# Practical exercises - Google Colab

(if not possible in the lab, try them on your own device.

## Exercise 1: Getting Started with Google Colab

1. **Task:** Open Google Colab by visiting colab.research.google.com.
2. **Task:** Create a new notebook titled "Introduction to Google Colab."
3. **Task:** Write a Python script in a code cell that prints "Hello, Colab!" and run the cell
4. **Task:** Add a markdown cell that explains what the notebook is about.

## **Exercise 2: Utilising Google Colab’s Features**

1. **Task:** Enable GPU support for your notebook.
   * **Instructions:** Go to "Runtime" > "Change runtime type" > Select "GPU" under "Hardware accelerator" > Save.
2. **Task:** Write a Python script that generates a random array using NumPy and multiplies it by 10.
3. **Task:** Install the matplotlib library and create a simple plot.

## Exercise 3: Collaborating on Google Colab

1. **Task:** Share your notebook with a classmate or colleague via Google Drive.
   * **Instructions:** Click "Share" in the top-right corner of the notebook and enter their email address.
2. **Task:** Collaborate on the same notebook by having both of you edit different cells simultaneously.
3. **Task:** Use the "Revision History" feature to view and revert changes.

## Exercise 4: Advanced Google Colab Usage

1. **Task:** Connect your Google Drive to the notebook and list all files in a specific folder.
2. **Task:** Create a new file in your Google Drive from Colab and write some text to it.

## How to use R with Google Colab

Google Colab primarily supports Python, but it can also be configured to run R. The following tasks will guide you through setting up and using R in Colab, performing basic operations, and leveraging R's powerful data analysis capabilities.

**Practical Task 1: Setting Up R in Google Colab**

**Task 1.1: Create a New Colab Notebook**

* **Instructions:**
  + Open Google Colab.
  + Sign in with your Google account.
  + Create a new notebook by clicking on "New Notebook."

**Task 1.2: Set Up R Kernel in Google Colab**

* **Instructions:**
  + Google Colab uses the IPython kernel by default. To run R code, you'll need to install the R kernel using the following commands.
  + Create a new code cell and run the following code to install R and essential R packages:

python

Copy code

# Install R and necessary packages

!apt-get install -y r-base

!R -e "install.packages('IRkernel'); IRkernel::installspec(user = FALSE)"

* **Explanation:** This installs the base R language and the IRkernel, which allows you to run R code in Colab.

**Task 1.3: Switch to R Kernel**

* **Instructions:**
  + After installing the R kernel, switch to it by selecting "Runtime" > "Change runtime type."
  + Under "Runtime type," select "R" from the "Runtime" dropdown menu and click "Save."

**Practical Task 2: Writing and Running R Code in Google Colab**

**Task 2.1: Write and Execute Simple R Code**

* **Instructions:**
  + In your notebook, write a simple R script that prints "Hello, R in Colab!".
  + Create a new code cell and enter the following R code:

r

Copy code

print("Hello, R in Colab!")

* **Task:** Run the cell by clicking the "Run" button or pressing Shift + Enter.

**Task 2.2: Perform Basic Mathematical Operations in R**

* **Instructions:**
  + Create a new code cell and write R code to perform basic arithmetic operations.
  + Use the following R code:

r

Copy code

a <- 5

b <- 3

# Addition

addition <- a + b

print(paste("Addition: ", addition))

# Subtraction

subtraction <- a - b

print(paste("Subtraction: ", subtraction))

# Multiplication

multiplication <- a \* b

print(paste("Multiplication: ", multiplication))

# Division

division <- a / b

print(paste("Division: ", division))

* **Task:** Run the cell and observe the output.

**Practical Task 3: Working with Data in R**

**Task 3.1: Load and Inspect a Dataset in R**

* **Instructions:**
  + Use R's built-in mtcars dataset for analysis.
  + Create a new code cell and write the following R code to load and inspect the dataset:

r

Copy code

# Load the mtcars dataset

data("mtcars")

# Display the first few rows of the dataset

head(mtcars)

* **Task:** Run the cell and inspect the output.

**Task 3.2: Perform Basic Data Manipulation**

* **Instructions:**
  + Create a new code cell to perform data manipulation on the mtcars dataset.
  + Use the following R code to calculate the mean miles per gallon (mpg) for cars with more than 6 cylinders:

r

Copy code

# Filter the dataset for cars with more than 6 cylinders

cars\_over\_6\_cyl <- subset(mtcars, cyl > 6)

# Calculate the mean mpg for these cars

mean\_mpg <- mean(cars\_over\_6\_cyl$mpg)

print(paste("Mean MPG for cars with more than 6 cylinders: ", mean\_mpg))

* **Task:** Run the cell and observe the output.

**Practical Task 4: Visualizing Data in R**

**Task 4.1: Create a Basic Plot**

* **Instructions:**
  + Create a new code cell to generate a basic scatter plot using the plot() function in R.
  + Use the following R code:

r

Copy code

# Scatter plot of horsepower (hp) vs. miles per gallon (mpg)

plot(mtcars$hp, mtcars$mpg,

main = "Scatter plot of HP vs MPG",

xlab = "Horsepower",

ylab = "Miles Per Gallon",

pch = 19, col = "blue")

* **Task:** Run the cell to generate the plot.

**Task 4.2: Create a More Advanced Plot Using ggplot2**

* **Instructions:**
  + Install the ggplot2 package and create a more advanced plot.
  + Create a new code cell and run the following R code:

r

Copy code

# Install ggplot2 package

install.packages("ggplot2")

library(ggplot2)

# Create a ggplot

ggplot(mtcars, aes(x = hp, y = mpg)) +

geom\_point(color = "blue", size = 3) +

geom\_smooth(method = "lm", col = "red") +

labs(title = "HP vs MPG with Linear Regression Line",

x = "Horsepower",

y = "Miles Per Gallon")

* **Task:** Run the cell to generate the advanced plot.

**Practical Task 5: Saving and Sharing Your R Work**

**Task 5.1: Save Your Notebook to Google Drive**

* **Instructions:**
  + Ensure your notebook is saved in Google Drive by clicking "File" > "Save" or "Save a copy in Drive."
  + Verify that the notebook is accessible from your Google Drive.

**Task 5.2: Export Your Notebook as a PDF**

* **Instructions:**
  + To share your notebook with others, export it as a PDF by clicking "File" > "Print" and selecting "Save as PDF."