

Introduction to R & RStudio

Week 1 - Lecture 4 & Lab 0

Hello R, This is Me!

Today...

In this lecture, we will...

- learn what is R, RStudio and Quarto Document
- create A STAT-218 Folder in Your Desktop
- create A New Quarto Document
 - save this document to your STAT-218 Folder
- fill out the document
 - have first coding experience by
 - saying Hello World!
 - creating an Object
 - running some functions
- learn How to Get Help
- render The First PDF

R and RStudio



[Hadley Wickham and others at RStudio, CC BY-SA 4.0, via Wikimedia Commons](#)



[RStudio, Inc., Public domain, via Wikimedia Commons](#)

- **R** is a computer language.
- **R** is an environment for statistical computing and graphics.
 - **R** provides a wide variety of statistical and graphical techniques.
- **R** is a free open source software

- **RStudio** is an *integrated development environment* (IDE) for **R**
- **RStudio** has four main panes each in a quadrant of your screen

What Can We Do with RStudio?

- Everything we need to do for this class and beyond!

What is Quarto Document?

Quarto is...

- an open-source scientific and technical publishing system
- a multi-language, next-generation version of R Markdown.
- enabling you to combine code and text to create rich outputs, like reports and presentations. (*like an advanced version of a word processing tool*)

! Important

- R is the programming language for statistical computing
- RStudio is the IDE that facilitates R programming
- Quarto document is a document type that combines text and code
- In short, we will create Quarto documents in RStudio and we will combine text and R codes in that Quarto document to create our lab reports.

Today's Tasks

Task 1: Create A Folder



Task 2: Creating a Quarto Document



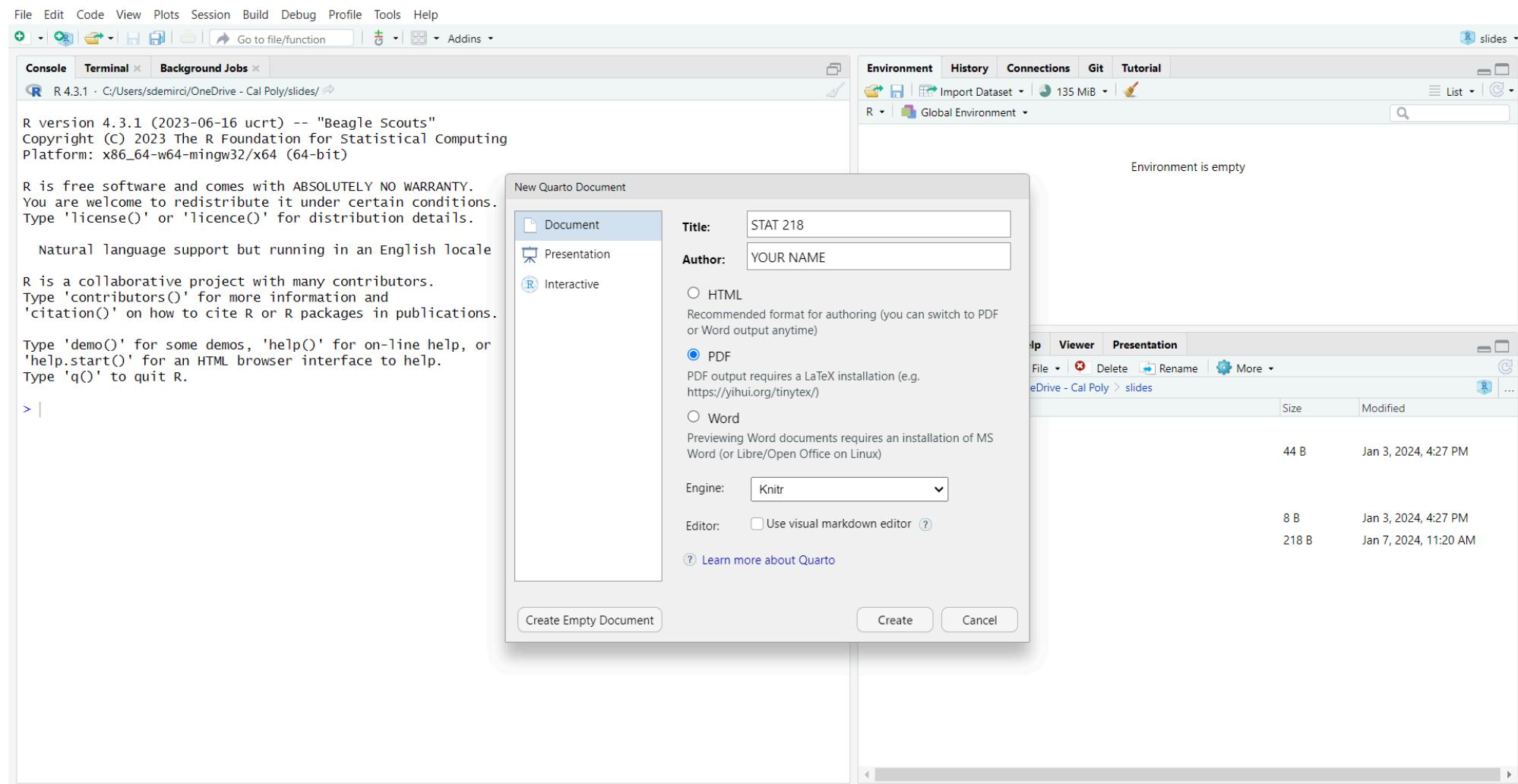
Tip

You can create your own Quarto document by clicking [File > New File > Quarto Document](#)

Let's try to create our first Quarto document!

WARNING! I use Windows, you may use Mac or Linux or online version of R. Thus, your screen might look a bit different than mine.

Task 2: Creating and Saving a Quarto Document



How to Create a New Quarto Document

Task 2: Creating and Saving a Quarto Document

- You can save your own Quarto document by clicking
 - [File > Save](#)
- After that, YOU NEED TO FIND YOUR FOLDER TO SAVE YOUR FILE.

Panes in RStudio

This is our Quarto document.
We will mainly work here!

Environment is empty
Think of the 'Environment' tab
in this pane as
R's memory.

We use this
Console Pane
to write our code.

There are 6 "Tabs"
in this "pane"!
We will use this OUTPUT PANE
containing the Files, Plots, Packages,
Help, Viewer, an Presentation tabs.

The screenshot shows the RStudio interface with several panes visible:

- Source Pane:** Displays R code for a Quarto document. A callout points to it with the text: "This is our Quarto document. We will mainly work here!"
- Environment Pane:** Shows the global environment. A callout points to the "Environment" tab with the text: "Environment is empty Think of the 'Environment' tab in this pane as R's memory."
- Console Pane:** Shows R version 4.3.1 output. A callout points to it with the text: "We use this Console Pane to write our code."
- Output Pane:** Shows tabs for Files, Plots, Packages, Help, Viewer, and Presentation. A callout points to it with the text: "There are 6 \"Tabs\" in this \"pane\"! We will use this OUTPUT PANE containing the Files, Plots, Packages, Help, Viewer, an Presentation tabs."

A Closer Look into the Quarto Document

stat-218-fa23 - main - RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Untitled1* Go to file/function Addins

Source Visual

Render on Save ABC Render Run Outline

A magical button that turns this page to something familiar like .pdf .docx or even .html

```
1 ---  
2 title: "Descriptive Statistics"  
3 subtitle: "STAT 218 - Week 2, Lecture 2, Lab 2"  
4 author: Dr. Sinem Demirci  
5 date: "2023-10-03"  
6 date-format: "MMMM D<sup style='font-size:65%;'>th</sup>, YYYY"  
7 format: html  
8 execute:  
9   echo: true  
10 ---  
11  
12 ## Hello, My Name Is Quarto Document!  
13 |  
14  
15 Quarto enables you to weave together content and executable code into a finished document. To learn more about Quarto see <https://quarto.org>.  
16  
17 ## Running Code  
18  
19 When you click the **Render** button a document will be generated that includes both content and the output of embedded code. You can embed code like this:  
20  
21 ``{r}  
22 1 + 1  
23 ``  
24  
25 You can add options to executable code like this  
26  
27 ``{r}  
28 #| echo: false  
29 2 * 2  
30 ``  
31  
32 The `echo: false` option disables the printing of code (only output is displayed).  
33
```

This part (YAML) is something that you don't need to learn.

Think this part as your text document

This is where we write our R codes (code chunk)

This is another code chunk with a chunk option!

We called this line as 'inline code'

Run the code

The screenshot shows the RStudio interface with a Quarto document open. The toolbar at the top has a 'Render' button circled in red. A large red arrow points from the text 'A magical button that turns this page to something familiar like .pdf .docx or even .html' to the 'Render' button. Another red arrow points from the text 'This part (YAML) is something that you don't need to learn.' to the YAML header at the top of the code. A bracket on the left side groups the first few lines of content ('## Hello, My Name Is Quarto Document!') and an annotation 'Think this part as your text document' points to it. A red arrow points from the text 'This is where we write our R codes (code chunk)' to the first code chunk starting with '``{r}'. Another red arrow points from the text 'This is another code chunk with a chunk option!' to the second code chunk starting with '#| echo: false'. A red bracket on the left groups the two code chunks, and an annotation 'We called this line as "inline code"' points to the first line of the second code chunk. A red arrow points from the text 'Run the code' to the green 'Run' button in the toolbar.

Task 3: Play with Your First Quarto Document

The screenshot shows a Quarto document titled "STAT 218 - Lab 2". The document content includes:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "YOUR NAME"  
4 format: pdf  
5 ---  
6  
7 ## Quarto  
8  
9 Quarto enables you to weave together content and executable code into a finished  
document. To learn more about Quarto see <https://quarto.org>.  
10  
11 ## Running Code  
12  
13 When you click the **Render** button a document will be generated that includes both  
content and the output of embedded code. You can embed code like this:  
14  
15 ```{r}  
16 1 + 1  
17 ````  
18  
19 You can add options to executable code like this  
20  
21 ```{r}  
22 #| echo: false  
23 2 * 2  
24 ````  
25  
26 The `echo: false` option disables the printing of code (only output is displayed).  
27
```

Below the document, the R console output is shown:

```
R 4.3.1 · C:/Users/sdemirci/OneDrive - Cal Poly/STAT-218/STAT-218-Summer/stat218-summer-24/  
Copyright (C) 2023 The R Foundation for Statistical Computing  
Platform: x86_64-w64-mingw32/x64 (64-bit)  
  
R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.  
  
Natural language support but running in an English locale  
  
R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.
```

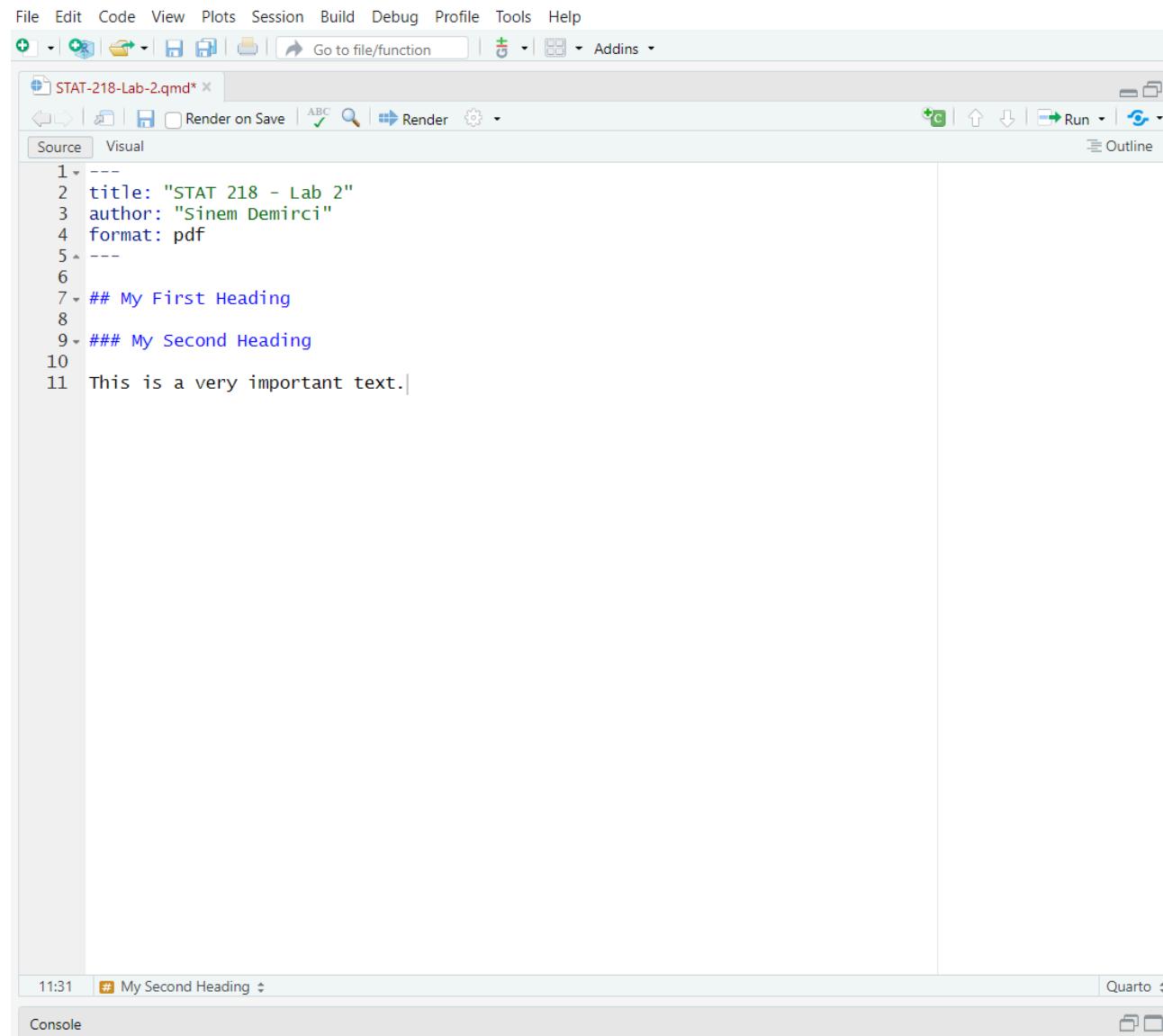
Delete The Default Content

The screenshot shows a Quarto editor window titled "STAT-218-Lab-2.qmd". The menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The toolbar contains various icons for file operations like Open, Save, and Render. The main pane displays the following code:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7
```

The status bar at the bottom left shows "7:1 (Top Level)". The bottom right corner features a "Quarto" logo.

Add Headings and Text

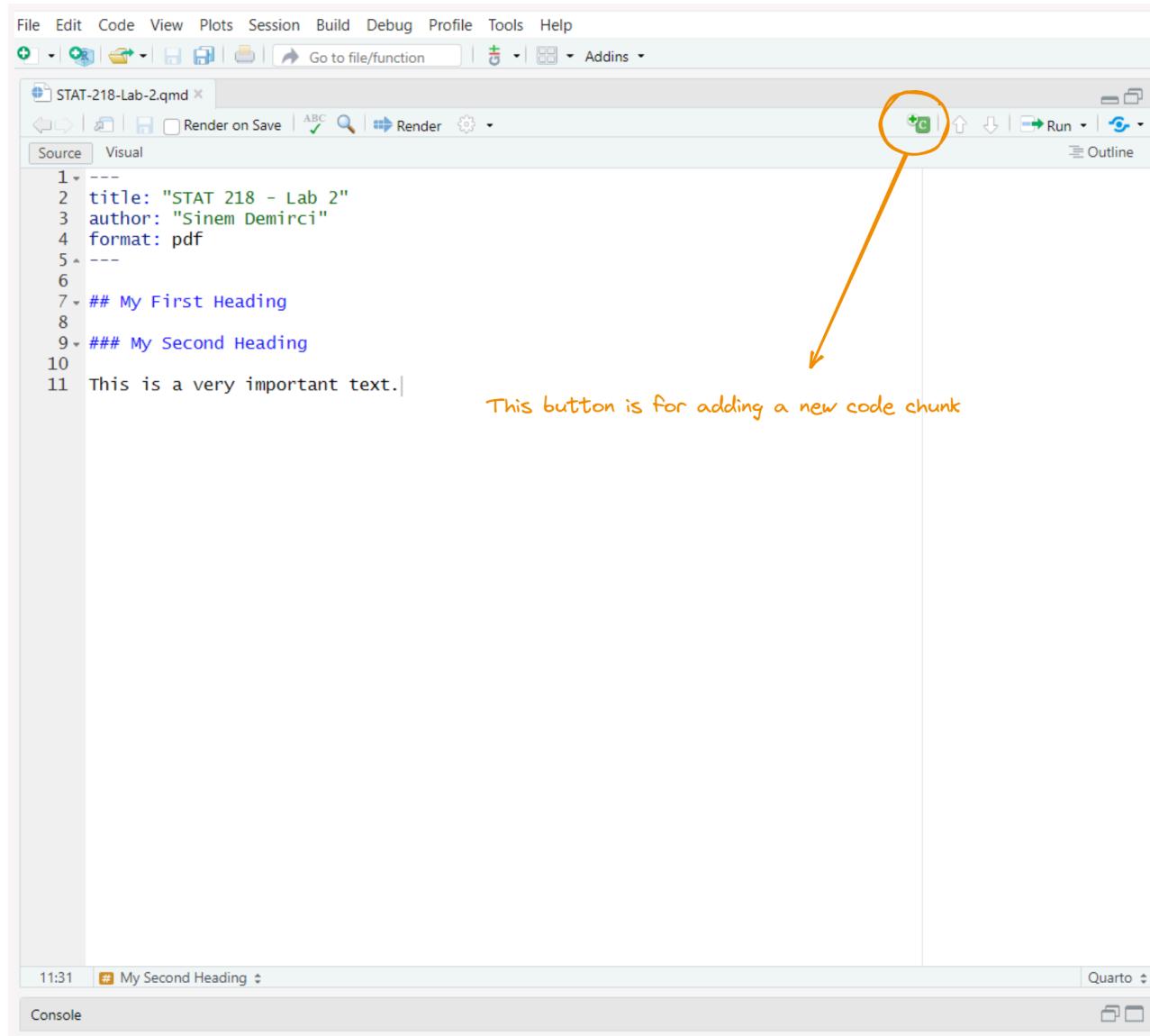


The screenshot shows a Quarto editor window with the following details:

- File Menu:** File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Help.
- Toolbar:** Includes icons for file operations (New, Open, Save, Print), Go to file/function, and Addins.
- File List:** Shows "STAT-218-Lab-2.qmd*".
- Tool Buttons:** Render on Save, ABC, Render, Run.
- Panels:** Source (active) and Visual.
- Source Panel Content:**

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9 ### My Second Heading  
10  
11 This is a very important text.|
```
- Visual Panel:** A large empty area where rendered content would appear.
- Status Bar:** Shows the time "11:31" and a dropdown menu "My Second Heading".
- Bottom Navigation:** Console tab and Quarto logo.

Add A Code Chunk



The screenshot shows the Quarto editor interface. At the top, there's a menu bar with File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with various icons for file operations like Open, Save, Print, and a search bar labeled "Go to file/function". The main workspace is titled "STAT-218-Lab-2.qmd". It contains the following R Markdown code:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9 ### My Second Heading  
10  
11 This is a very important text.|
```

A large orange arrow points from the text "This button is for adding a new code chunk" to a specific button in the toolbar. This button is a green square with a white plus sign and the letter 'c' inside it. It is circled with a thick orange line.

This button is for adding a new code chunk

Add This Simple Code

The screenshot shows a Quarto code editor interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with various icons for file operations like Open, Save, and Print, along with a "Go to file/function" search bar and an "Addins" dropdown.

The main workspace displays the following R code:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9 ### My Second Heading  
10  
11 This is a very important text.  
12  
13 `r`  
14 my_birthyear <- 1988  
15 my_birthyear  
16`  
17  
18
```

The code includes a title block, two headings (## and ###), a text block, and a code block (my_birthyear). The status bar at the bottom left shows "18:1" and "My Second Heading". The status bar at the bottom right shows "Quarto".

Creating An Object

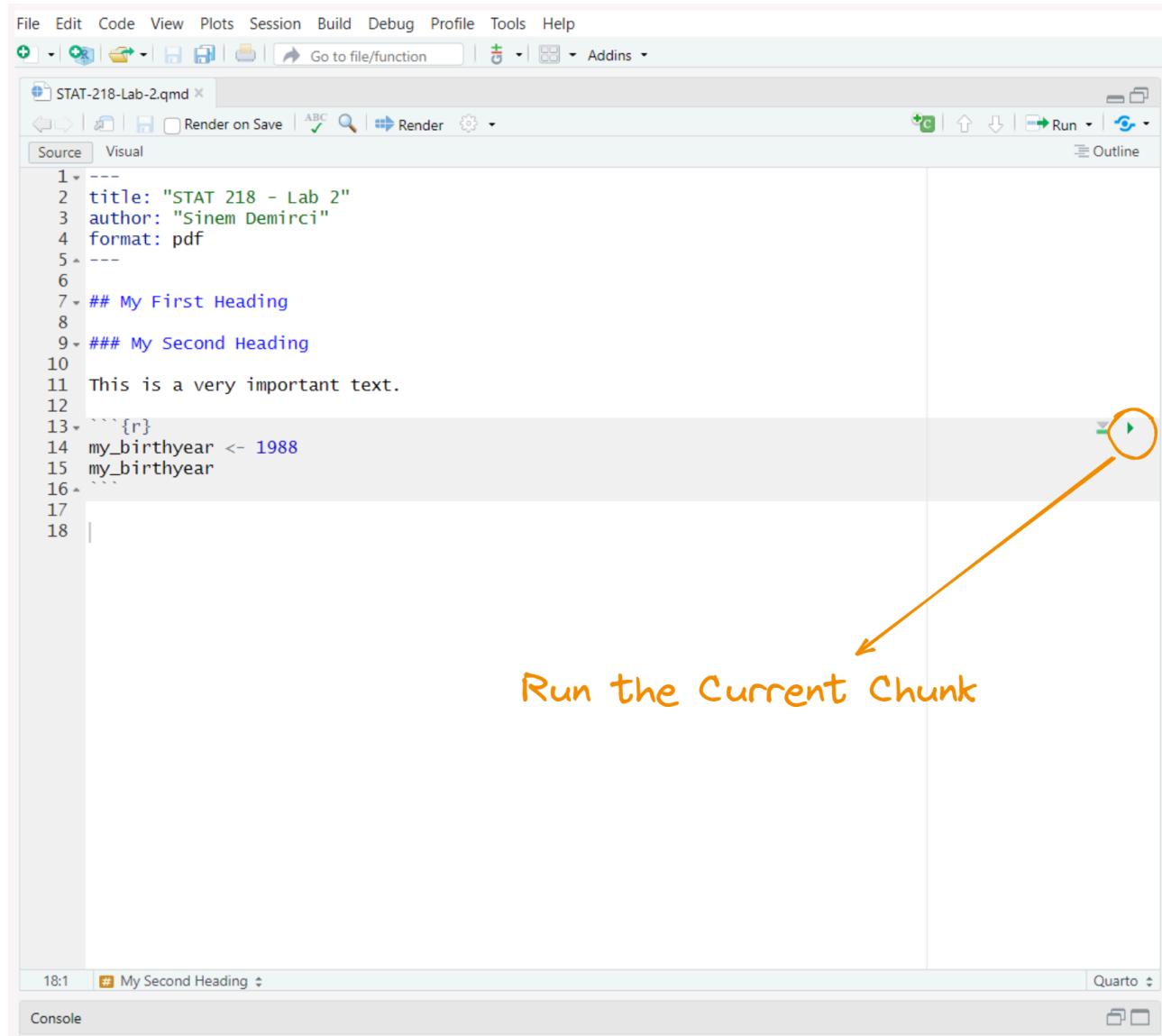
We create an object by using “`<-`” called as “Object Assignment Operator”

| | Windows | Mac |
|----------|------------------------|---------------------------|
| Shortcut | <code>Alt and -</code> | <code>Option and -</code> |

```
1 my_birthyear <- 1988  
2 my_birthyear
```

```
[1] 1988
```

Run the Code Chunk



A screenshot of a Quarto code editor interface. The file being edited is "STAT-218-Lab-2.qmd". The code content is as follows:

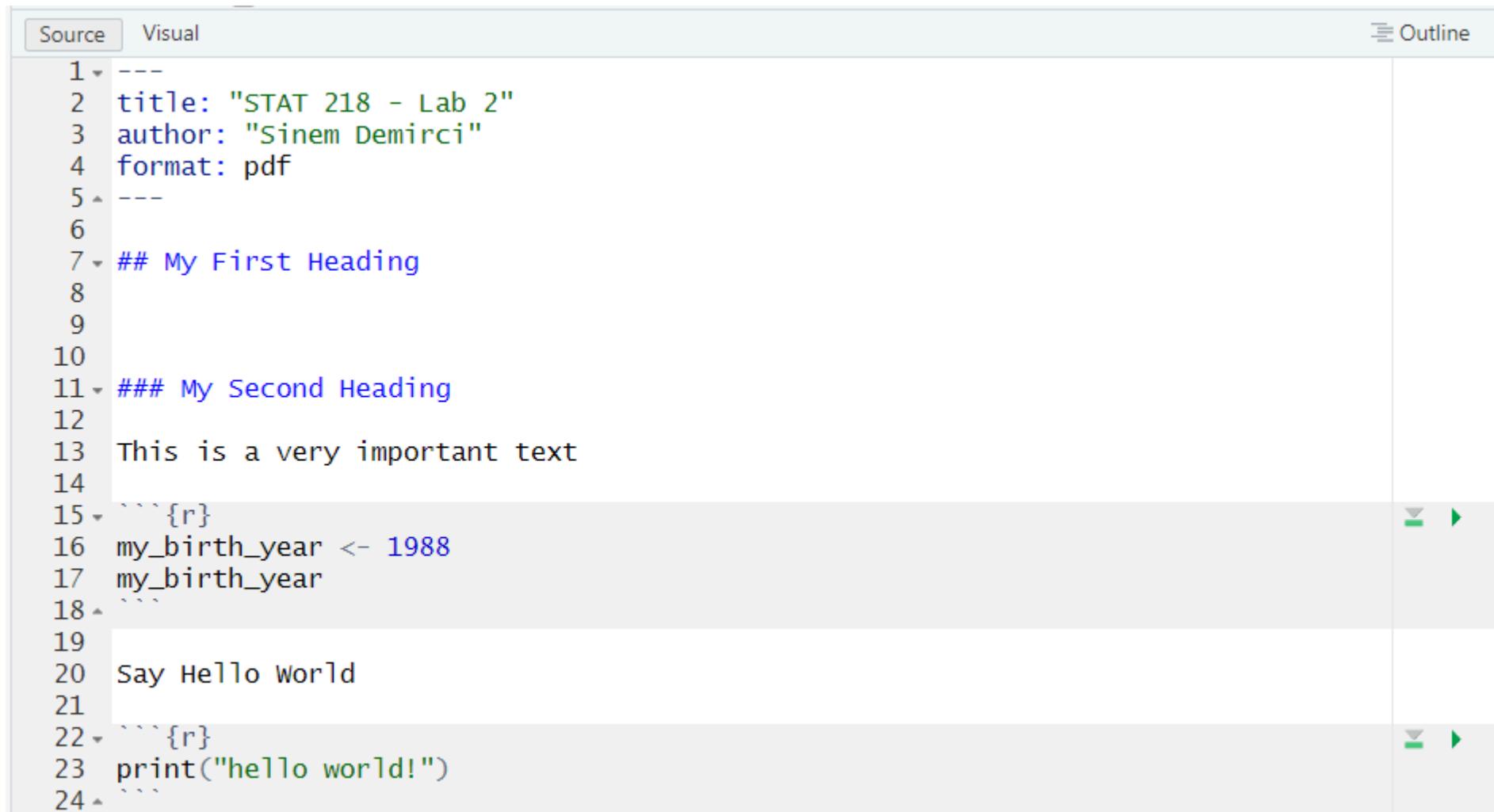
```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9 ### My Second Heading  
10  
11 This is a very important text.  
12  
13 `{{r}}`  
14 my_birthyear <- 1988  
15 my_birthyear  
16  
17  
18
```

An orange arrow points from the text "Run the Current Chunk" to the "Run" button in the toolbar, which is highlighted with a yellow circle.

Run the Current Chunk

Say, Hello World!

- **hello world** is a phrase that most programmers use when they first begin programming in any language.
 - Let's write our first “hello world!” together.



The screenshot shows the RStudio interface with the 'Source' tab selected. The code editor displays the following R script:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9  
10  
11 ### My Second Heading  
12  
13 This is a very important text  
14  
15 ```{r}  
16 my_birth_year <- 1988  
17 my_birth_year  
18 ```  
19  
20 Say Hello World  
21  
22 ```{r}  
23 print("hello world!")  
24 ```
```

Vocabulary Section

```
1 do(something)
```

do() is a function;

something is the argument of the function.

```
1 do(something, colorful) # I can put here a comment by using hashtag
```

do() is a function;

something is the first argument of the function;
colorful is the second argument of the function.

R ignores comments if you put # like above

I love  Dr. Dogucu's teaching strategy to teach students the basics of coding. This is how she explains the idea of coding. I am using some of her strategies during this session.

Check Your Document Before Rendering

The screenshot shows the RStudio interface with the 'Source' tab selected. The code editor displays the following R code:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5 ---  
6  
7 ## My First Heading  
8  
9  
10  
11 ### My Second Heading  
12  
13 This is a very important text  
14  
15 `r`  
16 my_birth_year <- 1988  
17 my_birth_year  
18 `r`  
19  
20 Say Hello World  
21  
22 `r`  
23 print("hello world!")  
24 `r`
```

The code includes YAML front matter at the top, followed by two headings and some text. Below that, there are three code blocks, each starting with a backtick and ending with a brace and an 'r'. The first and third code blocks contain assignments to variables, while the second contains a call to the 'print' function.

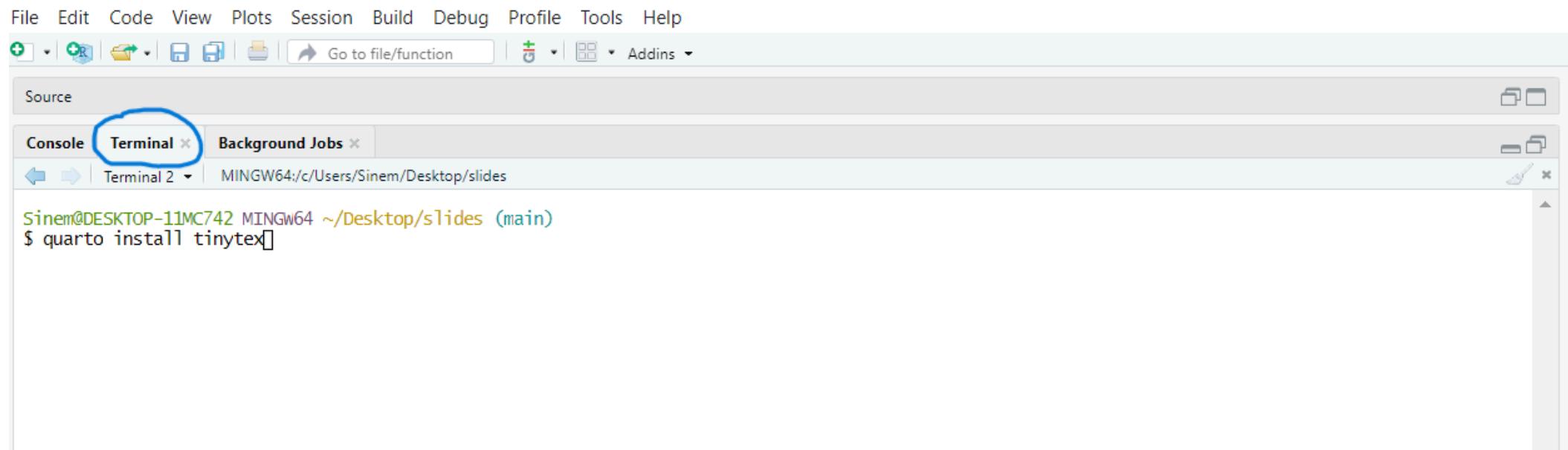
Rendering a PDF Document

- The Quarto document that we created is a *source file*.
- By rendering this, will have a different *output file* (e.g., PDF)

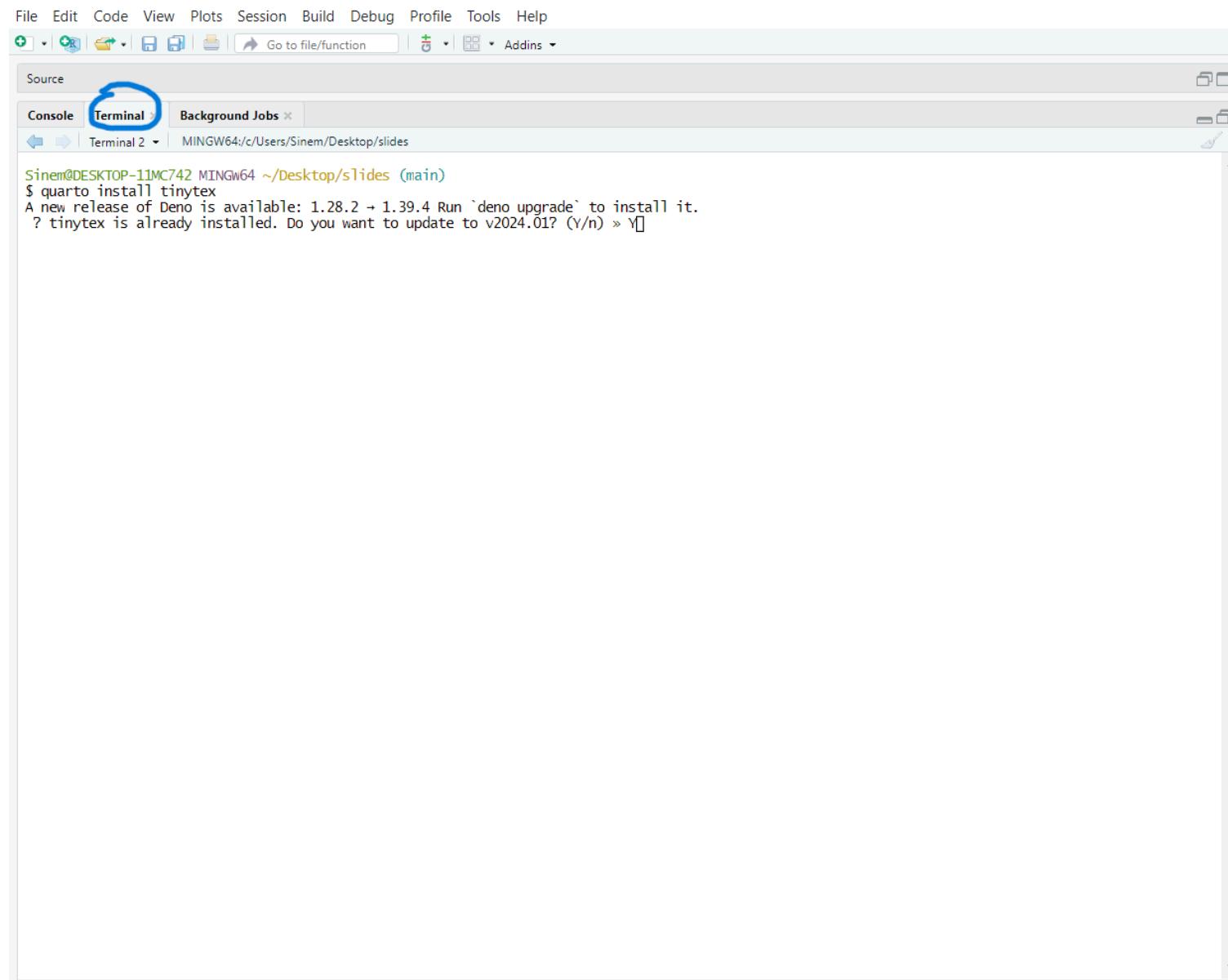
Rendering a PDF Document

Open your terminal pane and type the following:

```
1 quarto install tinytex
```



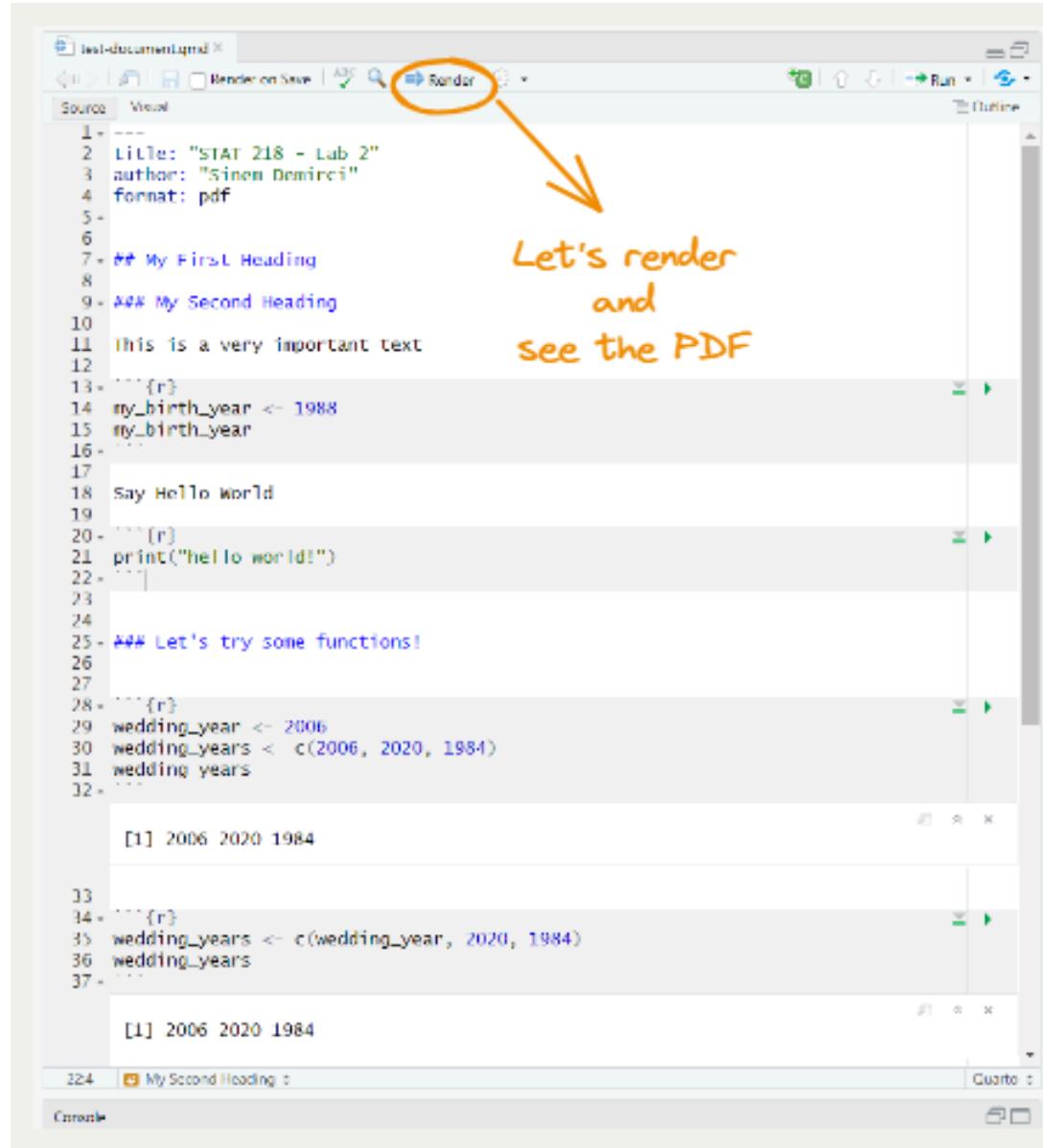
Rendering a PDF Document



The screenshot shows the RStudio interface with the 'Terminal' tab highlighted by a blue circle. The terminal window displays the following command-line session:

```
Sinem@DESKTOP-11MC742 MINGW64 ~/Desktop/slides (main)
$ quarto install tinytex
A new release of Deno is available: 1.28.2 → 1.39.4 Run `deno upgrade` to install it.
? tinytex is already installed. Do you want to update to v2024.01? (Y/n) » Y
```

Rendering a PDF Document



The screenshot shows an RStudio interface with a script editor window titled "test-document.Rmd". The "Visual" tab is selected. A yellow arrow points from the "Render" button in the toolbar to the text "Let's render and see the PDF". The code in the script editor is:

```
1 ---  
2 title: "STAT 218 - Lab 2"  
3 author: "Sinem Demirci"  
4 format: pdf  
5  
6  
7 # My First Heading  
8  
9 ## My Second Heading  
10  
11 This is a very important text  
12  
13 ```{r}  
14 my_birth_year <- 1988  
15 my_birth_year  
16  
17  
18 Say Hello World  
19  
20 ```{r}  
21 print("Hello World!")  
22  
23  
24  
25 ### Let's try some functions!  
26  
27  
28 ```{r}  
29 wedding_year <- 2006  
30 wedding_years <- c(2006, 2020, 1984)  
31 wedding_years  
32  
[1] 2006 2020 1984  
33  
34 ```{r}  
35 wedding_years <- c(wedding_year, 2020, 1984)  
36 wedding_years  
37  
[1] 2006 2020 1984  
324 My Second Heading  
Current
```

The code uses R's `knitr` package to render the document into a PDF. It includes sections for headings, a block of text, and a function call. The output shows the results of the `print` and `c` functions.

Rendering a PDF Document

STAT 218 - Lab 2

Sinem Demirci

My First Heading

My Second Heading

This is a very important text

```
my_birth_year <- 1988  
my_birth_year
```

```
[1] 1988
```

Say Hello World

```
print("hello world!")
```

```
[1] "hello world!"
```

Lab Assignment 0

- Please upload this PDF document to our Canvas page as **LAB Assignment 1 (Individual)**
- Beginning from next week, we will start working in groups.

CONGRATULATIONS

Now, you can close your RStudio.

Everything you did is in your STAT 218 folder!