

R Programming Week 1 - Homework

Lab 1: Getting Started with R and Data Loading

Objective: In this lab, you will be introduced to R, RStudio, and data loading methods. By the end of this lab, you should be able to install and set up R and RStudio, load data from a CSV file, and perform a basic exploration of the dataset.

Activity 1: Installation and Setup (5 minutes)

Task: Follow the steps below to install R and RStudio, and configure your environment.

1. Step 1: Install R

- Visit the [CRAN R Project website](#), and download the correct version of R for your operating system (Windows, Mac, or Linux).
- Complete the installation by following the prompts on your screen.

2. Step 2: Install RStudio

- Go to [RStudio's download page](#) and download the free version of RStudio Desktop.
- After downloading, install RStudio by following the on-screen instructions.

3. Step 3: Configure RStudio

- Once installed, open RStudio. To configure your settings, go to **Tools > Global Options**.
- Adjust paths, appearance (you can change themes), and other preferences to suit your needs.
- Now you're ready to begin working in RStudio.

Activity 2: Exploring the RStudio Interface (10 minutes)

Task: In this activity, you'll explore the different components of the RStudio interface and familiarize yourself with how to run commands in R.

1. Step 1: Console and Source Panel

- The **Console** is where you'll enter R commands and see the results immediately. Try typing `2 + 2` and pressing **Enter**. You should see the answer `4` displayed below.
- The **Source Panel** is where you'll write and save R scripts for later use. Open a new script by clicking **File > New File > R Script**. Here, you can write longer pieces of code.

2. Step 2: Environment, History, and Files Tabs

- The **Environment** tab will show you all the variables and data loaded into your workspace.
- The **History** tab keeps track of all commands you've run during your session.
- The **Files** tab displays files in your working directory, where you can access and open data files.

3. Step 3: Running Basic Commands

- In the **Console**, type `print("Hello, World!")` and press **Enter** to see the output.
- In the **Source Panel**, type the same command, but this time click **Run** or press **Ctrl + Enter** to execute the script. This is how you'll run scripts throughout the course.

Activity 3: Loading Data (15 minutes)

Task: Next, you will load data from a CSV file into R using two different methods: `read.csv()` and `read_csv()` from the `readr` package.

1. Step 1: Load Data Using `read.csv()`

- Download the provided dataset:

`Drinking_Water_Quality_Distribution_Monitoring_Data_<date downloaded>.csv`.

Access data set at:

https://data.cityofnewyork.us/Environment/Drinking-Water-Quality-Distribution-Monitoring-Dat/bkwf-xfkj/about_data

-Click the “Export” button in the upper right hand corner of the page.

-In the “Export dataset” dialog box that pops up, make sure the “Download file” box is blue.

-In the Export format drop down, select CSV and click the “Download” button in the lower right.

- Save the file in your working directory (you can check your working directory by running `getwd()` in the Console).

- Load the data by running:
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- Confirm the data has loaded by running `head(dataset)` to display the first few rows of the dataset.

2. Step 2: Load Data Using `read_csv()`

- First, install the `readr` package if you haven’t done so already:
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- Now, use the `read_csv()` function to load the data:
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- Again, use `head(dataset)` to check that the data loaded correctly.

Activity 4: Exploring the Dataset (15 minutes)

Task: In this activity, you'll explore the structure of the dataset and learn how to identify missing values.

1. Step 1: Examine the Structure

- To better understand the dataset, use the `str()` function to check the structure of the dataset:
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This command will show you the different data types in each column (e.g., numbers, text).

2. Step 2: View a Summary of the Data

- Use the `summary()` function to get summary statistics for the numeric columns in the dataset:
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- The summary will provide information like the minimum, median, and maximum values for columns like pH, chlorine, and turbidity levels.

3. Step 3: Identify Missing Values

- To check if there are any missing values in the dataset, run:
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This will count the total number of missing values in the dataset.

- To view the rows with missing values, use:
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Lab 2: Data Manipulation Techniques

Objective: This lab will teach you how to manipulate data in R using packages like dplyr and tidyr. You'll learn how to clean, filter, and transform your data.

Activity 1: Basic Data Structures (10 minutes)

Task: In this activity, you'll practice working with basic R data structures like vectors and data frames.

1. Step 1: Access Columns as Vectors

- In a dataset, each column is a vector. To access the `Residual Free Chlorine (mg/L)` column from the dataset, run:
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2. Step 2: Access Specific Rows

- You can access specific rows and columns of a data frame by specifying the row and column indices. For example, to get the first 10 rows of the dataset:
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3. Step 3: Create a List

- Lists can contain different data types. Create a list with `Residual Free Chlorine (mg/L)` and `E.coli(Quanti-Tray) (MPN/100mL)` values:
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Activity 2: Basic Data Cleaning (15 minutes)

Task: In this activity, you'll learn how to handle missing data and clean the dataset.

1. Step 1: Remove Rows with Missing Data

- To remove rows that contain missing values, use the `na.omit()` function:

Check to see if clean (It should return 0):

2. Step 2: Fill Missing Values in a Specific Column

- Sometimes, rather than removing missing data, you'll want to fill it in. For example, fill in missing chlorine values with the mean chlorine value:

How many missing values are there:

Replace missing values:

How many missing values are there after the replace:

Activity 3: Introduction to Piping (10 minutes)

Task: This activity will teach you how to use the pipe operator (%>%) to make your code easier to read and write.

1. Step 1: Install and Load dplyr

- If you haven't installed dplyr, do so now:
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- Load the package with:
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2. Step 2: Use Pipes for Cleaner Code

- Pipes allow you to chain together multiple operations. Here's how to select two columns (pH and chlorine) and filter for rows where pH is greater than 7:
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Activity 4: Advanced Data Manipulation (10 minutes)

Task: This activity will introduce more advanced data manipulation techniques, including summarizing and grouping data.

1. Step 1: Select and Filter Data

- Select specific columns from the dataset:

```
selected_data <- dataset %>% select(`Residual Free Chlorine  
(mg/L)`, `Fluoride (mg/L)`, `Turbidity (NTU)`)
```

```
selected_data %>% print(n=200)
```

- Filter the dataset for rows where chlorine levels are above 0.5:
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2. Step 2: Group and Summarize Data

- Group the data by monitoring site and calculate the mean pH for each group:
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