Statistical Computing
Lab R Notes Examples

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What is R?

- R is a programming language and software environment for statistical computing and graphics.
- It is widely used for data analysis, statistical modeling, and visualization.
- Open-source and supported by a vast community of users and contributors.

Getting Started with R

- Install R from https://cran.r-project.org/.
- Install RStudio, an Integrated Development Environment (IDE) for R, from https://posit.co/products/open-source/rstudio/.
- Basic workflow in RStudio:
  1. Write code in the script editor.
  2. Run code in the console.
  3. View results in the environment and plots tabs.

Basic Syntax in R

```r
# Assigning values to variables
x <- 5
y <- 10

# Basic operations
z <- x + y

# Display the result
print(z)

# Built-in functions
mean(c(1, 2, 3, 4, 5))
sd(c(1, 2, 3, 4, 5))

# Generating random data
rnorm(5, mean = 0, sd = 1)  # Normal distribution
runif(5, min = 0, max = 1)  # Uniform distribution
rpois(5, lambda = 2)        # Poisson distribution
```

What is R Markdown?

- A framework for creating dynamic documents that combine code, text, and visualizations.
- Output formats include HTML, PDF, and Word.
- Ideal for reproducible research and reporting.

Installing R Markdown in RStudio

1. Open RStudio.
2. Install the `rmarkdown` package by running the following command in the console:

```
install.packages("rmarkdown")
```

3. Once installed, you can create R Markdown documents via `File > New File > R Markdown`.

Creating an R Markdown Document

1. Open RStudio and go to `File > New File > R Markdown`.
2. Fill in the title, author name, and select the desired output format (e.g., HTML).
3. A template document will be created with default sections.

Structure of an R Markdown File

- YAML Header:

```
---
title: "My Document"
author: "Your Name"
output: html_document
---
```

- Text and Markdown syntax for formatting.
- Code chunks:

````
```{r}
# R code goes here
summary(cars)
```
````

Running and Rendering R Markdown

1. Write text and code in the R Markdown editor.
2. Click the `Knit` button to render the document.
3. View the output in the chosen format (HTML, PDF, or Word).

Example output after rendering:

- Text sections.
- Inline code results (e.g., `` `r 2+2` `` outputs `4`).
- Graphs and tables generated by R.

Example R Markdown Code

````
---
title: "Example Analysis"
author: "Your Name"
output: html_document
---

## Introduction

This is an example of an R Markdown document.

```{r}
# Load the cars dataset
data(cars)

# Summary of the dataset
summary(cars)

# Plot the data
plot(cars)
````
````

Example R Markdown Code

```
    # Generating random data
    set.seed(123)
    rnorm(10, mean = 0, sd = 1)   # Normal distribution
    runif(10, min = 0, max = 1)   # Uniform distribution
    rpois(10, lambda = 3)         # Poisson distribution
    ```
```
```

Why Use R Markdown?

- Combines analysis and reporting in a single document.
- Encourages reproducible research.
- Flexible output formats for sharing results.
- Easy to integrate code, text, and visuals seamlessly.