

## Getting Started with R

### Introduction to R Programming

- Overview of R as a statistical programming language.
- Downloading and installing R.
- Setting up the R environment.
- Introduction to the R console.

### Basics of R Programming

- Basics of R scripting.
- Interactivity and Code Execution

### Variables and Data Types

- Variables and Assignments
- Atomic Data Types in R (Numeric, Integer, Logical, Character)
- Printing Output

### Operators in R

- Arithmetic Operators
- Logical Operators
- Comparison Operators
- Assignment Operators

## Data Structures in R

### Vectors

- Creating vectors using `c()`
- Indexing and subsetting vectors in R
- Operations on Vectors
- Understanding vectorized operations and efficiency

## Matrices

- Creating matrices using `matrix()`
- Basic matrix operations: addition, subtraction, multiplication
- Transposing matrices
- Indexing and Subsetting Matrices

## Lists

- Creating lists with `list()`
- Nested lists and their components
- Indexing and extracting values from lists.
- Manipulating list components.

## Arrays

- Creating arrays using `array()`
- Manipulating and transforming array data.
- Indexing and subsetting multidimensional arrays.

## Data Frames

- Introduction to Data Frames
- Manipulating Data Frames

- Indexing, filtering, and subsetting data frames
- Applying functions to columns.
- Aggregating and summarizing data.

## Factors

- Categorical data representation with factors
- Modifying and Working with Ordinal Factors in R
- Merging and Simplifying Factor Levels in R
- Converting factors to other data types.

## Control Structures in R

### Conditional Statements

- Basic if and else statements
- else if and multiple conditions
- Vectorized conditions with ifelse()

### Loops in R

- For Loop
- Nested For Loops
- break and next statements.
- While Loop
- Repeat Loop

## Functions in R

### Introduction to Functions

- Writing custom functions using `function()`
- Parameters, return values, and scope
- Error Handling in Functions

### Built-in Functions

- Commonly used functions: `sum()`, `mean()`, `sd()`, `length()`
- Applying functions to vectors and data frames

### Recursion

- Recursive Functions
- Handling Recursion Limits

### Anonymous Functions

- Creating Anonymous Functions
- Functional programming with `apply()`, `lapply()`, `sapply()`, `mapply()`

## Data Manipulation and Cleaning

### Working with Strings

- String manipulation
- Regular expressions in R

## Data Cleaning

- Handling missing values with `is.na()` and `na.omit()`
- Data type conversions

## Reshaping Data

- Reshaping data frames with `reshape()`, `melt()`, `cast()`
- Aggregating data using `aggregate()`, `apply()`

## Data Import and Export

- Reading data from CSV, Excel, and other formats: `read.csv()`, `read.xlsx()`, `read.table()`, `read.delim()`, `readLines()` etc.
- Writing data to files: `write.csv()`, `write.xlsx()` etc.

## Data Visualization in R

### Introduction to Plotting

- Base R plotting functions: `plot()`, `hist()`, `boxplot()`
- Customizing plots (titles, labels, colors)
- Saving plots to file (PDF, PNG)

### Visualizations with ggplot2

- Introduction to the ggplot2 package
- Creating scatter plots, bar plots, histograms, and more
- Aesthetic Mapping

- Faceting in ggplot2: Splitting Data into Subplots
- Themes in ggplot2

## **3 D Visualizations**

- Introduction to 3D visualization
- Generating 3D scatter plots, surface plots
- Use cases of 3D visualization for complex data analysis
- Manipulating 3D graphics for deeper insight into multi-dimensional data

## **Statistical Analysis in R**

### **Introduction to R Statistics**

- Overview of R as a tool for statistical analysis
- Importance of R in data science and its wide use in statistical tasks
- Calculating summary statistics: mean, median, variance, standard deviation
- Creating frequency tables and cross-tabulations

### **Probability Distributions in R**

- Normal Distribution in R
- Plot Normal Distribution over Histogram in R
- How to Test for Normality in R
- Binomial Distribution in R Programming

## Hypothesis Testing

- Introduction to hypothesis testing concepts
- T-tests, Chi-squared tests
- Understanding when and why to use ANOVA
- Performing One-Way ANOVA with `aov()` in R for basic analysis
- Understanding When and Why to Use Two-Way ANOVA

## Descriptive Statistics and Resampling Techniques

- Bootstrapping in R: A Powerful Resampling Technique
- Skewness in R Programming
- Kurtosis in R Programming
- Central Tendency in R Programming

## Introduction to Machine Learning in R

### Overview of Machine Learning

- How Machine Learning Works?
- Classification Of Machine Learning
- Setting Up R for Machine Learning

### Data Preprocessing for Machine Learning

- Data Cleaning and Transformation
- Splitting Data into Training and Testing Sets
- Feature Selection

## Supervised Learning Algorithms

- Decision Trees, Random Forests
- Support Vector Machines (SVM) in R
- K-Nearest Neighbors (KNN) in R
- Linear and Ridge Regression
- AdaBoost Algorithm

## Unsupervised Learning Algorithms

- K-Means Clustering in R: Grouping Data Made Simple!
- Hierarchical Clustering: Building Groups Step-by-Step
- Dendrogram interpretation.
- Principal Component Analysis (PCA): Unveiling Patterns in Complex Data

## Model Evaluation

- Understanding the Confusion Matrix, Precision, Recall, and F1-Score
- Understanding ROC Curves and AUC (Area Under Curve):
- Mean squared error (MSE), R-squared

## Module: NLP in R

### Introduction to Natural Language Processing (NLP)

- What is NLP?
- Setting Up R for NLP



## **Data Preprocessing for NLP**

- Removing Punctuation, Numbers, and Stop Words
- Tokenization
- Stemming and Lemmatization

## **Text Mining and Analysis in NLP**

- Visualizing Text Data with Word Clouds
- Analyzing N-grams
- Bag-of-Words Model
- Term Frequency-Inverse Document Frequency (TF-IDF)
- Word Embeddings (e.g., Word2Vec, GloVe)

## **Module: Web Scraping in R**

### **Introduction to Web Scraping in R**

- Overview of Web Scraping
- Tools and Packages for Web Scraping in R (Web scraping Packages rvest, httr, xml2)

### **Scraping Static Web Pages with rvest**

- Understanding HTML and DOM Structure
- Extracting HTML Elements with CSS Selectors
- Scraping Tables and Lists
- Scraping Text and Attributes

## Handling More Complex Web Scraping Scenarios

- Handling Pagination
- Understanding REST APIs
- Making API Requests with http
- Parsing JSON Data in R