Basic C++ Programming

Lab Questions

1. **Matrix Multiplication:** Write a C++ program to multiply two matrices.

   - **Input:**

     $$\text{Matrix A:} \quad \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \quad \text{Matrix B:} \quad \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$$

   - **Expected Output:**

     $$\text{Matrix C (Result):} \quad \begin{pmatrix} 19 & 22 \\ 43 & 50 \end{pmatrix}$$

2. **Palindrome Check:** Write a C++ program to check if a given string is a palindrome.

   - **Input:** `madam`
   - **Expected Output:** `The string is a palindrome.`

3. **Fibonacci Series (Recursion):** Write a C++ program to print the Fibonacci series up to a given number n using recursion.

   - **Input:** 6
   - **Expected Output:** 0 1 1 2 3 5

4. **Sorting an Array (Bubble Sort):** Implement Bubble Sort to sort an array of integers.

   - **Input:** 5 3 8 1 2
   - **Expected Output:** 1 2 3 5 8

5. **Find Largest and Smallest Element in an Array:** Write a C++ program to find the largest and smallest element in an array.

   - **Input:** 15 20 8 35 12
   - **Expected Output:** Largest Element: 35
     Smallest Element: 8

6. **Merge Two Arrays:** Write a C++ program to merge two sorted arrays.

   - **Input:** Array 1: 1 3 5
     Array 2: 2 4 6
   - **Expected Output:** Merged Array: 1 2 3 4 5 6

7. **Count Vowels in a String:** Write a C++ program to count the number of vowels in a string.

   - **Input:** `hello world`
   - **Expected Output:** Number of vowels: 3

8. **Prime Number Check:** Write a C++ program to check whether a given number is prime.

   - **Input:** 17
   - **Expected Output:** 17 is a prime number.

9. **Reverse an Array:** Write a C++ program to reverse an array in-place.

   - **Input:** 1 2 3 4 5
   - **Expected Output:** 5 4 3 2 1

10. **Sum of Digits of a Number:** Write a C++ program to calculate the sum of digits of a given number.

    - **Input:** 12345
    - **Expected Output:** Sum of digits: 15

11. **Reversing a Linked List:** Write a C++ program to reverse a singly linked list.

    - **Input:** Linked List: `1` → `2` → `3` → `4`
    - **Expected Output:** Reversed Linked List: `4` → `3` → `2` → `1`

12. **Detect Cycle in a Graph (DFS):** Write a C++ program to detect if a cycle exists in a directed graph using Depth First Search (DFS).

    - **Input:** Graph: `A` → `B, B` → `C, C` → `A`
    - **Expected Output:** Cycle Detected in Graph

13. **Count Occurrences of a Substring in a String:** Write a C++ program to count the number of occurrences of a substring within a string.

    - **Input:** String: "banana"
      Substring: "ana"
    - **Expected Output:** Substring "ana" occurs 1 time(s)

14. **Merge Sort Algorithm:** Implement the merge sort algorithm to sort an array.

   - **Input:** 12 11 13 5 6 7
   - **Expected Output:** Sorted Array: 5 6 7 11 12 13

15. **Matrix Transpose:** Write a C++ program to find the transpose of a matrix of order $m \times n$.

   - **Input:** Matrix:
     $$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$$
   - **Expected Output:** Transpose:
     $$\begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$$