



# R PROGRAMMING PRACTICAL MANUAL

**Course Title: R- Programming**

**Couse Code: MAT-1103SE**

**Software Used: R / RStudio**

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## **UNIT 1: Getting Started with R – The Statistical Programming Language**

### **Practical 1: Using R as a Calculator**

**Objective:** To perform basic arithmetic and mathematical operations in R.

**R Code:**

```
# Arithmetic operations
2 + 5
10 - 3
8 * 4
20 / 5
3^2
sqrt(49)
log(10)
exp(2)

# Assigning and using variables
x <- 25
y <- 10
z <- x + y
z
```

**Output:**

Basic mathematical results and variable assignments.

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### **Practical 2: Exploring Data and Relationships in R**

**Objective:** To create and analyze relationships between data objects.

**R Code:**

```
# Creating vectors
height <- c(150, 160, 170, 180, 190)
weight <- c(50, 60, 70, 80, 90)

# Relationship (linear model)
relation <- lm(weight ~ height)
relation

# Plot relationship
plot(height, weight, main="Height vs Weight", xlab="Height",
ylab="Weight", col="blue", pch=19)
abline(relation, col="red")
```

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### Practical 3: Reading and Getting Data into R

**Objective:** To import data using combine and scan commands.

**R Code:**

```
# Using combine
marks <- c(65, 75, 80, 55, 90)
marks

# Using scan
ages <- scan()
# (Enter numbers manually and press Enter twice)
ages
```

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### Practical 4: Viewing and Removing Objects

**Objective:** To view and manage objects in R workspace.

**R Code:**

```
# View all objects
ls()

# Remove a specific object
rm(ages)

# Remove all objects
rm(list = ls())
```

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### Practical 5: Data Types and Structures

**Objective:** To understand different data structures in R.

**R Code:**

```
# Numeric, character, and logical data
num <- 10
char <- "R Programming"
logi <- TRUE

# Check types
class(num)
class(char)
class(logi)

# Structures
v <- c(1, 2, 3, 4)
m <- matrix(1:6, nrow=2)
l <- list(Name="Ravi", Age=21, Marks=c(80,85,90))
df <- data.frame(Name=c("A", "B"), Marks=c(85,90))

v; m; l; df
```

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### Practical 6: Working with History and Saving Work

**Objective:** To use history commands and save R scripts/workspace.

**R Code:**

```
# View command history
history()

# Save command history
savehistory(file = "my_history.Rhistory")

# Save workspace
save.image(file = "my_workspace.RData")
```

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## Practical 7: Manipulating Vectors, Matrices, Data Frames and Lists

**Objective:** To perform manipulations on data structures.

**R Code:**

```
# Vectors
v <- c(2, 4, 6, 8)
v[2] <- 10
v

# Matrices
m <- matrix(1:9, nrow=3)
m[1,2]

# Data Frame
df <- data.frame(Name=c("Amit", "Riya"), Age=c(20,21))
df$Marks <- c(85,90)
df

# Lists
l <- list(A=1:3, B=matrix(1:4, nrow=2))
l$A
```

---

## Practical 8: Constructing and Converting Data Objects

**Objective:** To convert data between structures.

**R Code:**

```
v <- 1:6
m <- matrix(v, nrow=2)
df <- as.data.frame(m)
l <- as.list(df)

class(v)
class(m)
class(df)
class(l)
```

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## UNIT 2: Descriptive Statistics and Tabulation

## Practical 9: Summary Statistics for Vectors

**Objective:** To compute descriptive statistics for a vector.

**R Code:**

```
marks <- c(45, 67, 89, 78, 56, 90, 66)
mean(marks)
median(marks)
var(marks)
sd(marks)
summary(marks)
```

---

## Practical 10: Summary Statistics for Data Frames

**Objective:** To use summary commands for data frames.

**R Code:**

```
students <- data.frame(
  Name=c("Amit", "Rekha", "Suresh", "Nita"),
  Age=c(20, 21, 22, 23),
  Marks=c(85, 90, 75, 88)
)
summary(students)
```

---

## Practical 11: Summary Statistics for Matrices and Lists

**Objective:** To summarize data in matrices and lists.

**R Code:**

```
# Matrix
m <- matrix(1:9, nrow=3)
summary(m)

# List
l <- list(A=c(2, 4, 6), B=c(1, 3, 5))
lapply(l, summary)
```

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## Practical 12: Creating Summary Tables

**Objective:** To create frequency and summary tables.

**R Code:**

```
gender <- c("M", "F", "M", "F", "F", "M")
table(gender)

marks <- c(45, 55, 65, 75, 85, 95)
cut_marks <- cut(marks, breaks=c(0, 50, 70, 90, 100))
table(cut_marks)
```

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## UNIT 3: Distribution of Data

### Practical 13: Stem and Leaf Plot

**Objective:** To represent data using a stem-and-leaf plot.

**R Code:**

```
marks <- c(45, 67, 89, 78, 56, 90, 66)
stem(marks)
```

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#### **Practical 14: Histogram and Density Plot**

**Objective:** To visualize data distribution.

**R Code:**

```
marks <- c(45, 67, 89, 78, 56, 90, 66, 74, 83, 92)
hist(marks, main="Histogram of Marks", xlab="Marks",
     col="lightblue")
lines(density(marks), col="red")
```

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#### **Practical 15: Normality Tests (Shapiro-Wilk & Kolmogorov-Smirnov)**

**Objective:** To check whether data follows normal distribution.

**R Code:**

```
marks <- c(45, 67, 89, 78, 56, 90, 66)

# Shapiro-Wilk test
shapiro.test(marks)

# Kolmogorov-Smirnov test
ks.test(marks, "pnorm", mean=mean(marks), sd=sd(marks))
```

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### **UNIT 4: Graphical Analysis with R**

#### **Practical 16: Box-Whisker Plot**

**Objective:** To visualize data spread using boxplot.

**R Code:**

```
marks <- c(45, 67, 89, 78, 56, 90, 66)
boxplot(marks, main="Boxplot of Marks", col="pink")
```

---

#### **Practical 17: Scatter Plot and Pairs Plot**

**Objective:** To plot relationships between variables.

**R Code:**

```
height <- c(150, 160, 170, 180, 190)
weight <- c(50, 60, 70, 80, 90)
plot(height, weight, main="Height vs Weight", xlab="Height",
     ylab="Weight", col="blue", pch=19)

# Pair plot
pairs(~height+weight)
```

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## Practical 18: Line and Pie Charts

**Objective:** To plot line and pie charts.

### R Code:

```
x <- c(1,2,3,4,5)
y <- c(10,20,15,25,30)
plot(x, y, type="l", main="Line Chart", xlab="X", ylab="Y",
col="green")

subjects <- c("Maths","Science","English","History")
marks <- c(80,70,90,85)
pie(marks, labels=subjects, main="Marks Distribution",
col=rainbow(4))
```

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## Practical 19: Cleveland Dot and Bar Charts

**Objective:** To plot dot and bar charts.

### R Code:

```
marks <- c(85,78,92,74,88)
names(marks) <- c("A","B","C","D","E")

# Cleveland dot chart
dotchart(marks, main="Cleveland Dot Chart", xlab="Marks")

# Bar chart
barplot(marks, main="Bar Chart of Marks", col="lightgreen")
```

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## Practical 20: Saving and Exporting Graphs

**Objective:** To save graphics to external files.

### R Code:

```
png("barplot.png")
barplot(marks, main="Bar Chart of Marks", col="lightgreen")
dev.off()

jpeg("scatter.jpg")
plot(height, weight, main="Height vs Weight", col="blue")
dev.off()
```

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- ✔ **Total Practicals:** 20 (covering all 4 units exactly as in syllabus)
- ✔ **Software:** R / RStudio
- ✔ **Data Sources:** Can use built-in or <https://data.gov.in/> datasets