

Rmarkdown-Template for Labs

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Name of Participants (can be multiple line like title)

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Introduction / Problem Definition

The goal of this report is to show case formatting syntax of R Markdown for authoring lab reports. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

Prerequisites

To be able to use R Markdown, an installation of R software is essential; use one of these CRAN Mirrors to find an appropriate installation file.

Although not necessary, it is highly recommended that RStudio, an integrated development environment (IDE) for R (and Python!), is also installed: the free RStudio Desktop version is sufficient.

Finally, if not installed, these packages need to be installed:

- knitr
- rmarkdown

The following code **chunk**, named `loadPackages` shows how to run an R code to perform some tasks, and generate some outputs for inclusion in the final document.

```
cat('Loading knitr and rmarkdown packages . . .')
```

```
## Loading knitr and rmarkdown packages . . .
```

```
if(!require("knitr")){  
  # if failed to load knitr, install it  
  install.packages("knitr")  
  # then load it  
  library("knitr")  
}
```

```
## Loading required package: knitr
```

```
if(!require("rmarkdown")){  
  # if failed to load rmarkdown, install it  
  install.packages("rmarkdown")  
  # then load it  
  library("rmarkdown")  
}
```

```
## Loading required package: rmarkdown
```

```
cat('Loading knitr and rmarkdown packages done.\n')
```

```
## Loading knitr and rmarkdown packages done.
```

NOTE: These packages are not required to be loaded explicitly in an R Markdown file, since they are only used to turn an R Markdown file into a PDF or HTML. In Rstudio, the conversion is automatically performed via **knitr** button located on the top of the code pane.

There are many other packages that are used in pre-processing, summarizing, and visualizing data, or performing statistical analysis; those packages can be loaded in the beginning of the file or are needed.

Capabilities

So far, we have seen how code and text can be combined in an R Markdown text file (having a file extension of Rmd) to create a document.

In the rest of this template, examples of other capabilities are shown. In these examples, it is assumed that the document is generated in Rstudio.

Adding an Image

The following image shows the folder structure used for this lab-template:

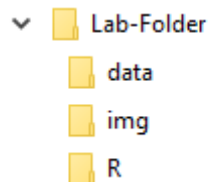


Figure 1: Folder Structure

This Rmd file is located in **R** folder, image files used here (like the one above) are located in **img** folder, data files are located in **data** folder. All these folders are located under **Lab-Folder**.

Instead of embedding an image, a link to it can be provided; here is a link to the same Folder Structure.

Adding formula

Simple LaTeX commands can be used as inline formulas, like $\hat{y} = b_0 + b_1x$, or displayed formulas

$$\bar{x} = \sum_{i=1}^n \frac{x_i}{n}.$$

Images of formulas, be it produced by online tools (like atomurl.net/math) or handwritten, could be a quick substitute for typing equations for novices.

Data Structure and Summaries

There are many internal datasets in R that can be used right away; for example, `cars` contains the information on speed and stopping distance of some cars from 1977. Here is how to show the structure of the dataset:

```
str(cars)
```

```
## 'data.frame':  50 obs. of  2 variables:
## $ speed: num  4 4 7 7 8 9 10 10 10 11 ...
## $ dist : num  2 10 4 22 16 10 18 26 34 17 ...
```

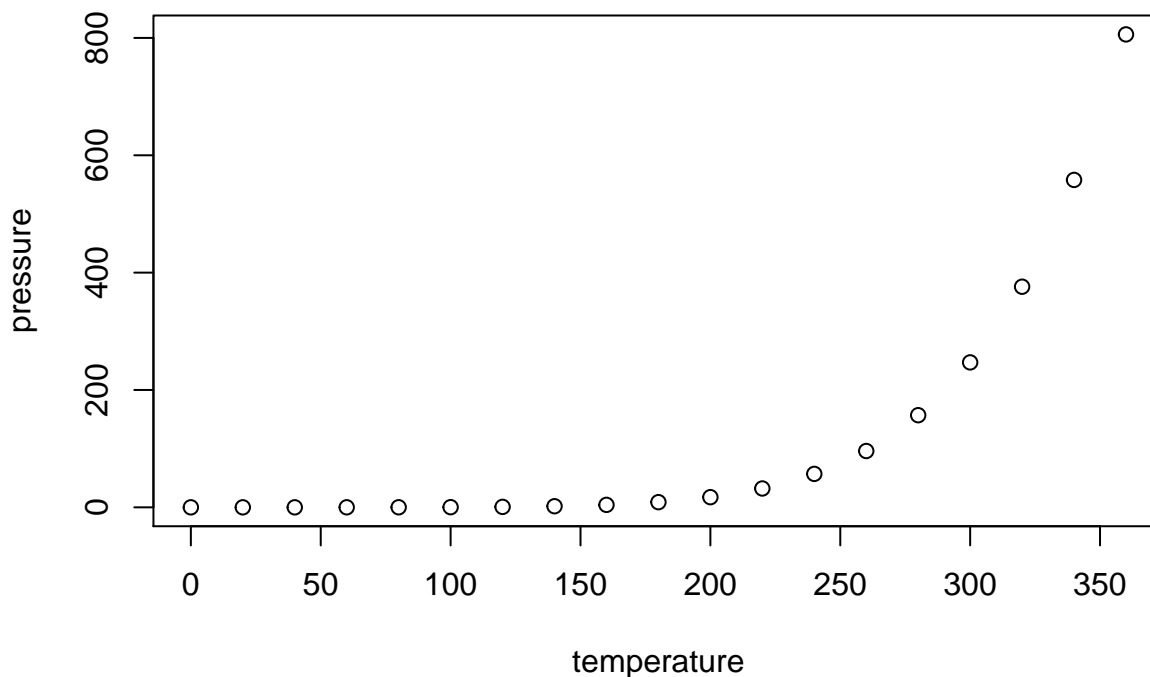
and its summaries:

```
summary(cars)
```

```
##      speed      dist
## Min.   : 4.0    Min.   :  2.00
## 1st Qu.:12.0    1st Qu.: 26.00
## Median :15.0    Median : 36.00
## Mean   :15.4    Mean   : 42.98
## 3rd Qu.:19.0    3rd Qu.: 56.00
## Max.   :25.0    Max.   :120.00
```

Including Plots

Another example of an internal dataset is `pressure` that contains vapor pressure of mercury as a function of temperature. The following code chunk shows how a plot can be produced while printing of the code is prevented by adding `echo=FALSE` option.



Reading Data

When an external is needed to be used, R can read data from a local file; for example:

```
x = read.csv(file = '../data/CheeseTaste.csv', header = TRUE)
head(x)
```

```
##   i..taste acetic   h2s lactic
## 1    12.3  4.543 3.135   0.86
## 2    20.9  5.159 5.043   1.53
## 3    39.0  5.366 5.438   1.57
## 4    47.9  5.759 7.496   1.81
## 5     5.6  4.663 3.807   0.99
## 6    25.9  5.697 7.601   1.09
```

R can also read files online from a given url; for example, `bac` (bear alcohol content) is a CSV file on OpenIntro site:

```
y = read.csv(file = 'https://www.openintro.org/data/csv/bac.csv',
             header = TRUE)
```

Conclusion

R markdown is a flexible and powerful tool for generating reproducible documents.

This tool can produce reports in HTML, PDF and even (perhaps) MS Word formats.