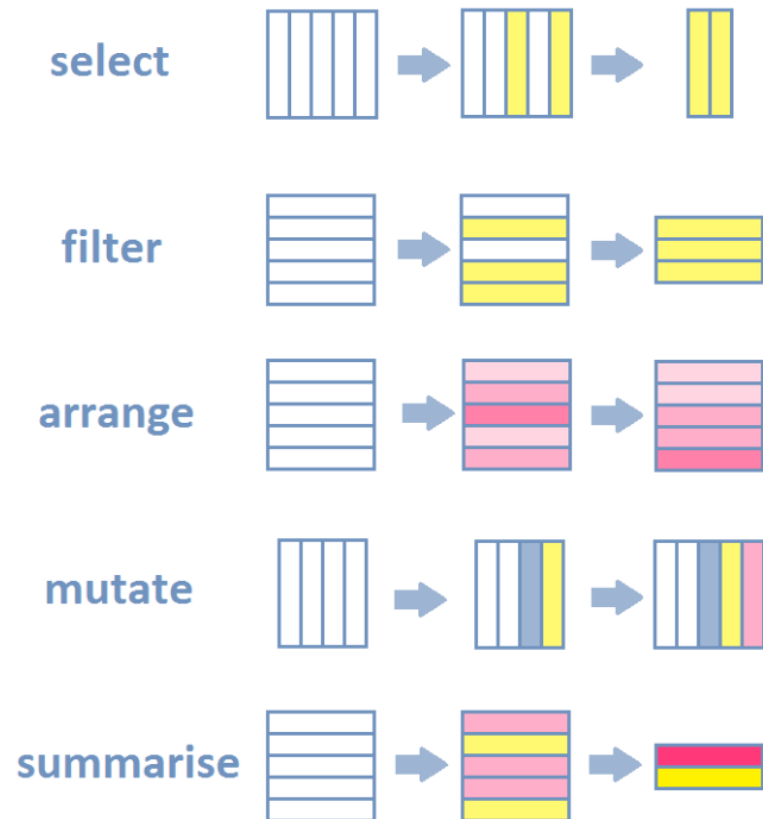
PREAMBLE

- A good online textbook, [Hands-on Programming with R](#), for R beginner.
- Explore the R project website: <https://www.r-project.org/>
- Explore R Studio: <https://posit.co/>

R-INTRODUCTION

- An online free learning source: [An Introduction to R](#)

Data Manipulation



Data Visualization

- Data Visualization Section in [R for Data Science](#)
- [Modern Data Visualization with R](#)

Interactive Applications

- [Shiny Gallery in R](#)

R - INTRODUCTION

Statistical Analysis

- Descriptive analysis (mean, median., etc)
- Regression analyses (linear, logistic, ect)
- Time series analysis (ARIMA, etc)
- Multivariate analysis (PCA, factor analysis)
- [A handbook of statistical analysis in R](#)

Geospatial Data Analysis

- Handle raster and vector data
- Analyze spatial data with sf, sp or raster



R - INTRODUCTION

Machine Learning

- Implement supervised learning (classification, regression).
- Apply unsupervised learning (clustering, dimensionality reduction).
- Perform deep learning with packages like keras or torch.
- Evaluate models using cross-validation and other metrics.

RSTUDIO – INTRODUCTION

- Open-source IDE (integrated development environment)



- Open-source IDE (integrated development environment)



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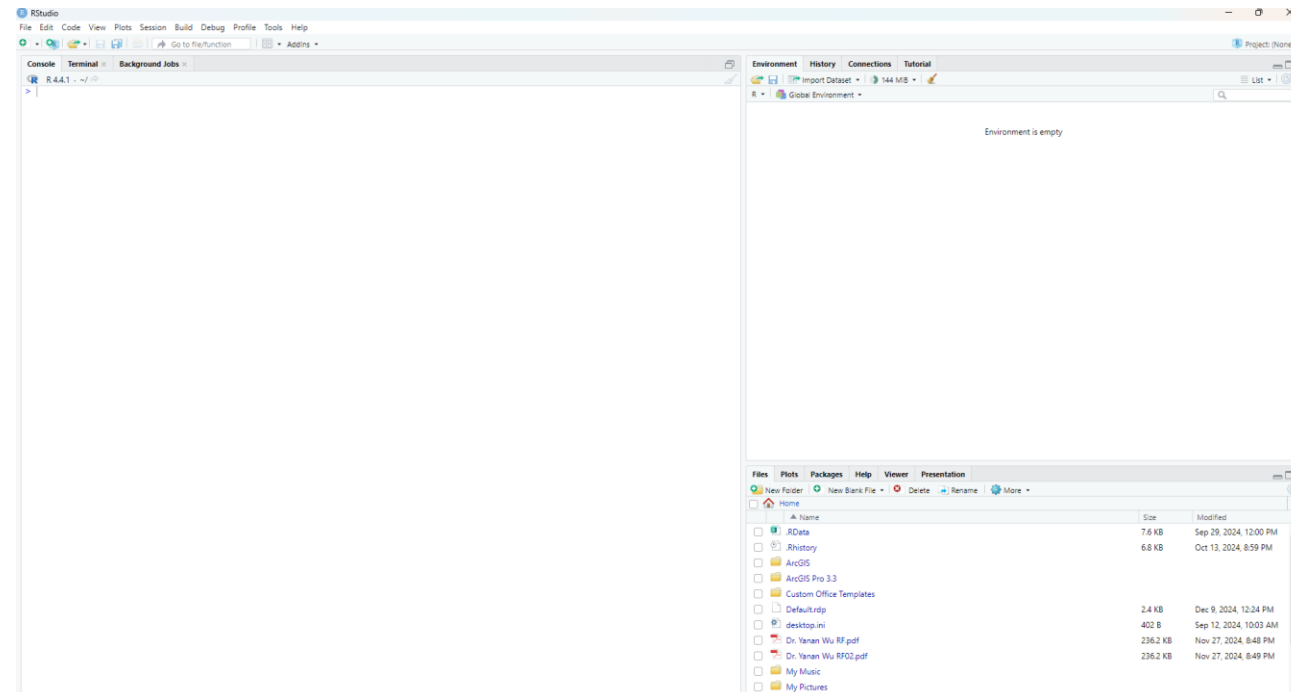
LAB SESSION

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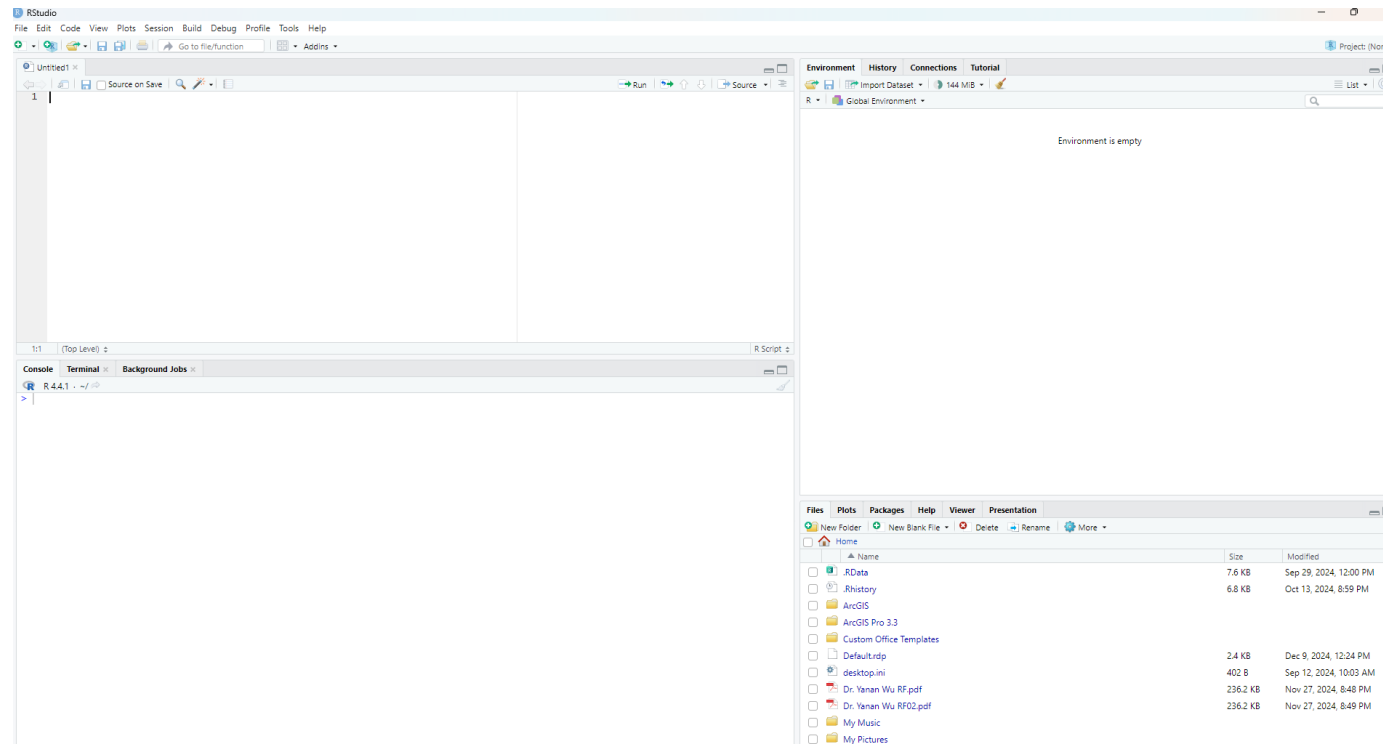
OVERVIEW OF RSTUDIO INTERFACE

- The panes
 - Left pane: R console
 - Right top pane: includes tabs such as *Environment* and *History*
 - *Right bottom pane: File, Plots, Packages, Help and Viewer*



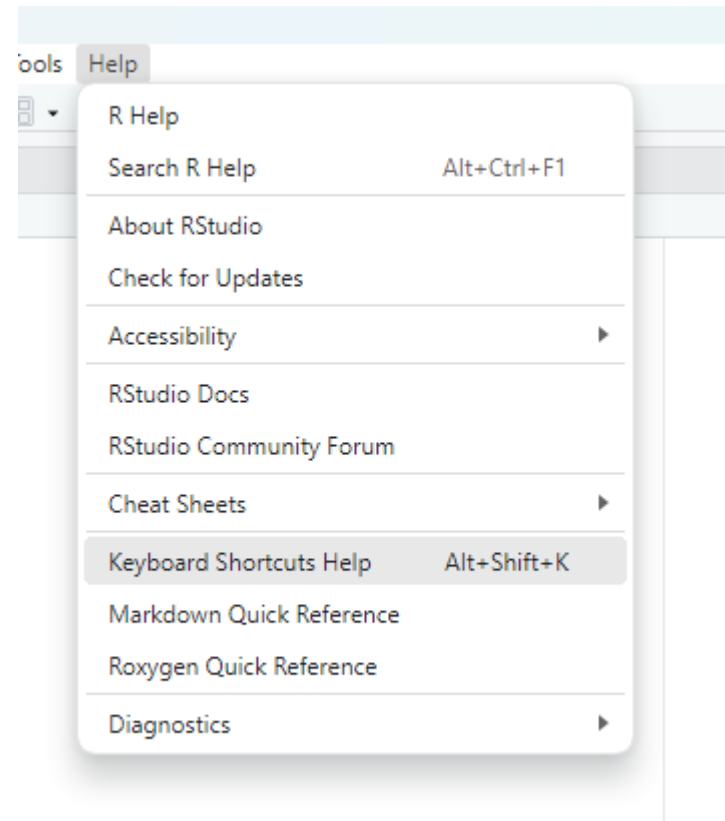
OVERVIEW OF RSTUDIO INTERFACE

- Starts a new pane on the left
 - File – New File – R Script



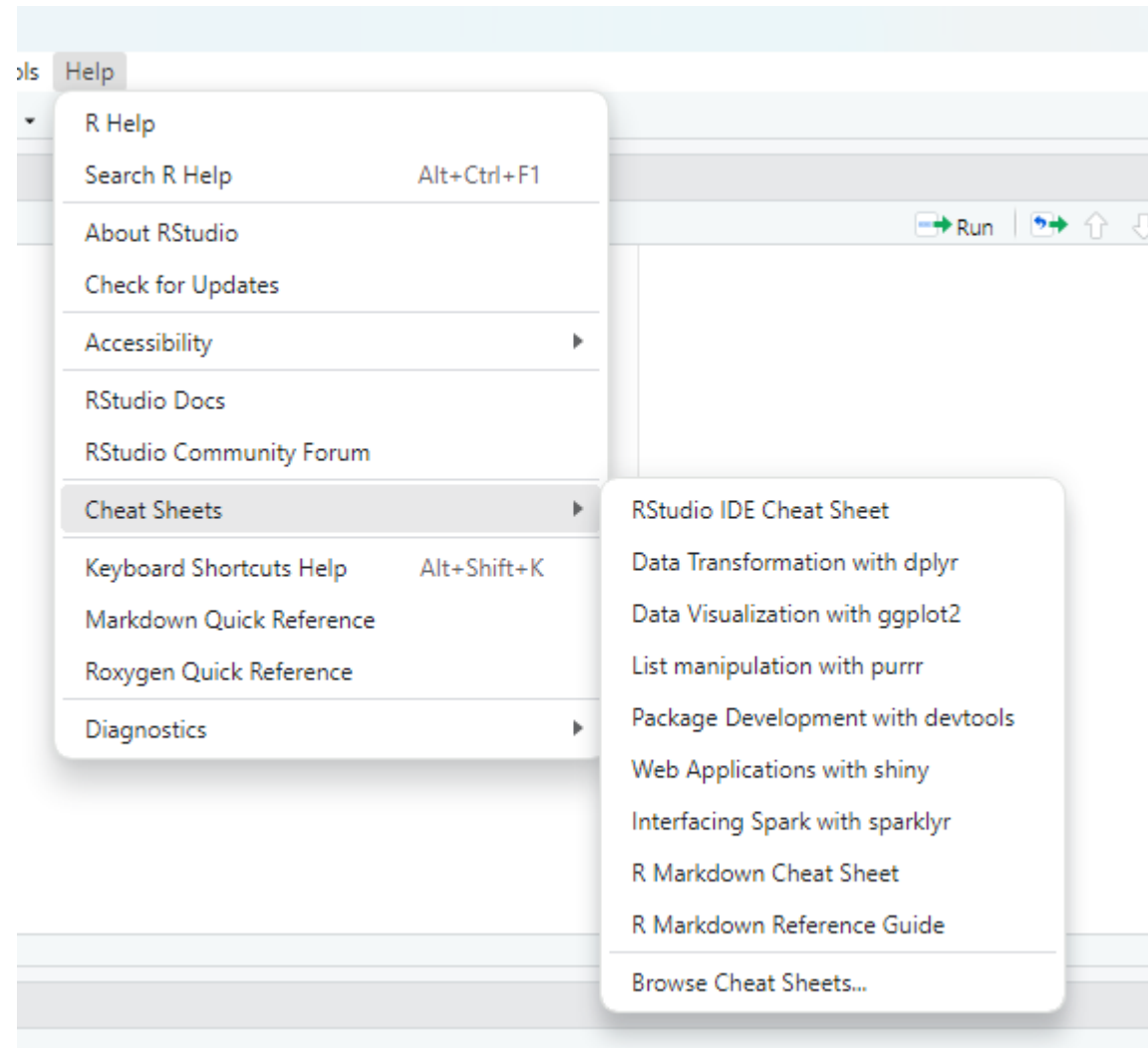
OVERVIEW OF KEYBOARD SHORTCUTS

- Keyboard shortcuts
 - Help – Keyboard Shortcuts Help



OVERVIEW OF CHEATSHEETS

- Cheatsheets in Rstudio
 - Help - Cheatsheets



GLOBAL SETTING

- .RData
 - Save your workspace, including variables, data frames, lists, and other objects
- Cons
 - Causing confusions especially when we share code with others and assume they have this .Rdata file
- Tools – Global Options
 - Change the setting as below

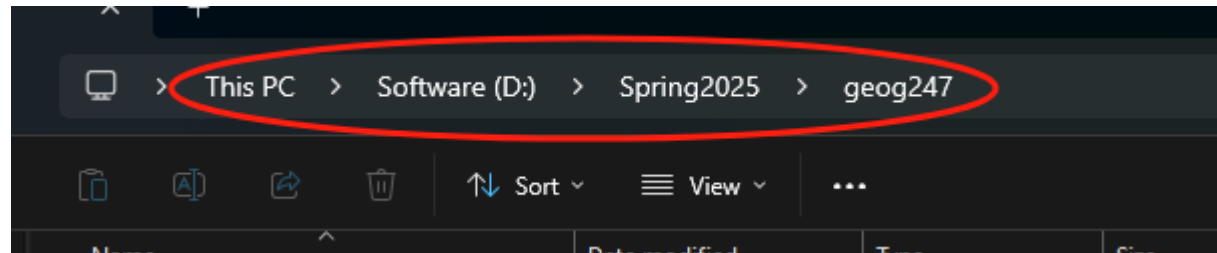
Workspace

☐ Restore .RData into workspace at startup:

Save workspace to .RData on exit: Never ▼

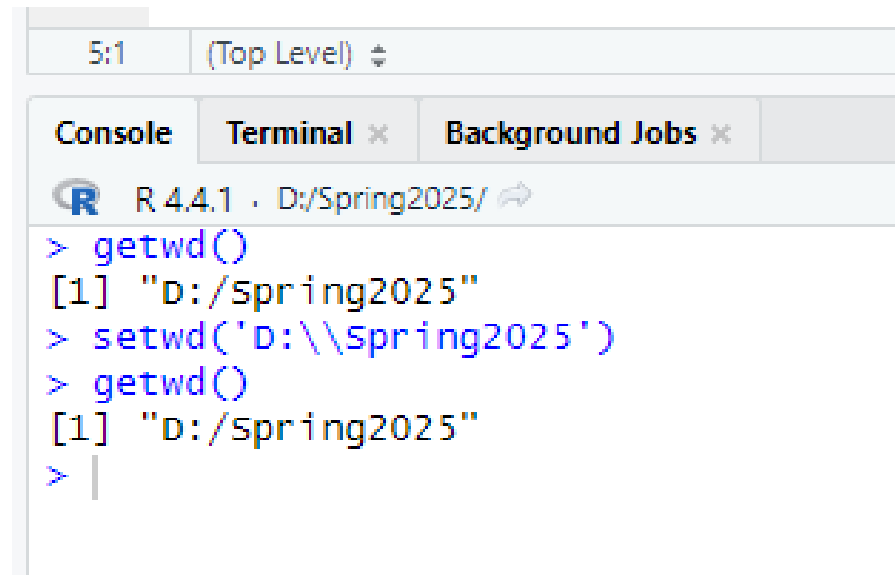
WORKING DIRECTORY

- Get working directory where your scripts and workspaces are stored
 - **getwd()**
 - Run this command:
 - Ctrl + Enter
 - Or Run in R
 - The returning strings, e.g., "C:/Users/yy00021/Documents" is the path to the working directory
 - The windows convention uses slash \ to separate sub-directories
 - However, R uses forward slash / or a double backward slash \\
- Change working directory
 - I suggest you to setup a specific directory for this course
 - **setwd('D:\\Spring2025\\geog247')**
 - Now check your working directory again



CONSOLE WINDOW

- The character > in CONSOLE window indicates that R is ready to receive new commands
- It show up when R completed executing a script



```
5:1 (Top Level) ⚙  
Console Terminal × Background Jobs ×  
R 4.4.1 · D:/Spring2025/ ↗  
> getwd()  
[1] "D:/Spring2025"  
> setwd('D:\\Spring2025')  
> getwd()  
[1] "D:/spring2025"  
> |
```

TERMINATE SCRIPT


- The Esc Key or pressing  in the CONSOLE window to terminate the script

```
## Terminate script  
i <- 1  
while (i>0) {  
  print('good')  
}
```

GET HELP

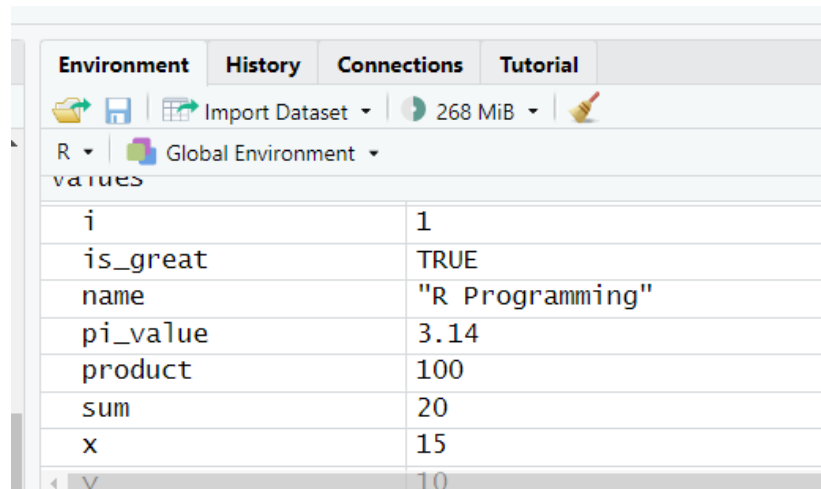
- Get help for activate libraries
 - `help('dplyr')`
 - `?dplyr`
- Get help for all installed libraries
 - `??dplyr`
 - `help.search('dplyr')`

INTERACTING WITH THE R-CONSOLE

- All commands (or programs) can be stored in external *.R script-files
- Single command or a set of highlighted commands can be run using shortcut (shift+enter) or Run button in R
- All commands can be run use the Source button in R
- Scroll through the history of previously commands in R
- Using shortcut key (Ctrl + L) or broom icon to clean the  Console window

VARIABLES IN R

- Variable names
 - Variables are created using the assignment operator <
 - Variables can store different types of data (numeric, character, logical, etc.).
 - Variables can be reassigned new values anytime.
 - The [document](#) shows professional naming for your code
- Object in the ENVIRONMENT
 - Any data structure or function that is defined using commands becomes an object in the ENVIRONMENT



The screenshot shows the RStudio Environment pane. At the top, there are tabs for 'Environment', 'History', 'Connections', and 'Tutorial'. Below the tabs, there are icons for file operations and a text box showing 'Import Dataset' and '268 MiB'. The main area displays the 'Global Environment' with a table of variables and their values.

values	
i	1
is_great	TRUE
name	"R Programming"
pi_value	3.14
product	100
sum	20
x	15
y	10

- Remove objects
 - The objects can be removed from the ENVIRONMENT
 - `rm(x)`
- Clean ENVIRONMENT
 - Broom icon in the ENVIRONMENT mean bar
 - or **`rm(list=ls())`**

LIST IN R

- Creating a list
 - A list in R is a flexible data structure that can contain elements of different types: numbers, characters, vectors, matrices, data frames, or even other lists.
 - It's like a container for multiple objects.
- Accessing elements in a list
 - Use `[[]]` to access elements by position or name.
 - Use `$` to access elements by name.

DATA SETS

- Read csv
 - **read.csv()** for reading CSV files.
- Check columns
 - Accessing column names using **colnames()**
- Add new columns
 - Adding columns based on calculations or conditions



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PRACTICES

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PRACTICES

- Explore Tools and Help in RStudio
- Explore the different tables in RStudio