

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 *.

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



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

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 3×3 matrices and compute their **sum**.

Q35. A data analytics tool flips rows and columns for better visualization. Implement a solution to store a 3×3 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:
 - o Total number of words
 - o 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.