**Theory Assignment on R Programming**

**Section A**

1. What is R? Mention two advantages of using it.
2. Differentiate between a **script** and a **console command** in R.
3. Define operator precedence. Give one example.
4. List any four data types in R with one example each.
5. Write one difference between a **vector** and a **list**.
6. What is the difference between a **matrix** and an **array** in R?
7. Give one example of using a **relational operator** in R.
8. Differentiate between break and next statements in R.
9. State the purpose of install.packages() function.
10. What is the difference between a **built-in function** and a **user-defined function** in R?

**Section B – Data Structures & Operators**

1. Create a numeric vector of length 10. Write R code to:

* Replace all even numbers with their squares
* Remove the 5th element
* Display the final vector

1. Construct a list containing:

* Student names (vector of 4 names)
* A vector of marks in 3 subjects
* A logical vector showing pass/fail (marks > 40)  
  Write R code to access:
* The marks of the 2nd student
* The pass/fail status of the 3rd student

1. Create a **4×4 matrix** with numbers 1–16 filled by rows. Write R code to:

* Extract the 2nd row as a vector
* Replace the 3rd column with all 0s
* Calculate row-wise sums

1. Create a **3D array of size 3×3×2** filled with random numbers. Write code to:

* Display the 2nd matrix
* Calculate the column sums of the 1st matrix

1. Demonstrate operator precedence in R with an example where results differ due to parentheses. Explain why the output differs.
2. Write an R program to merge two vectors and remove duplicates.
3. Create a character vector of 5 words. Convert all words to uppercase and sort them alphabetically.
4. Construct a list that contains a student’s name, roll number, and marks. Modify the marks and display the updated list.
5. Write an R program to generate a **5×5 identity matrix** and check whether it is symmetric.
6. Write an R program to create two matrices and perform **addition, subtraction, and multiplication**.

**Section C – Flow Control**

1. Write an R program using **if-else-if ladder** to assign grades to students:

* ≥90: A, 80–89: B, 70–79: C, 60–69: D, <60: Fail

1. Write an R program using a **for loop** to generate the first 10 Fibonacci numbers.
2. Write an R program using a **while loop** to find the sum of digits of a number given by the user.
3. Write an R program using a **repeat loop** that keeps generating random numbers between 1 and 100 until a multiple of 7 is found. Print how many iterations it took.
4. Write an R program with **nested loops** to print the multiplication table (1 to 5).
5. Write an R program using **if-else** to check whether a string is a palindrome.
6. Write an R program using a **for loop** to calculate the factorial of a number.
7. Write an R program using a **while loop** to print prime numbers between 1 and 50.
8. Write an R program using a **repeat loop** to calculate the sum of numbers entered by the user until the user enters 0.
9. Write an R program using **nested loops** to display a number pyramid like this:

1

1 2

1 2 3

1 2 3 4

**Section D – Functions & Packages**

1. Write a function in R that checks whether a given number is prime or not.
2. Define a function that accepts a numeric vector and returns:

* The maximum value
* The minimum value
* The average value

1. Write a recursive function in R to calculate the factorial of a given number.
2. Using the stringr package, write an R program to:

* Count the number of vowels in a sentence
* Replace all spaces with underscores

1. Using the dplyr package, create a data frame with students’ names, marks in 3 subjects, and total marks. Write R code to:

* Filter students with total marks > 200
* Arrange them in descending order of total marks

1. Write a function in R that calculates the **nth Fibonacci number** using recursion.
2. Create a user-defined function that takes two numbers and returns their LCM (Least Common Multiple).
3. Write a function that takes a character vector and returns the number of words longer than 5 characters.
4. Using the ggplot2 package, create a simple bar chart of student names vs. their total marks.
5. Write a function in R to compute the sum of squares of the first **n natural numbers**, where **n** is a function argument.