

Basic R course : CGA

CECAD Bioinformatics Core

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Chapter 1

Prerequisites

It is highly recommended to have the following **R** packages installed on their computers before starting the course.

The packages can be installed from *CRAN* or *Github* or *Bioconductor*:

```
install.packages(c("ggplot2", "dplyr", "gprofiler2", "imager", "magick", "tibble", "MASS", "tidyr", "stri")
if (!require("BiocManager", quietly = TRUE))
  install.packages("BiocManager")

BiocManager::install(c("DESeq2", "clusterProfiler"))
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading #.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.name/tinytex/>.

Chapter 2

Introduction

You can label chapter and section titles using `{#label}` after them, e.g., we can reference Chapter 2. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter ??.

Figures and tables with captions will be placed in `figure` and `table` environments, respectively.

```
par(mar = c(4, 4, .1, .1))  
plot(pressure, type = 'b', pch = 19)
```

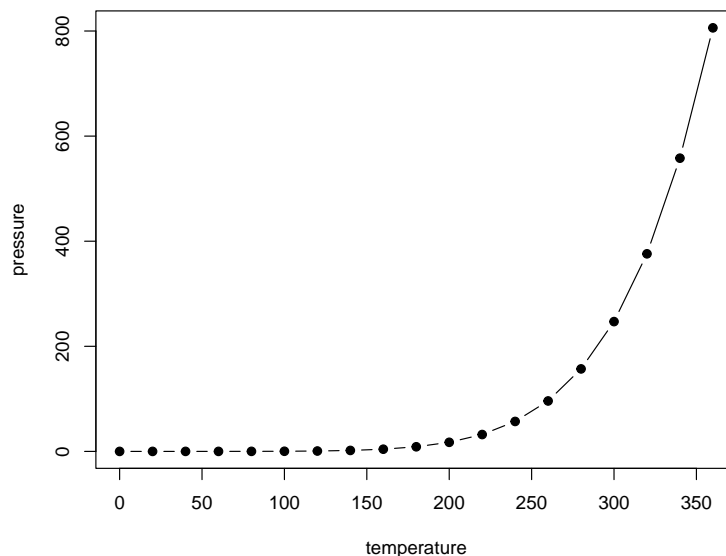


Figure 2.1: Here is a nice figure!

Table 2.1: Here is a nice table!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.0	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa
5.4	3.7	1.5	0.2	setosa
4.8	3.4	1.6	0.2	setosa
4.8	3.0	1.4	0.1	setosa
4.3	3.0	1.1	0.1	setosa
5.8	4.0	1.2	0.2	setosa
5.7	4.4	1.5	0.4	setosa
5.4	3.9	1.3	0.4	setosa
5.1	3.5	1.4	0.3	setosa
5.7	3.8	1.7	0.3	setosa
5.1	3.8	1.5	0.3	setosa

Reference a figure by its code chunk label with the `fig:` prefix, e.g., see Figure 2.1. Similarly, you can reference tables generated from `knitr::kable()`, e.g., see Table 2.1.

```
knitr::kable(
  head(iris, 20), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

You can write citations, too. For example, we are using the **bookdown** package (Xie, 2024) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).

Chapter 3

Day 1

3.1 Variables

Variables are containers for storing data values. These are reusable.

```
myvar <- 5  
print(myvar)
```

```
## [1] 5
```

```
myvar <- "Hello, World!"  
print(myvar)
```

```
## [1] "Hello, World!"
```

You can see the same variable `myvar` stores the value 5 and later gets replaced by Hello, World!

3.2 R-objects

Although you can make **vectors** manually using the `c()` function, there are also some specialised functions for making vectors.

- The `seq()` function can be used to make up arithmetic series of values.
- The `rep()` function simply repeats a value a specified number of times.
- special operator `:` for creating vectors of sequential integers

```
seq(from=1,to=5,by=0.5)
```

```
## [1] 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
```

```
rep("hello!",5)
```

```
## [1] "hello!" "hello!" "hello!" "hello!" "hello!"
15:25

## [1] 15 16 17 18 19 20 21 22 23 24 25
c(rep(1,3),rep("hello!",3),rep(3,3))

## [1] "1"      "1"      "1"      "hello!" "hello!" "hello!" "3"      "3"
## [9] "3"
```

3.2.1 Accessing Vector Subsets

One can access specific positions in a vector in various ways

```
myvec <- c(rep(1,3),rep("hello!",3),rep(3,3))
myvec[4]

## [1] "hello!"
myvec[4:7]

## [1] "hello!" "hello!" "hello!" "3"
myvec[c(4,9)]

## [1] "hello!" "3"
```

3.2.2 Named Vectors

In all R data structures you have the option of assigning names to numeric positions so that you can use the name to access the data instead of the position.

```
myobj <- 11:15
names(myobj) <- c("pos1","pos2","pos3","pos4","pos5")
myobj

## pos1 pos2 pos3 pos4 pos5
## 11 12 13 14 15
myobj[c("pos2","pos5","pos1")]

## pos2 pos5 pos1
## 12 15 11
```

Chapter 4

Day 1 Practice

We describe our methods in this chapter.

Math can be added in body using usual syntax like this

4.1 math example

p is unknown but expected to be around $1/3$. Standard error will be approximated

$$SE = \sqrt{\left(\frac{p(1-p)}{n}\right)} \approx \sqrt{\frac{1/3(1-1/3)}{300}} = 0.027$$

You can also use math in footnotes like this¹.

We will approximate standard error to 0.027^2

¹where we mention $p = \frac{a}{b}$

² p is unknown but expected to be around $1/3$. Standard error will be approximated

$$SE = \sqrt{\left(\frac{p(1-p)}{n}\right)} \approx \sqrt{\frac{1/3(1-1/3)}{300}} = 0.027$$

Chapter 5

Day 2

Some *significant* applications are demonstrated in this chapter.

5.1 Example one

5.2 Example two

Chapter 6

Day 2 Practice

We have finished a nice book.

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2024). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.39.