**Loops in R Programming**

**1. Introduction to Loops**

Loops are used in R to execute a block of code multiple times. They help automate repetitive tasks and process large datasets efficiently.

**2. Types of Loops in R**

**a. for Loop**

Used when the number of iterations is known.

**Syntax:**

for (variable in sequence) {

# Code to execute

}

**Example:**

for (i in 1:5) {

print(paste("Iteration:", i))

}

**b. while Loop**

Executes a block of code while a condition remains TRUE.

**Syntax:**

while (condition) {

# Code to execute

}

**Example:**

x <- 1

while (x <= 5) {

print(paste("Value of x:", x))

x <- x + 1

}

**c. repeat Loop**

Executes a block of code indefinitely until explicitly stopped using break.

**Syntax:**

repeat {

# Code to execute

if (condition) {

break

}

}

**Example:**

x <- 1

repeat {

print(paste("Value of x:", x))

x <- x + 1

if (x > 5) {

break

}

}

**3. Controlling Loop Execution**

**a. break Statement**

Exits a loop immediately.

**Example:**

for (i in 1:10) {

if (i == 6) {

break

}

print(i)

}

**b. next Statement**

Skips the current iteration and proceeds to the next.

**Example:**

for (i in 1:10) {

if (i %% 2 == 0) {

next

}

print(i)

}

**4. Looping Over Data Structures**

**a. Looping Through a Vector**

vec <- c(10, 20, 30, 40)

for (value in vec) {

print(value)

}

**b. Looping Through a List**

lst <- list(a = 1, b = 2, c = 3)

for (item in lst) {

print(item)

}

**c. Looping Through a Matrix**

mat <- matrix(1:9, nrow = 3)

for (i in 1:nrow(mat)) {

for (j in 1:ncol(mat)) {

print(mat[i, j])

}

}

**5. Practice Problems**

**Problem 1:** Write a loop to print the first 10 natural numbers.

**Problem 2:** Use a while loop to calculate the sum of numbers from 1 to 100.

**Problem 3:** Write a for loop to print all even numbers from 1 to 50.

**Problem 4:** Write a loop to compute the factorial of a number (n!).

**Problem 5:** Iterate through a dataframe and print the names of all columns.