Lab 0: An introduction to the R environment

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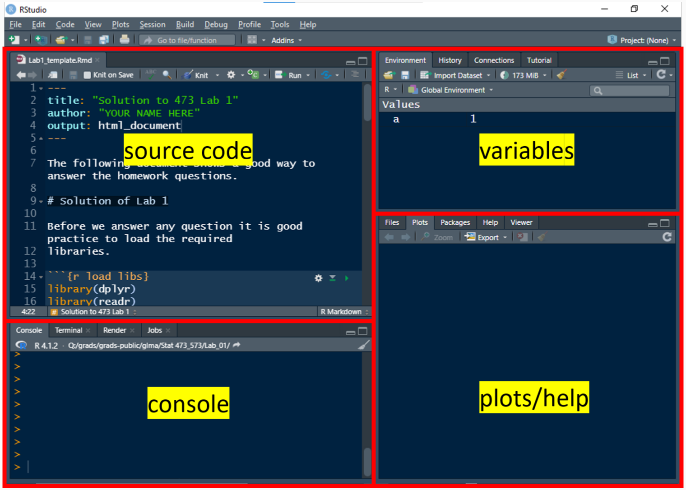
The R executable and the IDE

1. R is a statistical computing language. You need to install it before install RStudio.
2. Go to `https://cran.r-project.org/bin/windows/base/` to download and install R .
3. An Integrated Development Environment (IDE)gives you more convenience to write your code. RStudio is the IDE we use for this course.
4. Go to `https://posit.co/downloads/` and download RStudio once you have installed R .

Layout of RStudio

1. The default layout of RStudio



~~~
---
title: "Solution to 473 Lab 1"
author: "YOUR NAME HERE"
output: html_document
---

The following document shows a good way to
answer the homework questions.

# Solution of Lab 1

Before we answer any question it is good
practice to load the required
libraries.

```{r load libs}
library(dplyr)
library(readr)
~~~

```
Values
  a          1
```

```
R 4.1.2 · Q:/grads/grads-public/glma/Stat 473_573/Lab_01/
>
>
>
>
>
>
>
>
>
> |
```

Layout of RStudio

2. The source code area shows your current file. Select a chunk of code and press Ctrl + Enter to execute them.
3. The console area helps you write short (typically one-line) testing code. When this console is activated (by clicking anywhere in the console), pressing Enter executes the current line of code.
4. The variable area shows you the variables generated, including the data you loaded from elsewhere.
5. The plots/help area shows the plots you make. In the console, type ? followed by any command, and the help documentation will pomp up in this area.

R source code and R markdown

In this course, we work with two types of files: `.R` and `.Rmd`.
⚠mind the capitalization!

1. `.R` file is used for running “normal” code. When the intention is just coding and computing, use `.R`. You will use .R most of the time for your own statistical analysis/computing task.
2. `.Rmd` file is used for documentation. It can be compiled and a .pdf or .html file will be the output. You will use .Rmd most of the time for your lab homework.

R packages

1. R is most powerful when you use its packages. We will use `knitr`, `dplyr`, `tidyr`, `readr`, `ggplot2`, `purrr`.
2. To install `dplyr`, type

   ```
   install.packages("dplyr")
   ```

   and Enter . Do the same for the other packages.
3. We introduce two ways to use an R package. You can

   3.1 load the whole package and use its functions by

   ```
   library("dplyr")
   ```

   ```
   select(data, colname)
   ```

   3.2 call the function of an installed package without loading the whole package

   ```
   dplyr::select(data, colname)
   ```

The **knit** package: Writing R markdown

The `knit` package is required to convert a source `.Rmd` to a .pdf or .html.

1. The title is at the beginning of a `.Rmd` file, surrounded by two "triple hyphens":

   ```
   ---
   ```

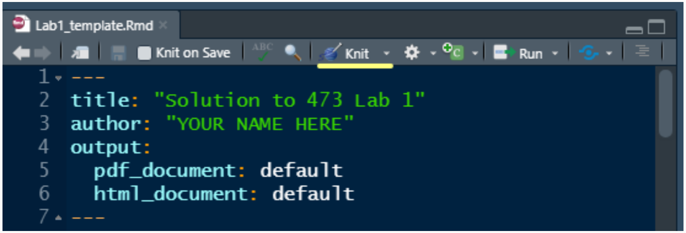
   An example title is:

   ```
   ---
   title: "Solution to 473 Lab 1"
   author: "Guoliang Ma"
   output:
    pdf_document: default
    html_document: default
   ---
   ```

The **knit** package: Writing R markdown

2. Some keyword letters
   - 2.1 `#` : gives you level-one header
   - 2.2 `##` : gives you a level-two header
   - 2.3 ` ```{r} ` and ` ``` ` (the one above `Tab`): are used to surround R code.
   - 2.4 `#` within an R code chunk defined by ` ```{r} ` and ` ``` ` : comments of the R code.

   Otherwise, type "normally" as you do with MS word or any other text editors.
3. Compile your `.Rmd` with `knit`. Use ▽ to select output format.



```
---
title: "Solution to 473 Lab 1"
author: "YOUR NAME HERE"
output:
  pdf_document: default
  html_document: default
---
```

The **dplyr** package and the Pipe workflow in R

1. In R , `=` is less frequently used as an assignment operator. Instead, `<-` is more popular. For example, you want to create a variable `a` with value 3, use

   ```
   a <- 3
   ```

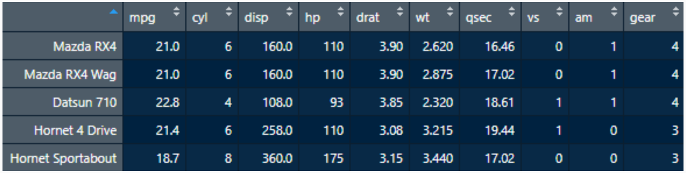
   Check out
   `https://stackoverflow.com/questions/1741820/what-are-the-differences-between-and-assignment-o`
   for reasons.

2. When indicating default function parameters, use `=` .

3. Built in `dplyr`, `tidyr`, and many other packages, is the operator `%>%` . This is called the Pipe workflow.

The **dplyr** package and the Pipe workflow in R

`dplyr` is a powerful tool for handling data. For example, consider this data set.



	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3

We would like to calculate the group mean of `mpg` grouped by `gear`, number of gears.

The **`dplyr`** package and the Pipe workflow in R

The workflow is group by `gear` ⇒ calculate means for grouped data.

The pipe workflow uses `%>%` to combine the workflow into one chunk of code:

```
data %>%
  group_by(gear) %>%
  summarise(mean_by_gear=mean(mpg))
```

There are many other useful functions in `dplyr`. When you want to achieve specific aims, search e.g., "group mean dplyr."