

# C++ Programming Lab Manual

## Section A – Basic Coding Skills

**Q1.** A teacher wants to calculate the average marks of three students to determine the class performance. Implement a solution to accept three numbers and compute their average.

**Q2.** An architect wants to calculate the space covered by a circular fountain. Implement a solution to compute the area of a circle.

**Q3.** A weather app developer needs to provide both Celsius and Fahrenheit readings. Implement a solution to convert Fahrenheit temperature into Centigrade or vice versa.

**Q4.** A shopkeeper wants to calculate the total bill amount after applying a 20% discount on the purchase. Implement a solution to accept item no., quantity, and unit price. Compute the amount and apply 20% discount.

**Q5.** A student wants to swap the values of two variables for practising coding basics. Implement a solution to swap two numbers using different techniques.

**Q6.** An HR system needs to calculate employees' net salaries, including a fixed 12% bonus for each worker. Implement a solution to accept the number of employees and their basic salary. Compute bonus, net salary, and display results.

**Q7.** A game compares three players' scores to find who is ahead. Implement a solution to accept three scores and identify the winner.

**Q8.** A monitoring system generates a sequence of numeric event IDs from **1 to N**.

To make logs easier to analyse, the system applies **tags** to certain events based on predefined rules:

- Events whose ID is divisible by **3** are tagged as **“Buzz”**
- Events whose ID is divisible by **5** are tagged as **“Fuzz”**
- Events divisible by **both 3 and 5** receive **both tags**

**Q9.** A text editor auto-detects whether an input letter is a vowel, a consonant or a number. Implement a solution to classify the symbol.

**Q10.** A calendar app calculates whether February has 29 days. Implement a solution to check if a year is a leap year or not.

**Q11.** A wholesale supplier applies 10% discount if the order > 1000 items. Implement a solution to compute total expenses and apply a discount accordingly.

**Q12.** A civil engineer classifies a triangle design as equilateral, isosceles, or scalene. Implement a solution to check the triangle type based on its sides.

**Q13.** A mathematics tool computes the exact roots of a quadratic equation for teaching purposes. Implement a solution to calculate the roots of a quadratic equation.

- Q14.** Develop a menu-driven calculator program in C++ to perform basic arithmetic operations. The program should continue executing based on the user's choice and display the result of each operation.
- Q15.** A data analytics tool finds the maximum sales figure from multiple entries. Implement a solution to accept 'n' numbers and display the largest.
- Q16.** A cybersecurity tool verifies prime numbers used in encryption keys. Implement a solution to accept a number and check whether it is prime.
- Q17.** A learning application analyzes numbers for mathematical properties. Design a solution to check whether a given number is a **Perfect number or an Armstrong number**.
- Q18.** A String-matching tool validates if IDs are palindromes. Implement a solution to check whether a given ID is a palindrome.
- Q19.** A network security system generates prime numbers in a range for encryption key pools. Implement a solution to find all prime numbers within a given range.

**Q20.** A printing press needs to repeat labels in a fixed tabular layout. Implement a solution to display:

1 2 3 4 5

1 2 3 4 5

1 2 3 4 5

**Q20.** A board displays reverse seating layouts for events. Implement a solution to print:

5 4 3 2 1

5 4 3 2

5 4 3

5 4

5

**Q21.** A CAD tool generates rectangular hollow frames. Implement a solution to display:

```
*****
*       *
*       *
*       *
*       *
*       *
*       *
*****
```

**Q22.** A jewelry design tool generates hollow diamond outlines for patterns. Implement a solution to display a hollow diamond pattern of \*.

```

*
* *
* *
* *
* *
* *
* *
* *
*

```

**Q23.** A fireworks display system arranges sparks in butterfly style. Implement a solution to display a butterfly star pattern.

```

*           *
* *         * *
* * *       * * *
* * * *     * * * *
* * * * *   * * * * *
* * * * *   * * * * *
* * * *     * * * *
* * *       * * *
* *         * *
*           *

```

**Q24.** A typing practice app displays the alphabets in pyramid form. Implement a solution to display:

```

A
AB
ABC
ABCD
ABCDE

```

**Q25.** A security system generates list of prime keys within given range. Implement a solution to display all prime numbers between two limits.

A web-based application enforces **strong password policies** during user registration to improve account security. The system requires that every password must satisfy the following conditions:

- Contain **at least one uppercase letter (A–Z)**
- Contain **at least one lowercase letter (a–z)**
- Contain **at least one digit (0–9)**
- Contain **at least one special character** from the set  
@ # \$ % ! & \*

You are required to develop the code so that the password validation logic can be implemented in the application.

## Section B- Arrays

**Q26.** The school report card system stores subject marks for each student.

Implement a solution to accept marks in 5 subjects, compute the **total** and **percentage**, and display the result.

**Q27.** A supermarket software maintains item price lists. Implement a solution to store the prices of 10 items in an array and display the **maximum price**.

**Q28.** A data processing system classifies even and odd inputs separately. Implement a solution to store 5 elements in an array, compute **sum of all even** and **sum of all odd** numbers.

**Q29.** A weather monitoring app records 30-day temperature logs. Implement a solution to store daily temperatures in an array and display the **minimum temperature** for the month.

**Q30.** A payroll system maintains employee salary records. Implement a solution to accept salary of 10 employees in an array, compute **total salary** and **average salary**, then display the result.

**Q31.** A manufacturing QC system checks defect codes divisible by both 3 and 5.

Implement a solution to store 5 elements in an array and count how many numbers are divisible by **3 and 5**.

**Q32.** A stock market app tracks first and second highest stock values. Implement a solution to find the **largest** and **second largest** number in an array of size 5.

**Q33.** A grading system stores marks of multiple students in arrays. Implement a solution to accept marks in 5 subjects for 3 students, then display:

- marks in **2nd subject of 1st student**, and
- marks in **5th subject of 3rd student**.

**Q34.** A graphics rendering engine adds pixel intensity matrices. Implement a solution to store two  $3 \times 3$  matrices and compute their **sum**.

**Q35.** A data analytics tool flips rows and columns for better visualization. Implement a solution to store a  $3 \times 3$  matrix and compute its **transpose**.

**Q36.** A machine learning model multiplies matrices for neural network layers. Implement a solution to multiply two matrices of order  $m \times n$  and  $p \times q$  (if valid).

**Q37.** A registration system rejects usernames that contain spaces or special characters. Write a C++ program to validate whether a given string can be accepted as a username.

**Q39.** A content-management system receives user-entered text that may contain inconsistent spacing, mixed letter cases, and invalid characters.

For reliable storage and processing, the system must **normalize and validate** the input string.

Develop a C++ program that performs the following tasks on a given input string:

1. Remove leading, trailing, and extra spaces between words
2. Convert the string to **sentence case** (first character uppercase, remaining lowercase)
3. Count and display:
  - Total number of words
  - Total number of digits

- Total number of special characters

4. Validate that the final string contains **only alphabets, digits, and spaces**

Display appropriate messages based on the validation result.