Starting out:

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Getting Started with R and RStudio

A Beginner's Guide for First-Year Graduate Students

What You're Installing and Why

Before we start, here's what each tool does:

- **R**: The programming language that does the actual data analysis
- **RStudio**: A user-friendly interface that makes R easier to use (like Microsoft Word for documents)
- **Git**: Software that helps you download and sync course materials
- **Additional tools**: Help R work with different types of data and create documents

Important: Install everything in the order listed below. Each step builds on the previous one.

Step 1: Install R

R is the programming language. Install this first!

For Windows:

1. Go to R Project website
2. Click "base" then "Download R for Windows"
3. Run the downloaded file and follow the installation prompts

For macOS:

These instructions work for ALL Macs (Intel and Apple Silicon):

1. Go to R Project website
2. Download the **Intel (x86_64)** version (yes, even for newer Macs with M1/M2/M3 chips)
3. Run the downloaded `.pkg` file and follow the installation prompts

Step 2: Install Additional Tools (macOS Only)

Windows users can skip to Step 3. Mac users need these tools for R to work properly:

Install Required System Tools:

Open **Terminal** (found in Applications → Utilities) and paste each command one at a time:

```
xcode-select --install
```

Click "Install" when prompted and wait for it to finish (this may take 10-15 minutes).

Install Graphics Support:

1. Go to XQuartz.org
2. Download and install XQuartz
3. **Log out and log back in** to your Mac after installation

Install Fortran Compiler:

1. Go to R Tools for macOS
2. Download **gfortran-12.2-universal.pkg**
3. Install it by double-clicking the downloaded file

Add Fortran to Your System Path:

In Terminal, paste these commands:

```
echo 'export PATH="/opt/gfortran/bin:/usr/local/bin:$PATH"' >> ~/.zshrc
echo 'export PATH="/opt/gfortran/bin:/usr/local/bin:$PATH"' >> ~/.bash_profile
```

Step 3: Install Git

Git helps you download and sync course materials.

For Windows:

1. Go to git-scm.com
2. Download Git for Windows
3. Run the installer using all default settings (just keep clicking "Next")

For macOS:

If you completed Step 2, Git is already installed! To verify, open Terminal and type:

```
git --version
```

You should see version information.

Configure Git (All Users):

Open **Terminal** (Mac) or **Git Bash** (Windows) and run these commands with your information:

```
git config --global user.name "Your Full Name"
git config --global user.email "your.email@university.edu"
```

Step 4: Install RStudio

RStudio is the user-friendly interface for R.

1. Go to RStudio.com
2. Download **RStudio Desktop** (the free version)
3. Install it like any other program

For Mac Users with Apple Silicon (M1/M2/M3):

After installing RStudio:

1. In Finder, go to **Applications**
2. Right-click on **RStudio.app**
3. Select **Get Info**
4. Check the box **"Open using Rosetta"**

Step 5: Test Your Installation

Let's make sure everything works:

Test RStudio and R:

1. **Open RStudio** (not R - always use RStudio)
2. You should see 4 panels:
    - **Console** (bottom left) - this is where you type R commands
    - **Environment** (top right) - shows your data
    - **Files/Plots** (bottom right) - shows files and graphs
    - **Script** (top left) - for writing longer code
3. **Click in the Console** (the bottom left panel where you see >)
4. Type this and press Enter:

```
2 + 2
```

You should see `[1] 4`

Test Git Connection:

1. In RStudio, go to **File → New Project → Version Control**
2. You should see **"Git"** as an option
3. If you see it, great! If not, restart RStudio and try again

Step 6: Download Course Materials

Now let's get the course files:

1. In RStudio, go to **File → New Project → Version Control → Git**
2. In the "Repository URL" field, paste:

   ```
   https://github.com/gurinina/2025_IntroR_and_RStudio
   ```

3. Choose where to save the project on your computer
4. Click **"Create Project"**

RStudio will download all course materials. This may take a few minutes.

Step 7: Install Required R Packages

R packages are like apps that add extra features. We need several for this course.

Find the Console:

Look for the **Console** panel in RStudio (bottom left). You'll see a > symbol where you can type.

Install Packages:

First, locate the Console in RStudio: Look at the bottom left panel of RStudio. You'll see a panel labeled "Console" with a > symbol - this is where you type R commands.

Click in the Console and paste this entire block of code (it will take 10-15 minutes):

```r
# Install basic tools first
install.packages(c("devtools", "BiocManager", "tidyverse", "rmarkdown"))

# Install Bioconductor (for biological data analysis)
if (!requireNamespace("BiocManager", quietly = TRUE)) {
    install.packages("BiocManager")
}

# Install all required packages for the course
BiocManager::install(c(
    "bookdown", "clusterProfiler", "DESeq2", "dplyr", "enrichplot", "fgsea",
    "ggplot2", "ggrepel", "gplots", "knitr", "org.Hs.eg.db", "pheatmap",
    "purrr", "RColorBrewer", "rmarkdown", "rsconnect", "tidyverse", "tinytex"
))

# Install course-specific package
devtools::install_github("gurinina/GOenrichment", force = TRUE)

# Install document creation tools
if (!tinytex::is_tinytex()) {
    tinytex::install_tinytex(force = TRUE)
}
```

Be patient! This process downloads and installs many packages. You'll see lots of text scrolling by - this is normal.

Step 8: Verify Everything Works

Let's test that all packages installed correctly:

In the Console, paste and run:

Remember: The Console is the bottom left panel in RStudio with the `>` symbol.

```
# Check if key packages work
library(ggplot2)
library(dplyr)
library(DESeq2)

# If no error messages appear, you're ready!
cat("Success! All packages are working.\n")
```

Test Creating a Document:

1. In RStudio, go to **File → New File → R Markdown**
2. Leave the default settings and click **OK**
3. Click the **"Knit"** button at the top
4. If a webpage opens with a document, everything is working perfectly!

Creating PDF Documents:

If you want to create PDF files (instead of HTML), you need to modify the document header:

1. **For documents with special characters or emojis**: Change the top of your document to:

```
---
title: "Your Document Title"
output:
  pdf_document:
    latex_engine: xelatex
---
```

2. **For simple documents**: You can use:

```
---
title: "Your Document Title"
output: pdf_document
---
```

Note: If you get errors about Unicode characters when making PDFs, always use `latex_engine: xelatex` in your document header.

What Success Looks Like

RStudio opens without errors
You can type `2 + 2` in the Console and get `[1] 4`
You can create a new R Markdown document and "Knit" it
You have a folder with course materials

Common Problems and Solutions

"Package not found" errors:

- Make sure you're typing in the **Console** (bottom left panel)
- Try restarting RStudio and running the code again

"Command not found" in Terminal:

- Close and reopen Terminal
- Try restarting your computer

RStudio can't find Git:

- Make sure you installed Git before RStudio
- Restart RStudio completely (quit and reopen)

Installation seems stuck:

- Be patient! Package installation can take 15-30 minutes
- As long as you see text appearing, it's working

Getting Help

If something doesn't work:

1. Try restarting RStudio
2. Try restarting your computer

3. Ask a classmate or instructor
4. Email the instructor with:
    - What step you're on
    - What error message you see (copy and paste it)
    - A screenshot if helpful

Remember: Software installation can be tricky, even for experienced users. Don't worry if you need help - this is completely normal!

Next Steps

Once everything is installed:

1. **Explore RStudio** - click around and see what's in each panel
2. **Try the built-in R tutorial**: In the Console, type:

```
install.packages("swirl")
library(swirl)
swirl()
```

3. **Read the course materials** you downloaded
4. **Don't panic!** Learning R takes time, and everyone starts as a beginner

Welcome to R! You're ready to start your data analysis journey.