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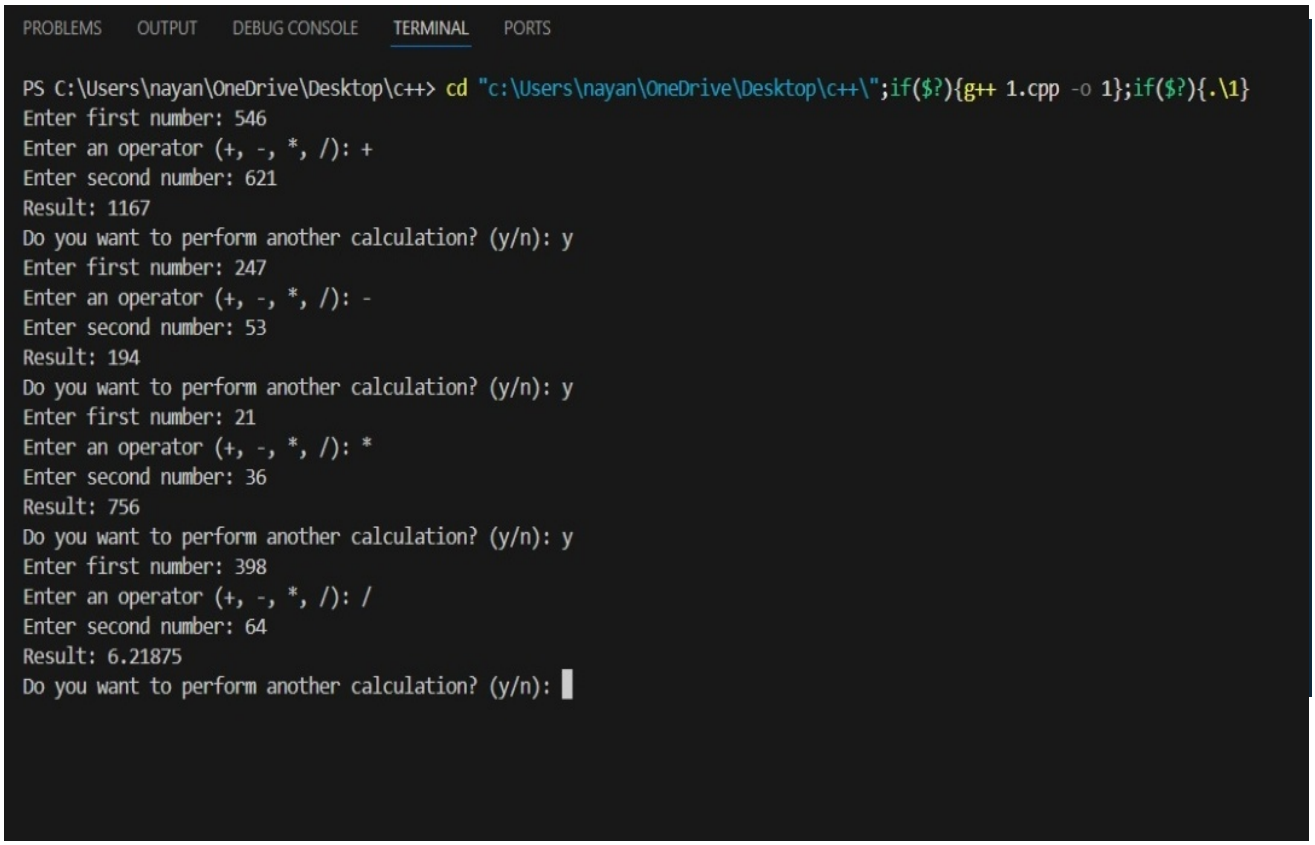
Program 1. Program to Create the equivalent of a four-function calculator. The Program requires the user to enter two numbers and an operator. It then carries out the specified arithmetical operation: addition,subtraction, multiplication or division of the two numbers. Finally, it displays the result.

Solution:

```
#include <iostream>

using namespace std;

int main() {

   char choice;

   do {

      double num1, num2, result;

      char operators;

      cout << "Enter first number: ";

      cin >> num1;

      cout << "Enter an operator (+, -, *, /): ";

      cin >> operators;

      cout << "Enter second number: ";

      cin >> num2;

      if (operators == '+') {

         result = num1 + num2;

         cout << "Result: " << result << endl;

      } else if (operators == '-') {

         result = num1 - num2;

   cout << "Result: " << result << endl;
```

```
    } else if (operators == '*') {
        result = num1 * num2;
        cout << "Result: " << result << endl;
    } else if (operators == '/') {
        if (num2 != 0) {
            result = num1 / num2;
            cout << "Result: " << result << endl;
        } else {
            cout << "Division by zero is not allowed." << endl;
        }
    } else {
        cout << "Invalid operator!" << endl;
    }
    cout << "Do you want to perform another calculation? (y/n): ";
    cin >> choice;
  } while (choice == 'y' || choice == 'Y');
  return 0;
}
```

Output:


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 1.cpp -o 1};if($?){.\1}
Enter first number: 546
Enter an operator (+, -, *, /): +
Enter second number: 621
Result: 1167
Do you want to perform another calculation? (y/n): y
Enter first number: 247
Enter an operator (+, -, *, /): -
Enter second number: 53
Result: 194
Do you want to perform another calculation? (y/n): y
Enter first number: 21
Enter an operator (+, -, *, /): *
Enter second number: 36
Result: 756
Do you want to perform another calculation? (y/n): y
Enter first number: 398
Enter an operator (+, -, *, /): /
Enter second number: 64
Result: 6.21875
Do you want to perform another calculation? (y/n):

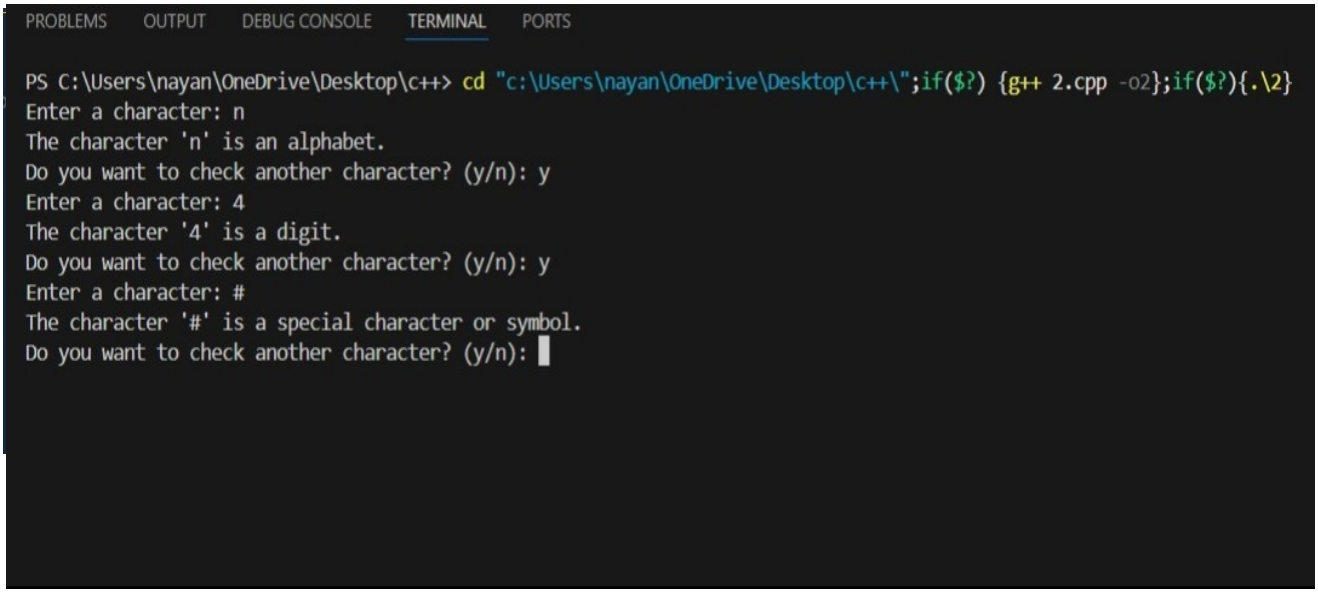
Program 2. Program to input a character and to print whether a given character is an alphabet, digit or any other character.

Solution:

```
#include <iostream>

using namespace std;

int main() {

   char inputChar; // Variable to store the input character

   char userChoice; // Variable to check if the user wants to continue

   do {

      // Input a character

      cout << "Enter a character: ";

      cin >> inputChar;

      // Check if the character is an alphabet, digit, or other character

      if ((inputChar >= 'A' && inputChar <= 'Z') || (inputChar >= 'a' && inputChar <= 'z')) {

         cout << "The character '" << inputChar << "' is an alphabet." << endl;

      }

      else if (inputChar >= '0' && inputChar <= '9') {

         cout << "The character '" << inputChar << "' is a digit." << endl;

      }

      else {

         cout << "The character '" << inputChar << "' is a special character or symbol." << endl;

      }

      // Ask if the user wants to check another character
```

```
        cout << "Do you want to check another character? (y/n): ";
        cin >> userChoice;
    } while (userChoice == 'y' || userChoice == 'Y');
    cout << "Program exited. Thank you!" << endl;
    return 0;
}
```

Output:



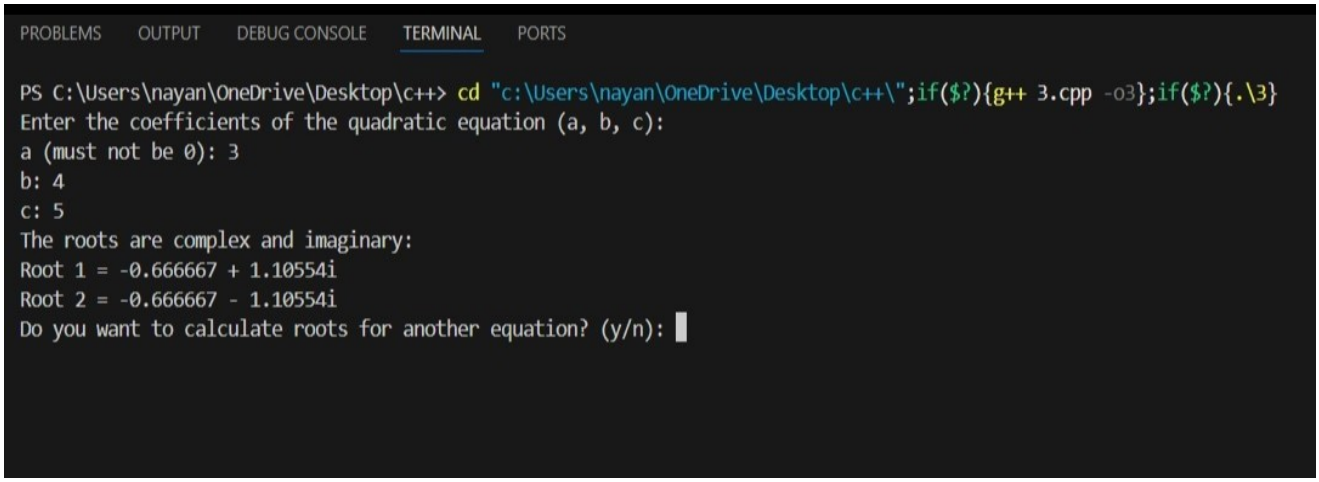
Program 3. Program to calculate and print roots of a quadratic equation $ax^2+bx+c = 0$ ($a \neq 0$).

Solution:

```
#include <iostream>
#include <cmath> // For sqrt function
using namespace std;
int main() {
   char userChoice; // To allow multiple calculations
   do {
      double a, b, c; // Coefficients of the quadratic equation
      double discriminant, root1, root2; // For calculations
      // Input coefficients
      cout << "Enter the coefficients of the quadratic equation (a, b, c): " << endl;
      cout << "a (must not be 0): ";
      cin >> a;
      // Check if 'a' is zero
      while (a == 0) {
         cout << "Coefficient 'a' cannot be zero. Please enter a valid value: ";
         cin >> a;
      }
      cout << "b: ";
      cin >> b;
      cout << "c: ";
        cin >> c;
      // Calculate the discriminant
      discriminant = (b * b) - (4 * a * c);
      // Determine the nature of the roots
      if (discriminant > 0) {
         // Real and distinct roots
         root1 = (-b + sqrt(discriminant)) / (2 * a);
         root2 = (-b - sqrt(discriminant)) / (2 * a);
         cout << "The roots are real and distinct: " << endl;
         cout << "Root 1 = " << root1 << endl;
         cout << "Root 2 = " << root2 << endl;
      } else if (discriminant == 0) {
         // Real and equal roots
         root1 = root2 = -b / (2 * a);
         cout << "The roots are real and equal: " << endl;
```

```
            cout << "Root 1 = Root 2 = " << root1 << endl;
        } else {
            // Complex roots
            double realPart = -b / (2 * a);
            double imaginaryPart = sqrt(-discriminant) / (2 * a);
            cout << "The roots are complex and imaginary: " << endl;
            cout << "Root 1 = " << realPart << " + " << imaginaryPart << "i" << endl;

                    cout << "Root 2 = " << realPart << " - " << imaginaryPart << "i" << endl;
        }
        // Ask if the user wants to solve another equation
        cout << "Do you want to calculate roots for another equation? (y/n): ";
        cin >> userChoice;
    } while (userChoice == 'y' || userChoice == 'Y');
    cout << "Program exited. Thank you!" << endl;
    return 0;
}
```

Output:



Program 4. Program to calculate area of a circle, a rectangle or a triangle depending upon user's choice.

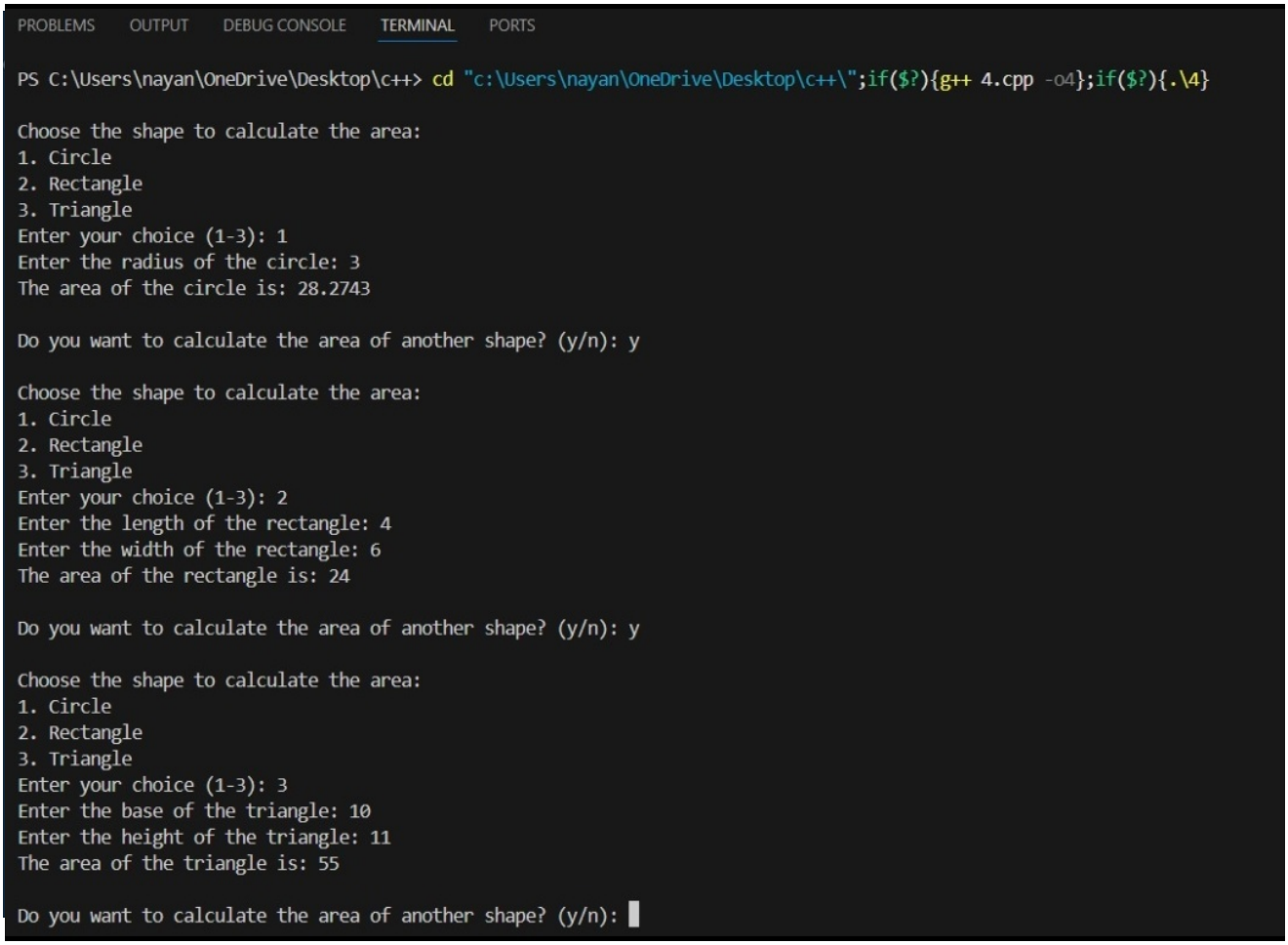
Solution:

```
#include <iostream>
#include <cmath> // For mathematical calculations
using namespace std;
int main() {
   int choice; // User's choice for the shape
   char repeat; // To check if the user wants to continue
   do {
      // Display menu
      cout << "\nChoose the shape to calculate the area:" << endl;
      cout << "1. Circle" << endl;
      cout << "2. Rectangle" << endl;
      cout << "3. Triangle" << endl;
      cout << "Enter your choice (1-3): ";
      cin >> choice;
      // Flow of control based on user's choice
      switch (choice) {
         case 1: {
            // Calculate area of a circle
            double radius, area;

            cout << "Enter the radius of the circle: ";
            cin >> radius;
            if (radius < 0) {
               cout << "Radius cannot be negative!" << endl;
            } else {
               area = M_PI * radius * radius; // Using πr^2 formula
               cout << "The area of the circle is: " << area << endl;
            }
            break;
         }
         case 2: {
            // Calculate area of a rectangle
            double length, width, area;
            cout << "Enter the length of the rectangle: ";
```

```
        cin >> length;
        cout << "Enter the width of the rectangle: ";
        cin >> width;
        if (length < 0 || width < 0) {
            cout << "Length and width cannot be negative!" << endl;
        } else {
            area = length * width; // Using l × w formula



            cout << "The area of the rectangle is: " << area << endl;
        }
        break;
    }
    case 3: {
        // Calculate area of a triangle
        double base, height, area;
        cout << "Enter the base of the triangle: ";
        cin >> base;
        cout << "Enter the height of the triangle: ";
        cin >> height;
        if (base < 0 || height < 0) {
            cout << "Base and height cannot be negative!" << endl;
        } else {
            area = 0.5 * base * height; // Using ½ × b × h formula
            cout << "The area of the triangle is: " << area << endl;
        }
        break;
    }



    default:
        cout << "Invalid choice! Please choose a valid option (1-3)." << endl;
}
// Ask if the user wants to calculate the area of another shape
cout << "\nDo you want to calculate the area of another shape? (y/n): ";
cin >> repeat;
```

```
    } while (repeat == 'y' || repeat == 'Y');
    cout << "Program exited. Thank you!" << endl;
    return 0;
}
```

Output:

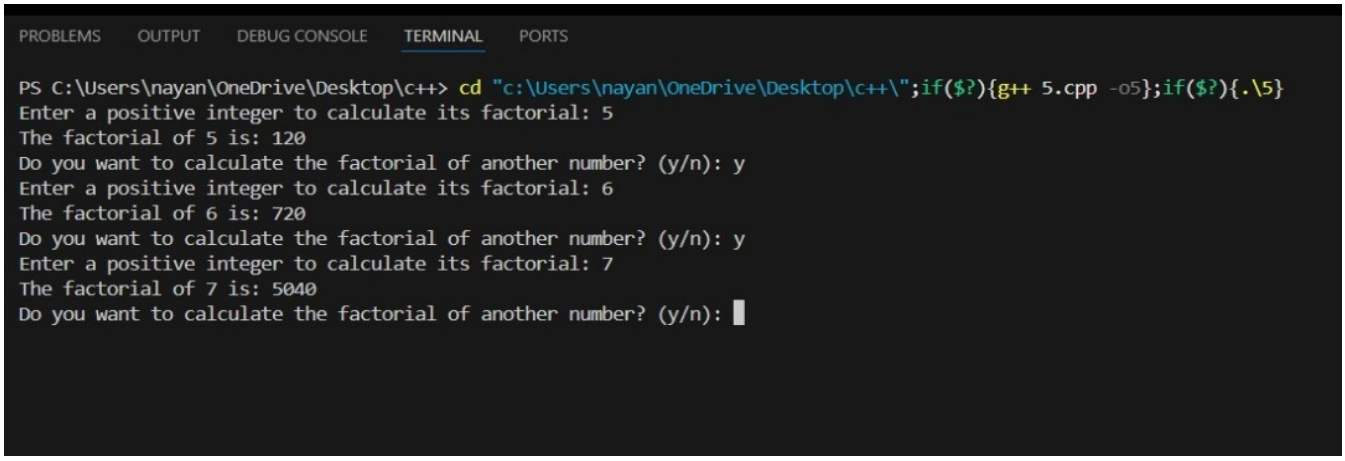


Program 5. Program to calculate the factorial of a positive integer.

Solution:

```
#include <iostream>
using namespace std;
int main() {
   int number;        // Variable to store the input number
   char userChoice;   // Variable to check if the user wants to continue
   do {
      // Input a positive integer
      cout << "Enter a positive integer to calculate its factorial: ";
      cin >> number;
      // Input validation: Check if the number is positive
      while (number < 0) {
         cout << "Factorial is not defined for negative numbers. Please enter a positive integer: ";
         cin >> number;
      }
      // Calculate the factorial using a loop
      unsigned long long factorial = 1; // Use 'unsigned long long' to handle large numbers
      for (int i = 1; i <= number; i++) {
         factorial *= i;
      }
      // Display the result

      cout << "The factorial of " << number << " is: " << factorial << endl;
      // Ask if the user wants to calculate another factorial
      cout << "Do you want to calculate the factorial of another number? (y/n): ";
      cin >> userChoice;
   } while (userChoice == 'y' || userChoice == 'Y');
   cout << "Program exited. Thank you!" << endl;
   return 0;
}
```

Output:



Program 6. Program to search for a specific integer in a 1-D array (Linear Search).

Solution:

```
#include <iostream>
using namespace std;
int main() {
   int size, target, found = 0; // Array size, number to search, and flag for search status
   char userChoice;           // Variable to allow multiple searches
   do {
      // Input the size of the array
      cout << "Enter the size of the array (positive integer): ";
      cin >> size;
      // Validate array size
      while (size <= 0) {
         cout << "Array size must be a positive integer. Please enter again: ";
         cin >> size;
      }
      int array[size]; // Array to hold integers
      // Input elements into the array
      cout << "Enter " << size << " integers for the array: " << endl;
      for (int i = 0; i < size; i++) {
         cout << "Element " << i + 1 << ": ";
         cin >> array[i];
      }
```

```
    // Input the target integer to search
    cout << "Enter the integer to search in the array: ";
    cin >> target;
    // Perform linear search
    found = 0; // Reset flag for each new search
    for (int i = 0; i < size; i++) {
        if (array[i] == target) {
            cout << "The integer " << target << " is found at position " << i + 1 << " (index " << i << ")." << endl;
            found = 1; // Set flag to indicate target was found
            break; // Stop further search once the target is found
        }
    }
    // If the target was not found
    if (!found) {
        cout << "The integer " << target << " is not present in the array." << endl;
    }
    // Ask if the user wants to perform another search
    cout << "Do you want to search in another array? (y/n): ";
    cin >> userChoice;
  } while (userChoice == 'y' || userChoice == 'Y');
  cout << "Program exited. Thank you!" << endl;
  return 0;
}
```

Output:

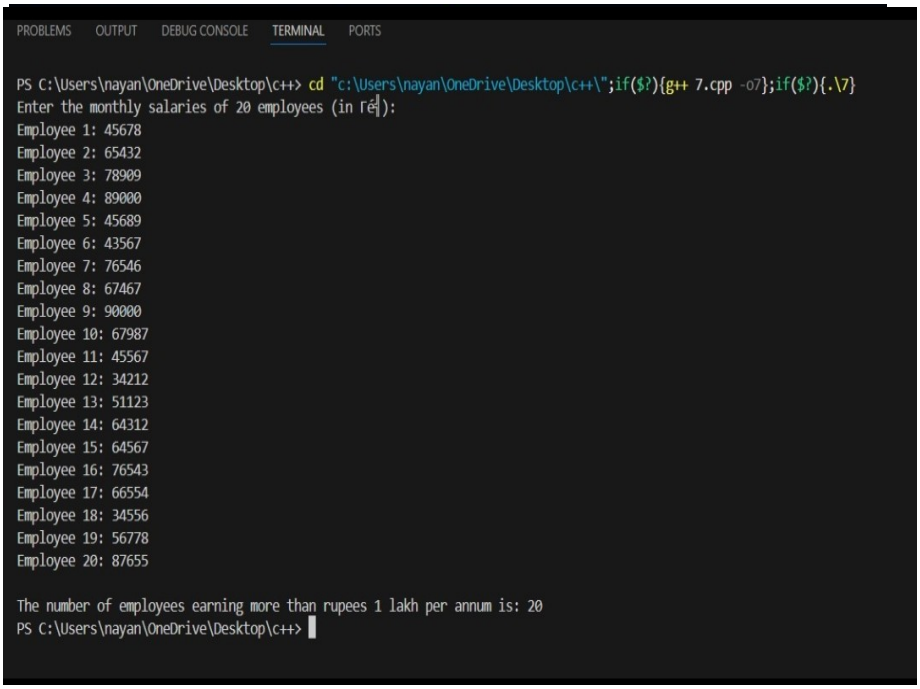
Program 7. Program to count the number of employees earning more than Rs 1 lakh per annum. The monthly salaries of 20 employees shall be provided by user

Solution:

```
#include <iostream>

using namespace std;

int main() {

   const int numEmployees = 20; // Total number of employees

   double monthlySalaries[numEmployees]; // Array to store monthly salaries

   int count = 0; // Counter for employees earning more than ₹1 lakh per annum

   // Input monthly salaries of employees

   cout << "Enter the monthly salaries of " << numEmployees << " employees (in ₹):" << endl;

   for (int i = 0; i < numEmployees; i++) {

      cout << "Employee " << i + 1 << ": ";

      cin >> monthlySalaries[i];

      // Validate input: salary cannot be negative

      while (monthlySalaries[i] < 0) {

         cout << "Monthly salary cannot be negative. Please re-enter: ";

         cin >> monthlySalaries[i];

      }

   }

   // Check and count employees earning more than ₹1 lakh per annum
```

```
    for (int i = 0; i < numEmployees; i++) {
        double annualSalary = monthlySalaries[i] * 12; // Calculate annual salary
        if (annualSalary > 100000) {
            count++;
        }
    }

    // Output the result
    cout << "\nThe number of employees earning more than ₹1 lakh per annum is: " << count << endl;
    return 0;
}
```

Output :



Program 8. Program to add two matrices.

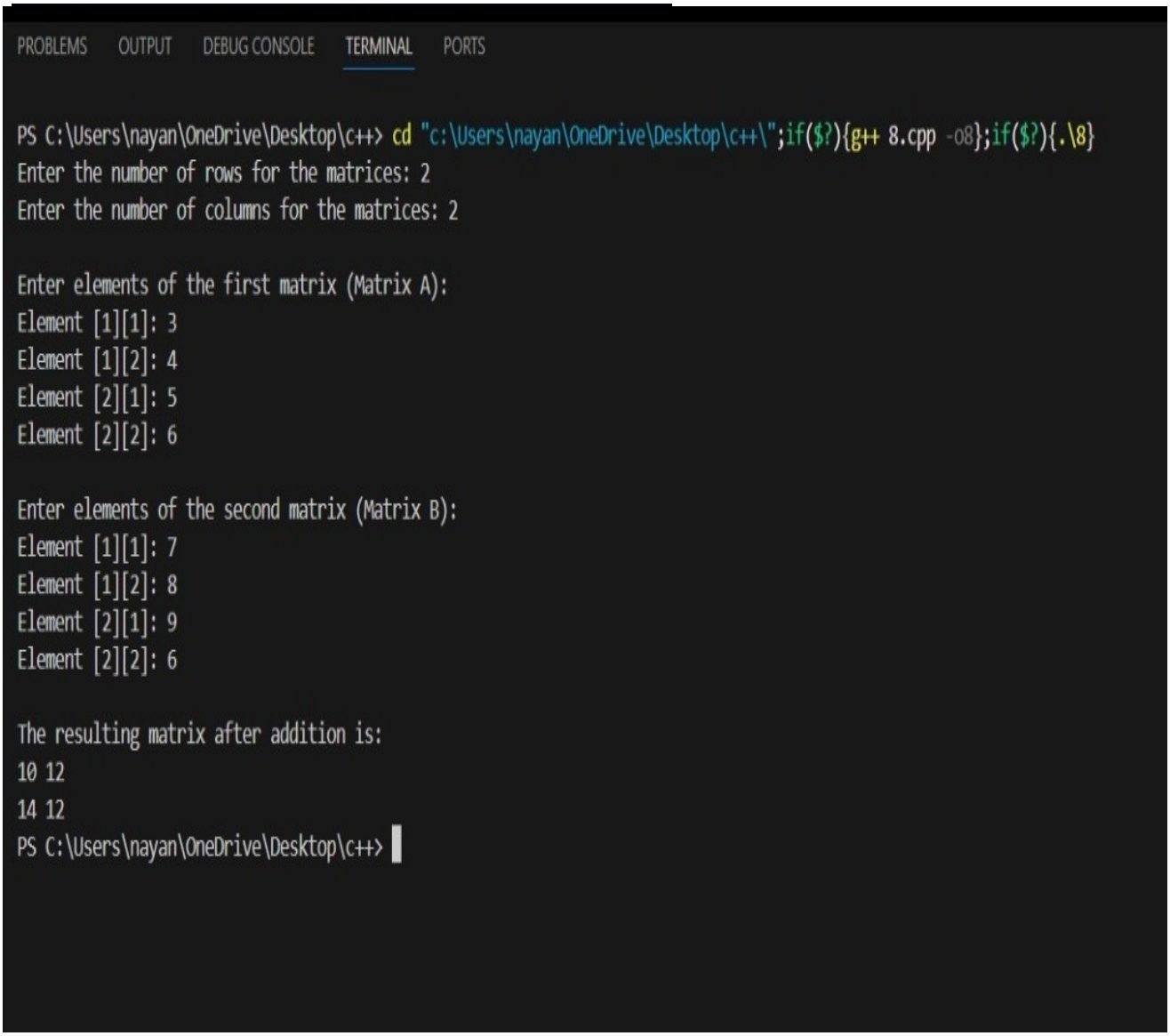
Solution:

```
#include <iostream>

using namespace std;

int main() {

   int rows, cols; // Variables to store the number of rows and columns

   // Input the size of the matrices

   cout << "Enter the number of rows for the matrices: ";

   cin >> rows;

   cout << "Enter the number of columns for the matrices: ";

   cin >> cols;

   // Declare two matrices and a result matrix

   int matrixA[rows][cols], matrixB[rows][cols], result[rows][cols];

   // Input elements of the first matrix

   cout << "\nEnter elements of the first matrix (Matrix A):" << endl;

   for (int i = 0; i < rows; i++) {

      for (int j = 0; j < cols; j++) {

         cout << "Element [" << i + 1 << "][" << j + 1 << "]: ";

         cin >> matrixA[i][j];

      }

   }
```

```
// Input elements of the second matrix
cout << "\nEnter elements of the second matrix (Matrix B):" << endl;
for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
        cout << "Element [" << i + 1 << "][" << j + 1 << "]: ";
        cin >> matrixB[i][j];
    }
}
// Add the two matrices
for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
        result[i][j] = matrixA[i][j] + matrixB[i][j];
    }
}
// Display the result matrix
cout << "\nThe resulting matrix after addition is:" << endl;
for (int i = 0; i < rows; i++) {
    for (int j = 0; j < cols; j++) {
        cout << result[i][j] << " ";
    }
```

```
        cout << endl; // Move to the next row
    }
    return 0;
}
```

Output



-

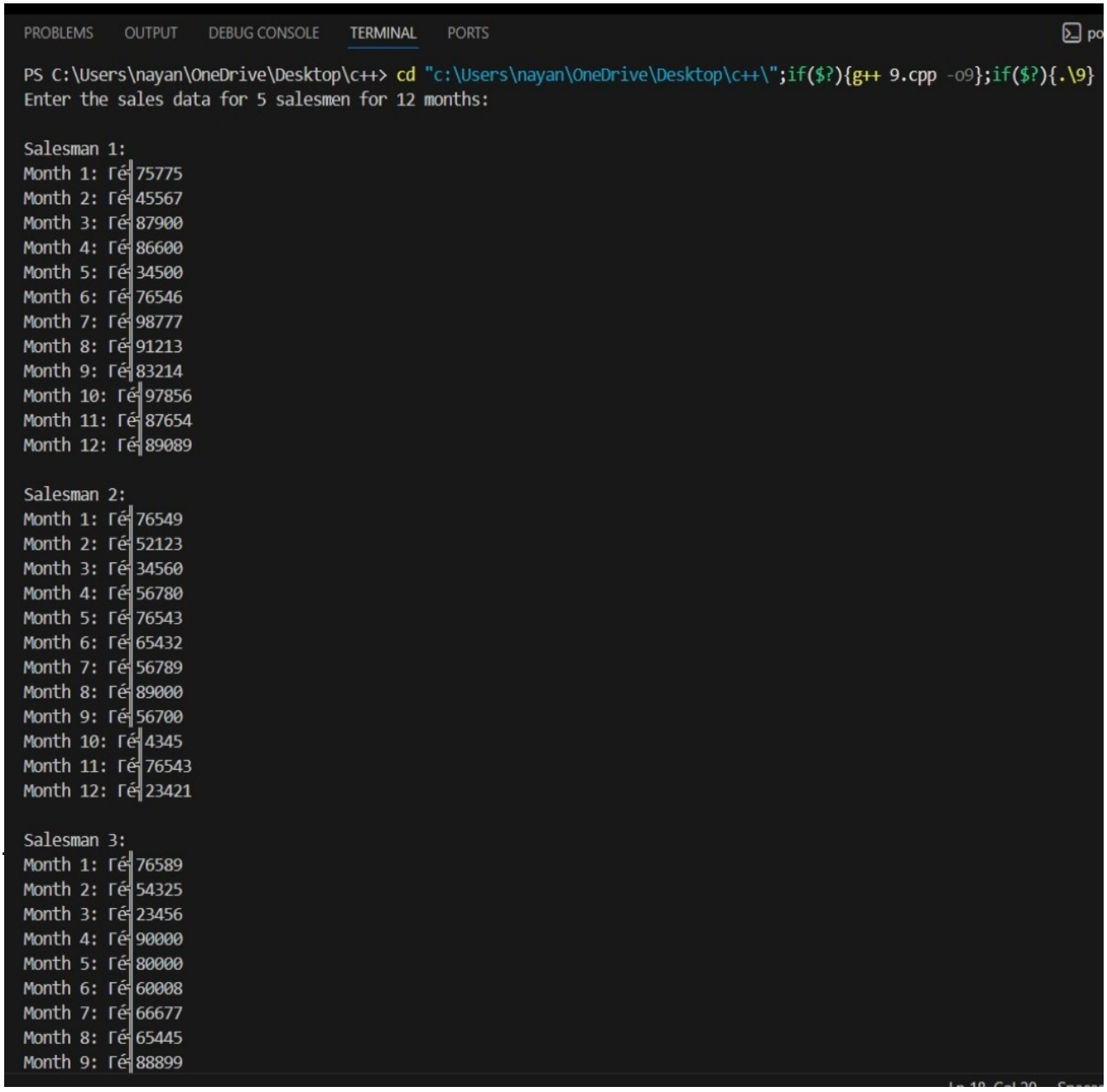
Program 9. Program to read Sales of 5 salesman in 12 months and to print total sales made by each salesman.

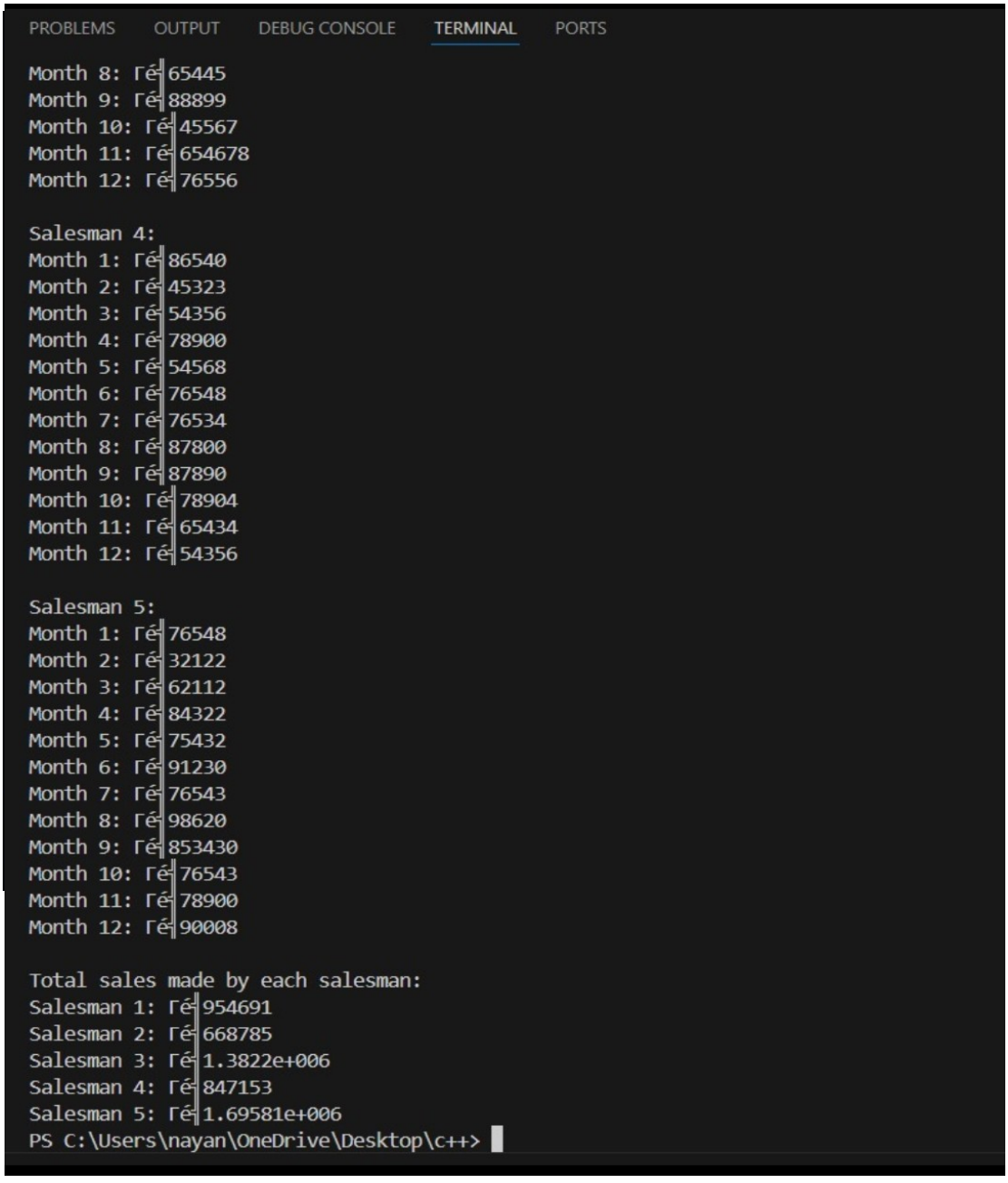
Solution:

```
#include <iostream>

using namespace std;

int main() {

   const int salesmen = 5;      // Number of salesmen

   const int months = 12;      // Number of months

   double sales[salesmen][months]; // 2D array to store sales data

   double totalSales[salesmen] = {0}; // Array to store total sales of each salesman

   // Input sales data for each salesman

   cout << "Enter the sales data for " << salesmen << " salesmen for " << months << " months:\n";

   for (int i = 0; i < salesmen; i++) {

      cout << "\nSalesman " << i + 1 << ":" << endl;

      for (int j = 0; j < months; j++) {

         cout << "Month " << j + 1 << ": ₹";

         cin >> sales[i][j];

         // Validate input (sales cannot be negative)

         while (sales[i][j] < 0) {

            cout << "Sales cannot be negative. Please re-enter for Month " << j + 1 << ": ₹";

            cin >> sales[i][j];
```

```
            }
            // Add the sales for this month to the total for this salesman
            totalSales[i] += sales[i][j];
        }
    }
    // Display total sales of each salesman
    cout << "\nTotal sales made by each salesman:\n";
    for (int i = 0; i < salesmen; i++) {
        cout << "Salesman " << i + 1 << ": ₹" << totalSales[i] << endl;
    }
    return 0;
}
```

Output :


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 9.cpp -o9};if($?){.\9}
Enter the sales data for 5 salesmen for 12 months:
Salesman 1:
Month 1: ₹ 75775
Month 2: ₹ 45567
Month 3: ₹ 87900
Month 4: ₹ 86600
Month 5: ₹ 34500
Month 6: ₹ 76546
Month 7: ₹ 98777
Month 8: ₹ 91213
Month 9: ₹ 83214
Month 10: ₹ 97856
Month 11: ₹ 87654
Month 12: ₹ 89089
Salesman 2:
Month 1: ₹ 76549
Month 2: ₹ 52123
Month 3: ₹ 34560
Month 4: ₹ 56780
Month 5: ₹ 76543
Month 6: ₹ 65432
Month 7: ₹ 56789
Month 8: ₹ 89000
Month 9: ₹ 56700
Month 10: ₹ 4345
Month 11: ₹ 76543
Month 12: ₹ 23421
Salesman 3:
Month 1: ₹ 76589
Month 2: ₹ 54325
Month 3: ₹ 23456
Month 4: ₹ 90000
Month 5: ₹ 80000
Month 6: ₹ 60008
Month 7: ₹ 66677
Month 8: ₹ 65445
Month 9: ₹ 88899


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
Month 8: ₹ 65445
Month 9: ₹ 88899
Month 10: ₹ 45567
Month 11: ₹ 654678
Month 12: ₹ 76556
Salesman 4:
Month 1: ₹ 86540
Month 2: ₹ 45323
Month 3: ₹ 54356
Month 4: ₹ 78900
Month 5: ₹ 54568
Month 6: ₹ 76548
Month 7: ₹ 76534
Month 8: ₹ 87800
Month 9: ₹ 87890
Month 10: ₹ 78904
Month 11: ₹ 65434
Month 12: ₹ 54356
Salesman 5:
Month 1: ₹ 76548
Month 2: ₹ 32122
Month 3: ₹ 62112
Month 4: ₹ 84322
Month 5: ₹ 75432
Month 6: ₹ 91230
Month 7: ₹ 76543
Month 8: ₹ 98620
Month 9: ₹ 853430
Month 10: ₹ 76543
Month 11: ₹ 78900
Month 12: ₹ 90008
Total sales made by each salesman:
Salesman 1: ₹ 954691
Salesman 2: ₹ 668785
Salesman 3: ₹ 1.3822e+006
Salesman 4: ₹ 847153
Salesman 5: ₹ 1.69581e+006
PS C:\Users\nayan\OneDrive\Desktop\c++>

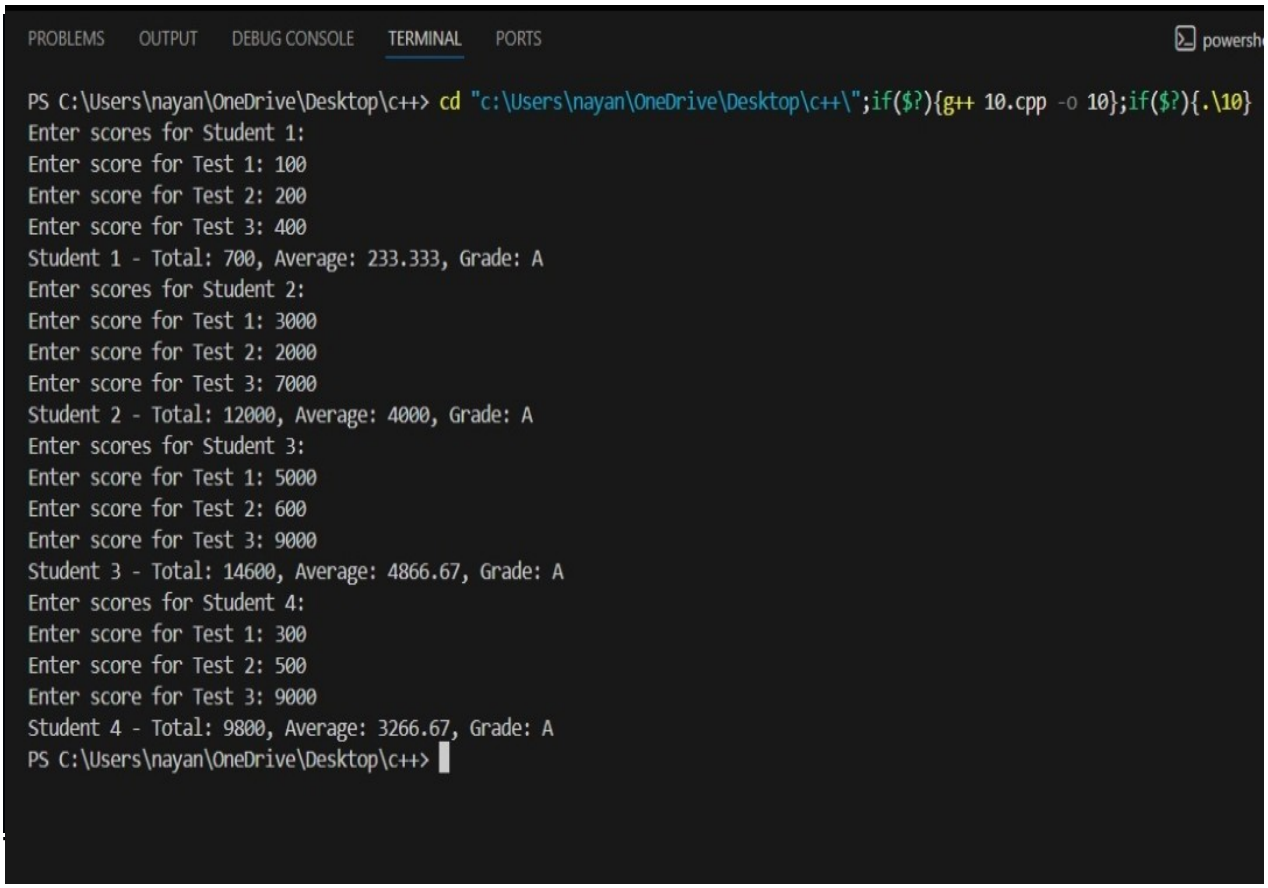
Program 10. Program to calculate grades of 4 students from 3 test scores.

Solution:

```
#include <iostream>

using namespace std;

int main() {

   int num_students = 4;

   int num_tests = 3;

   float scores[num_students][num_tests];  // 2D array to store scores for 4 students

   float total, average;

   // Loop through each student to take input

   for (int i = 0; i < num_students; i++) {

      total = 0;  // Initialize total score for each student

      cout << "Enter scores for Student " << i + 1 << ":\n";

      // Loop through each test score for the current student

      for (int j = 0; j < num_tests; j++) {

         cout << "Enter score for Test " << j + 1 << ": ";

         cin >> scores[i][j];

         total += scores[i][j];  // Add the score to total

      }

      // Calculate average

      average = total / num_tests;
```

```
        // Output the grade based on the average score
        cout << "Student " << i + 1 << " - Total: " << total << ", Average: " << average << ", Grade: ";

        // Grade calculation based on average score
        if (average >= 90) {
            cout << "A\n";
        } else if (average >= 80) {
            cout << "B\n";
        } else if (average >= 70) {
            cout << "C\n";
        } else if (average >= 60) {
            cout << "D\n";
        } else {
            cout << "F\n";
        }
    }
    return 0;
}
```

Output :



Program 11. Write a program that takes a string as input and outputs the reversed string. For example, if the input is "Skillarger", the output should be "regallikS".

Solution:

```
#include <iostream>

#include <string>

using namespace std;

int main() {

    string originalString, reversedString = "";

    // Taking input from the user
```

```
    cout << "Enter a string: ";
    cin >> originalString;
    // Loop to reverse the string
    int stringLength = originalString.length();  // Get the length of the string
    for (int index = stringLength - 1; index >= 0; index--) {
        reversedString += originalString[index];  // Adding characters in reverse order
    }
    // Output the reversed string
    cout << "Reversed string: " << reversedString << endl;

    return 0;
}
```

Output:

Program 12. Write a program to count the number of vowels and consonants in a given string. For example, for the input "Computer", the output should be Vowels: 3, Consonants: 5.

Solution:

```
#include <iostream>

#include <string>

using namespace std;

int main() {

   string inputString;

   int vowelsCount = 0, consonantsCount = 0;

   // Taking input from the user

   cout << "Enter a string: ";

   cin >> inputString;

   // Converting all letters to lowercase for easier checking

   for (int i = 0; i < inputString.length(); i++) {

      char ch = tolower(inputString[i]);  // Convert each character to lowercase

      // Check if the character is a vowel

      if (ch == 'a' || ch == 'e' || ch == 'i' || ch == 'o' || ch == 'u') {

         vowelsCount++;

      }

      // Check if the character is a consonant (alphabetic and not a vowel)

      else if ((ch >= 'a' && ch <= 'z')) {
```

```
 consonantsCount++;

        }

    }


    // Output the results

    cout << "Vowels: " << vowelsCount << ", Consonants: " << consonantsCount << endl;

    return 0;

}
```

Output :

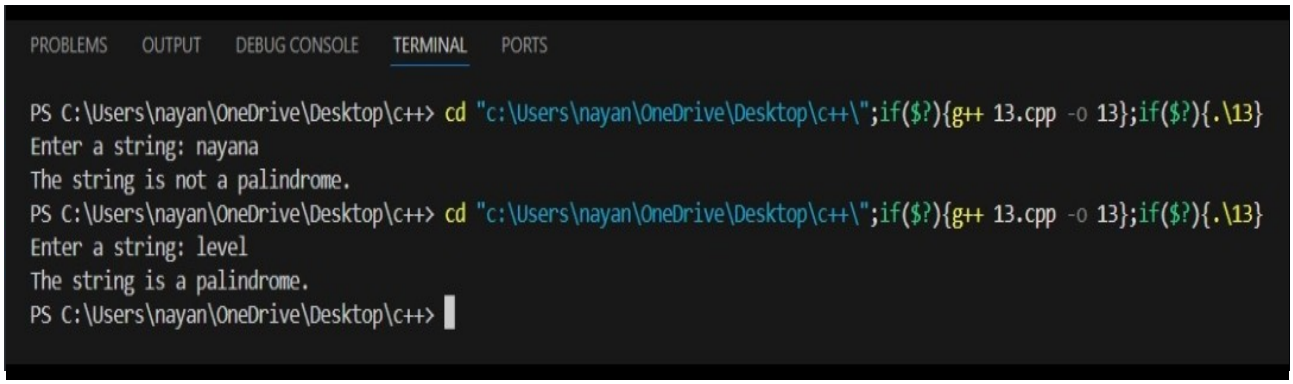
Program 13. Write a program to check whether a given string is a palindrome. For example, "level" is a palindrome, but "hello" is not.

Solution:

```
#include <iostream>

#include <string>

using namespace std;


int main() {

   string inputString;

   bool isPalindrome = true;  // Assume the string is a palindrome initially


   // Taking input from the user

   cout << "Enter a string: ";

   cin >> inputString;


   int start = 0;  // Starting index of the string

   int end = inputString.length() - 1;  // Ending index of the string

   // Loop to check each character from the beginning and end

   while (start < end) {

      if (tolower(inputString[start]) != tolower(inputString[end])) {  // Compare characters in lowercase

         isPalindrome = false;  // If characters don't match, it's not a palindrome
```

```
            break;  // No need to check further
        }
        start++;  // Move the start index towards the center
        end--;    // Move the end index towards the center
    }
    // Output the result
    if (isPalindrome) {
        cout << "The string is a palindrome." << endl;
    } else {
        cout << "The string is not a palindrome." << endl;
    }
    return 0;
}
```

Output :



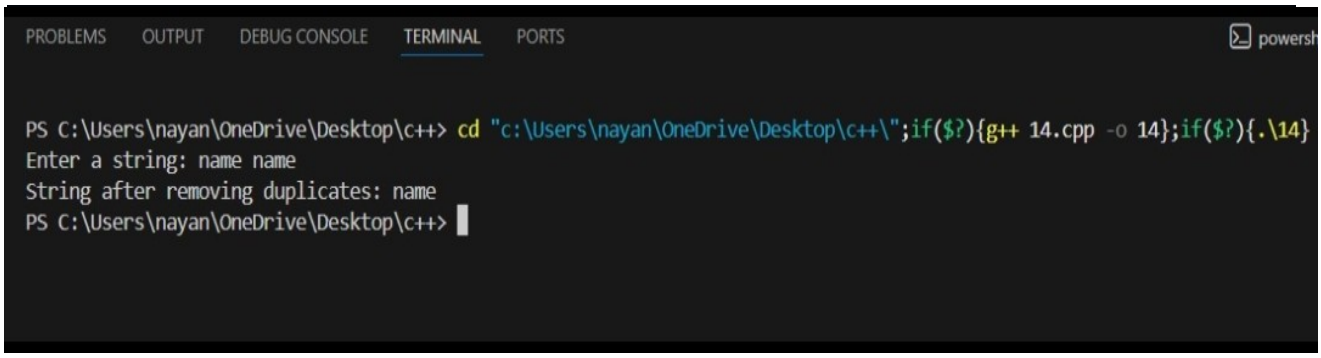
Program 14. Write a program that removes duplicate characters from a string. For example, if the input is "programming", the output should be "progamin".

Solution:

```
#include <iostream>

#include <string>

using namespace std;


int main() {

   string inputString, resultString = "";


   // Taking input from the user

   cout << "Enter a string: ";

   cin >> inputString;


   // Loop through each character in the input string

   for (int i = 0; i < inputString.length(); i++) {

      bool isDuplicate = false;


      // Check if the character already exists in the result string

      for (int j = 0; j < resultString.length(); j++) {

         if (inputString[i] == resultString[j]) {
```

```
            isDuplicate = true;  // Mark as duplicate
            break;  // No need to check further
        }
    }

    // If it's not a duplicate, add it to the result string
    if (!isDuplicate) {
        resultString += inputString[i];
    }
}

// Output the result string with duplicates removed
cout << "String after removing duplicates: " << resultString << endl;

return 0;
}
```

Output :



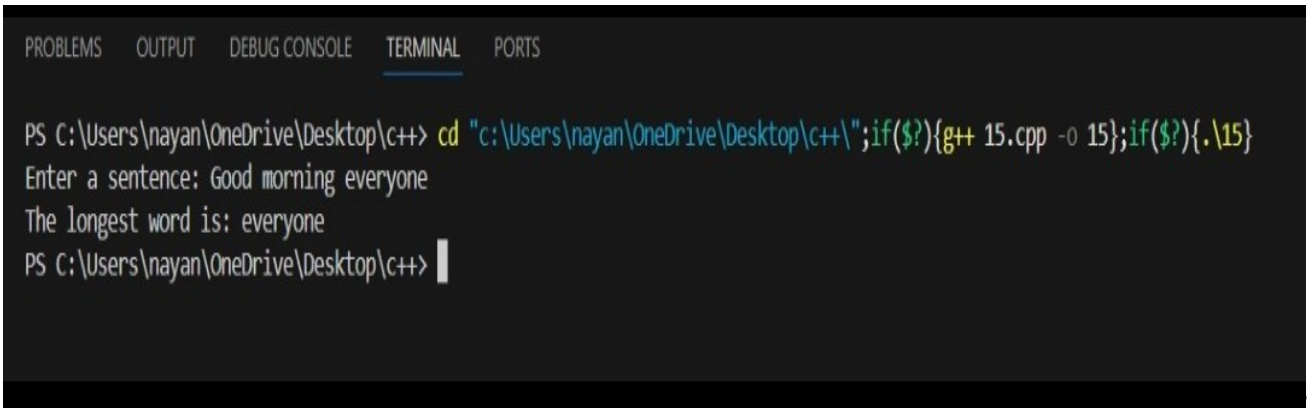
Program 15. Write a program to find the longest word in a given sentence. For example, for the input "C++ is a powerful programming language", the output should be "programming"

Solution:

```
#include <iostream>

#include <sstream>  // For using stringstream

#include <string>

using namespace std;

int main() {

    string sentence, word, longestWord = "";

    int maxLength = 0;

    // Taking input from the user

    cout << "Enter a sentence: ";

    getline(cin, sentence);  // Use getline to allow spaces in the sentence
```

```
    stringstream ss(sentence);  // Create a stringstream object to break the sentence into words

    // Loop through each word in the sentence
    while (ss >> word) {
        // Check if the current word is longer than the longest word found so far
        if (word.length() > maxLength) {
            longestWord = word;  // Update the longest word
            maxLength = word.length();  // Update the maximum length
        }
    }


    // Output the longest word
    cout << "The longest word is: " << longestWord << endl;
    return 0;
}
```

Output :



Program 16. Program to read values into a nested structure."

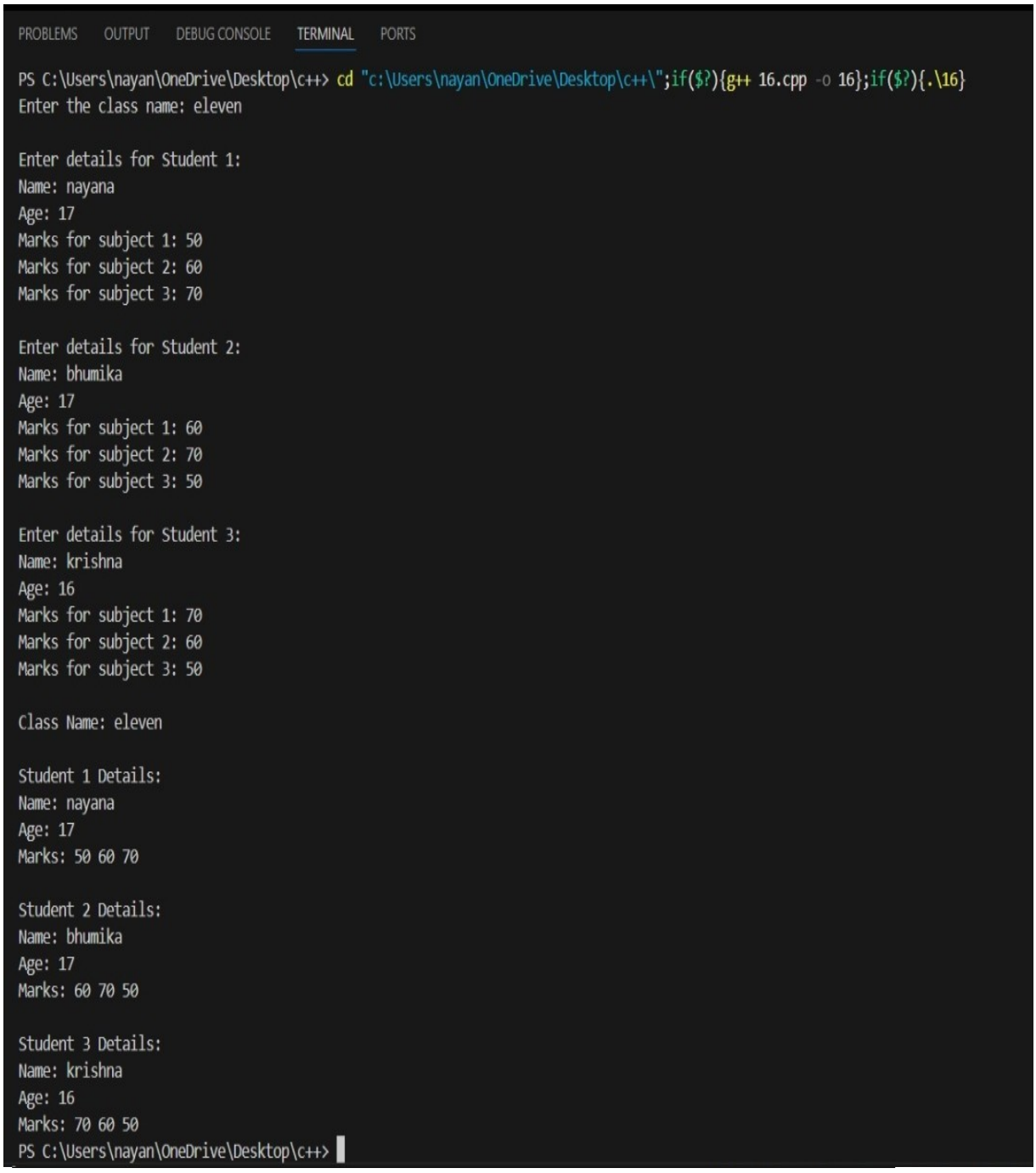
Solution:

```
#include <iostream>

#include <string>

using namespace std;


// Define a structure for a student

struct Student {

   string name;

   int age;

   float marks[3];  // Array to store marks for 3 subjects

};


// Define a structure for a class

struct Class {

   string className;

   Student students[3];  // Array to store details of 3 students

};


int main() {

   Class classData;  // Declare a variable of type Class
```

```
    // Taking input for the class name
    cout << "Enter the class name: ";
    getline(cin, classData.className);  // Read the class name

    // Loop to input data for each student
    for (int i = 0; i < 3; i++) {
        cout << "\nEnter details for Student " << i + 1 << ":\n";

        // Input student name and age
        cout << "Name: ";
        getline(cin, classData.students[i].name);
        cout << "Age: ";
        cin >> classData.students[i].age;

        // Input marks for 3 subjects
        for (int j = 0; j < 3; j++) {
            cout << "Marks for subject " << j + 1 << ": ";
            cin >> classData.students[i].marks[j];
        }
        cin.ignore();  // To clear the newline character from the buffer
    }
```

```
    // Output the class details
    cout << "\nClass Name: " << classData.className << endl;
    for (int i = 0; i < 3; i++) {
        cout << "\nStudent " << i + 1 << " Details:\n";
        cout << "Name: " << classData.students[i].name << endl;
        cout << "Age: " << classData.students[i].age << endl;
        cout << "Marks: ";
        for (int j = 0; j < 3; j++) {
            cout << classData.students[i].marks[j] << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Output :


PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 16.cpp -o 16};if($?){.\16}
Enter the class name: eleven
Enter details for Student 1:
Name: nayana
Age: 17
Marks for subject 1: 50
Marks for subject 2: 60
Marks for subject 3: 70
Enter details for Student 2:
Name: bhumika
Age: 17
Marks for subject 1: 60
Marks for subject 2: 70
Marks for subject 3: 50
Enter details for Student 3:
Name: krishna
Age: 16
Marks for subject 1: 70
Marks for subject 2: 60
Marks for subject 3: 50
Class Name: eleven
Student 1 Details:
Name: nayana
Age: 17
Marks: 50 60 70
Student 2 Details:
Name: bhumika
Age: 17
Marks: 60 70 50
Student 3 Details:
Name: krishna
Age: 16
Marks: 70 60 50
PS C:\Users\nayan\OneDrive\Desktop\c++>

Program 17. Program to store information of 10 employees and to display information of an employee depending upon the **employee no** given.

Solution:

```
#include <iostream>

#include <string>

using namespace std;


// Structure to store employee details

struct Employee {

   int employeeNumber;

   string employeeName;

   string employeeDepartment;

   float employeeSalary;

};


// Function to input employee details

void inputEmployeeDetails(Employee employeeList[], int totalEmployees) {

   for (int index = 0; index < totalEmployees; index++) {

      cout << "\nEnter details for Employee " << index + 1 << ":\n";

      cout << "Employee Number: ";

      cin >> employeeList[index].employeeNumber;

      cin.ignore(); // To clear the input buffer
```

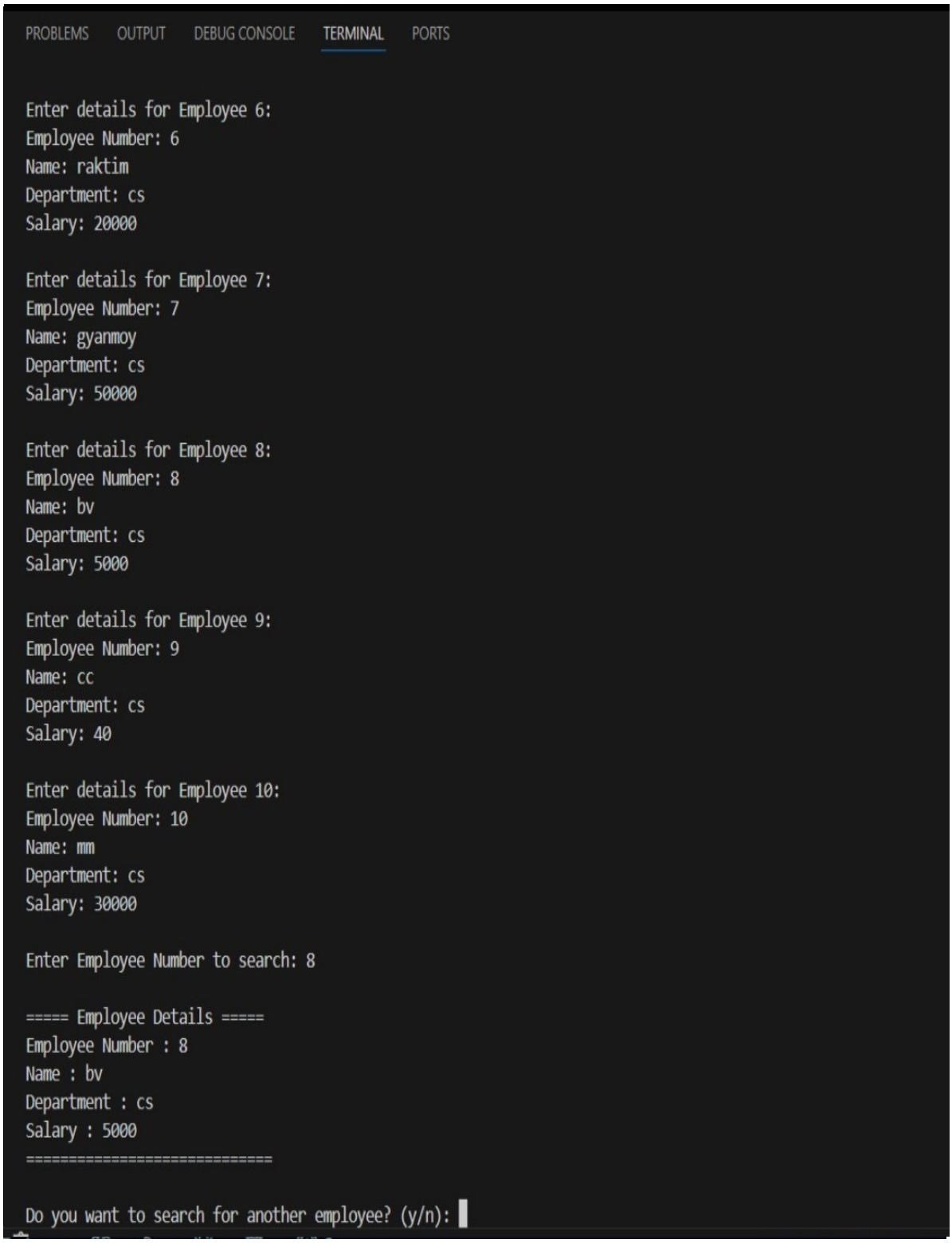
```
        cout << "Name: ";
        getline(cin, employeeList[index].employeeName);
        cout << "Department: ";
        getline(cin, employeeList[index].employeeDepartment);
        cout << "Salary: ";
        cin >> employeeList[index].employeeSalary;
    }
}

// Function to display employee details
void displayEmployeeDetails(const Employee &employee) {
    cout << "\n===== Employee Details =====\n";
    cout << "Employee Number  : " << employee.employeeNumber << endl;
    cout << "Name             : " << employee.employeeName << endl;
    cout << "Department       : " << employee.employeeDepartment << endl;
    cout << "Salary           : " << employee.employeeSalary << endl;
    cout << "============================\n";
}
// Function to search for an employee by their number
void searchEmployeeByNumber(Employee employeeList[], int totalEmployees, int
searchEmployeeNumber) {
```

```
    for (int index = 0; index < totalEmployees; index++) {
  if (employeeList[index].employeeNumber == searchEmployeeNumber) {
            displayEmployeeDetails(employeeList[index]);
            return; // Exit the function after finding the employee
        }
    }
    cout << "Employee with Employee Number " << searchEmployeeNumber << " not found.\n";
}

// Main function
int main() {
    const int TOTAL_EMPLOYEES = 10; // Number of employees
    Employee employeeList[TOTAL_EMPLOYEES]; // Array to store employee details

    cout << "===== Employee Information System =====\n";

    // Input details for employees
    inputEmployeeDetails(employeeList, TOTAL_EMPLOYEES);

    char userChoice;
```

```
    do {
        int searchEmployeeNumber;
        cout << "\nEnter Employee Number to search: ";
        cin >> searchEmployeeNumber;

        // Search and display employee details
        searchEmployeeByNumber(employeeList, TOTAL_EMPLOYEES, searchEmployeeNumber);

        // Ask user if they want to search again
        cout << "\nDo you want to search for another employee? (y/n): ";
        cin >> userChoice;

    } while (userChoice == 'y' || userChoice == 'Y');

    cout << "\nThank you for using the Employee Information System. Goodbye!\n";
    return 0;
}
```

Output :

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 17.cpp -o 17};if($?){.\17}
===== Employee Information System =====

Enter details for Employee 1:
Employee Number: 1
Name: nayana
Department: cs
Salary: 4000

Enter details for Employee 2:
Employee Number: 2
Name: krishna
Department: cs
Salary: 5000

Enter details for Employee 3:
Employee Number: 3
Name: bhumika
Department: cs
Salary: 30000

Enter details for Employee 4:
Employee Number: 4
Name: himashree
Department: cs
Salary: 40000

Enter details for Employee 5:
Employee Number: 5
Name: chinmoy
Department: cs
Salary: 10000

Enter details for Employee 6:
Employee Number: 6
Name: raktim
Department: cs
Salary: 20000

Enter details for Employee 7:
Employee Number: 7
```


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
Enter details for Employee 6:
Employee Number: 6
Name: raktim
Department: cs
Salary: 20000
Enter details for Employee 7:
Employee Number: 7
Name: gyanmoy
Department: cs
Salary: 50000
Enter details for Employee 8:
Employee Number: 8
Name: bv
Department: cs
Salary: 5000
Enter details for Employee 9:
Employee Number: 9
Name: cc
Department: cs
Salary: 40
Enter details for Employee 10:
Employee Number: 10
Name: mm
Department: cs
Salary: 30000
Enter Employee Number to search: 8
===== Employee Details =====
Employee Number : 8
Name : bv
Department : cs
Salary : 5000
==========
Do you want to search for another employee? (y/n):

Program 18. Program to accept and print a student's result using a structure having array inside it.

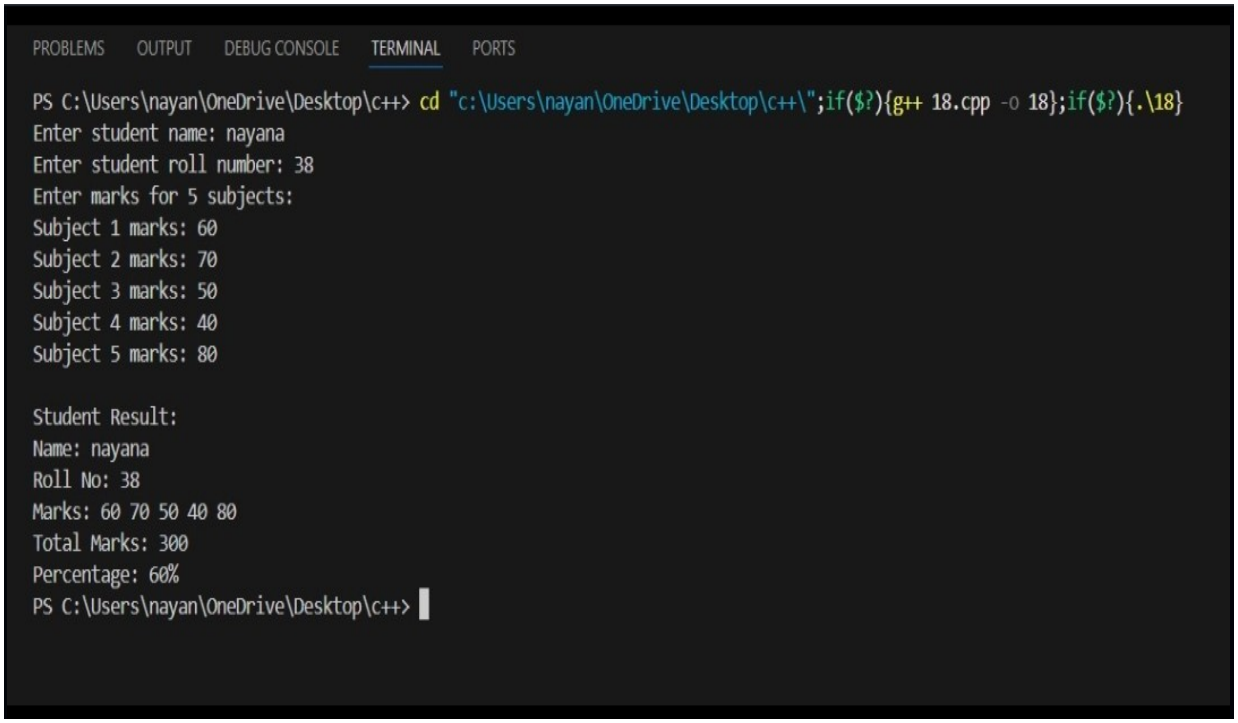
Solution:

```
#include <iostream>

#include <string>

using namespace std;


// Define a structure for Student

struct Student {

   string name;

   int rollNo;

   float marks[5];  // Array to store marks for 5 subjects

   float totalMarks;

   float percentage;

};


// Function to calculate total and percentage

void calculateResult(Student &student) {

   student.totalMarks = 0;

   for (int i = 0; i < 5; i++) {

      student.totalMarks += student.marks[i];

   }
```

```
    student.percentage = (student.totalMarks / 500) * 100;  // Assuming maximum marks for each subject is 100
}

int main() {
    Student student;

    // Accept student details
    cout << "Enter student name: ";
    getline(cin, student.name);

    cout << "Enter student roll number: ";
    cin >> student.rollNo;

    // Accept marks for 5 subjects
    cout << "Enter marks for 5 subjects:\n";
    for (int i = 0; i < 5; i++) {
        cout << "Subject " << i + 1 << " marks: ";
        cin >> student.marks[i];
    }
```

```
    // Calculate total and percentage
    calculateResult(student);

    // Print student result
    cout << "\nStudent Result:\n";
    cout << "Name: " << student.name << endl;
    cout << "Roll No: " << student.rollNo << endl;
    cout << "Marks: ";
    for (int i = 0; i < 5; i++) {
        cout << student.marks[i] << " ";
    }
    cout << endl;

    cout << "Total Marks: " << student.totalMarks << endl;
    cout << "Percentage: " << student.percentage << "%" << endl;

    return 0;
}
```

Output :


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 18.cpp -o 18};if($?){.\18}
Enter student name: nayana
Enter student roll number: 38
Enter marks for 5 subjects:
Subject 1 marks: 60
Subject 2 marks: 70
Subject 3 marks: 50
Subject 4 marks: 40
Subject 5 marks: 80
Student Result:
Name: nayana
Roll No: 38
Marks: 60 70 50 40 80
Total Marks: 300
Percentage: 60%
PS C:\Users\nayan\OneDrive\Desktop\c++>

Program 19. Program to illustrate passing of structures by value.

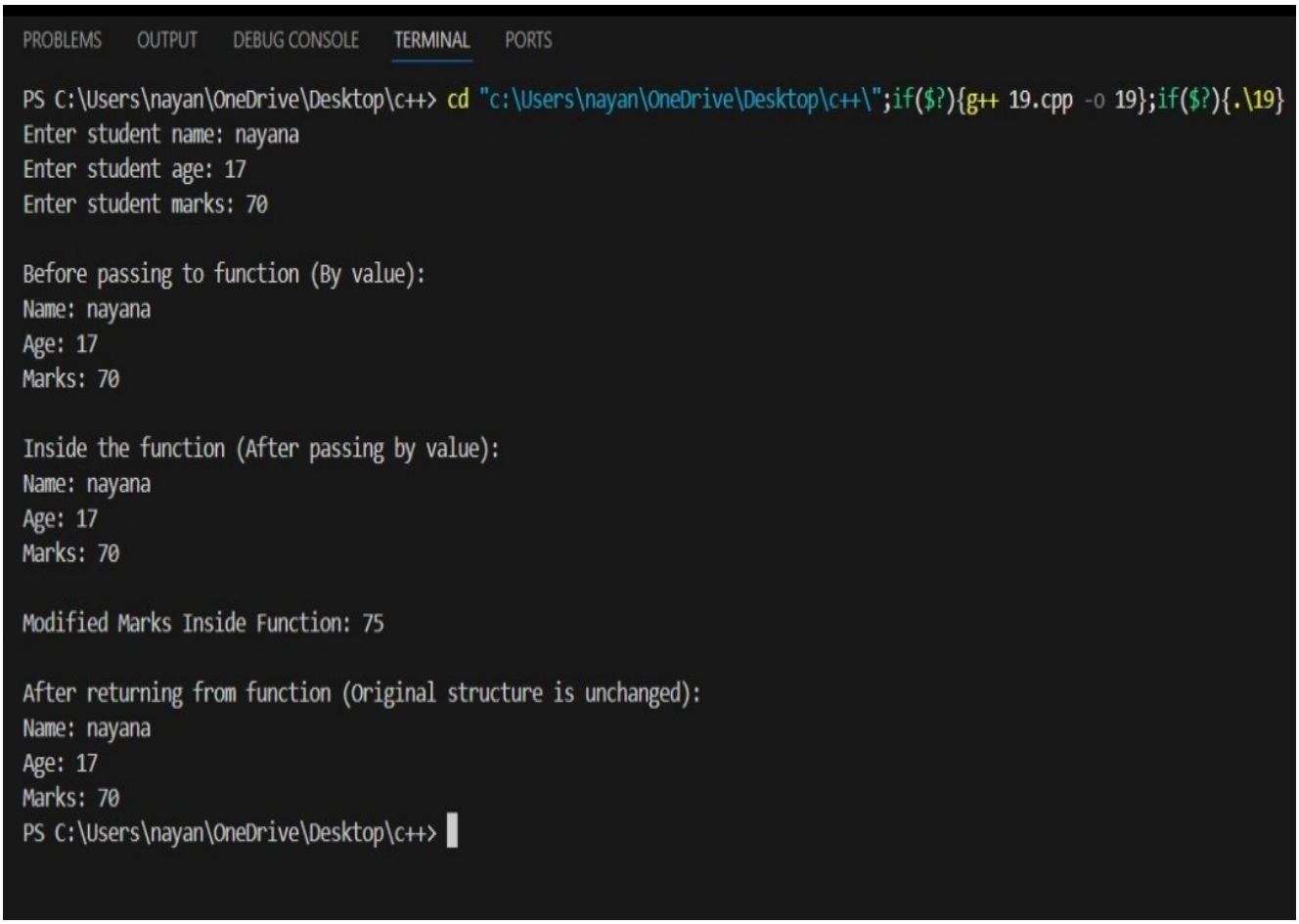
Solution:

```
#include <iostream>

#include <string>

using namespace std;


// Define a structure for Student

struct Student {

   string name;

   int age;

   float marks;

};


// Function to display student details

void displayStudentDetails(Student student) {

   cout << "\nInside the function (After passing by value):\n";

   cout << "Name: " << student.name << endl;

   cout << "Age: " << student.age << endl;

   cout << "Marks: " << student.marks << endl;


   // Modify the student's marks inside the function (this won't affect the original structure)
```

```
    student.marks += 5;
    cout << "\nModified Marks Inside Function: " << student.marks << endl;
}

// Main function
int main() {
    Student student1;

    // Input student details
    cout << "Enter student name: ";
    getline(cin, student1.name);

    cout << "Enter student age: ";
    cin >> student1.age;

    cout << "Enter student marks: ";
    cin >> student1.marks;

    // Display student details before calling the function
    cout << "\nBefore passing to function (By value):\n";
    cout << "Name: " << student1.name << endl;
```

```
    cout << "Age: " << student1.age << endl;
    cout << "Marks: " << student1.marks << endl;

    // Pass structure by value to the function
    displayStudentDetails(student1);

    // Display student details after calling the function
    cout << "\nAfter returning from function (Original structure is unchanged):\n";
    cout << "Name: " << student1.name << endl;
    cout << "Age: " << student1.age << endl;
    cout << "Marks: " << student1.marks << endl;

    return 0;
}
```

Output :


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 19.cpp -o 19};if($?){.\19}
Enter student name: nayana
Enter student age: 17
Enter student marks: 70
Before passing to function (By value):
Name: nayana
Age: 17
Marks: 70
Inside the function (After passing by value):
Name: nayana
Age: 17
Marks: 70
Modified Marks Inside Function: 75
After returning from function (Original structure is unchanged):
Name: nayana
Age: 17
Marks: 70
PS C:\Users\nayan\OneDrive\Desktop\c++>

Program 20. Program to illustrate passing of a structure by reference.

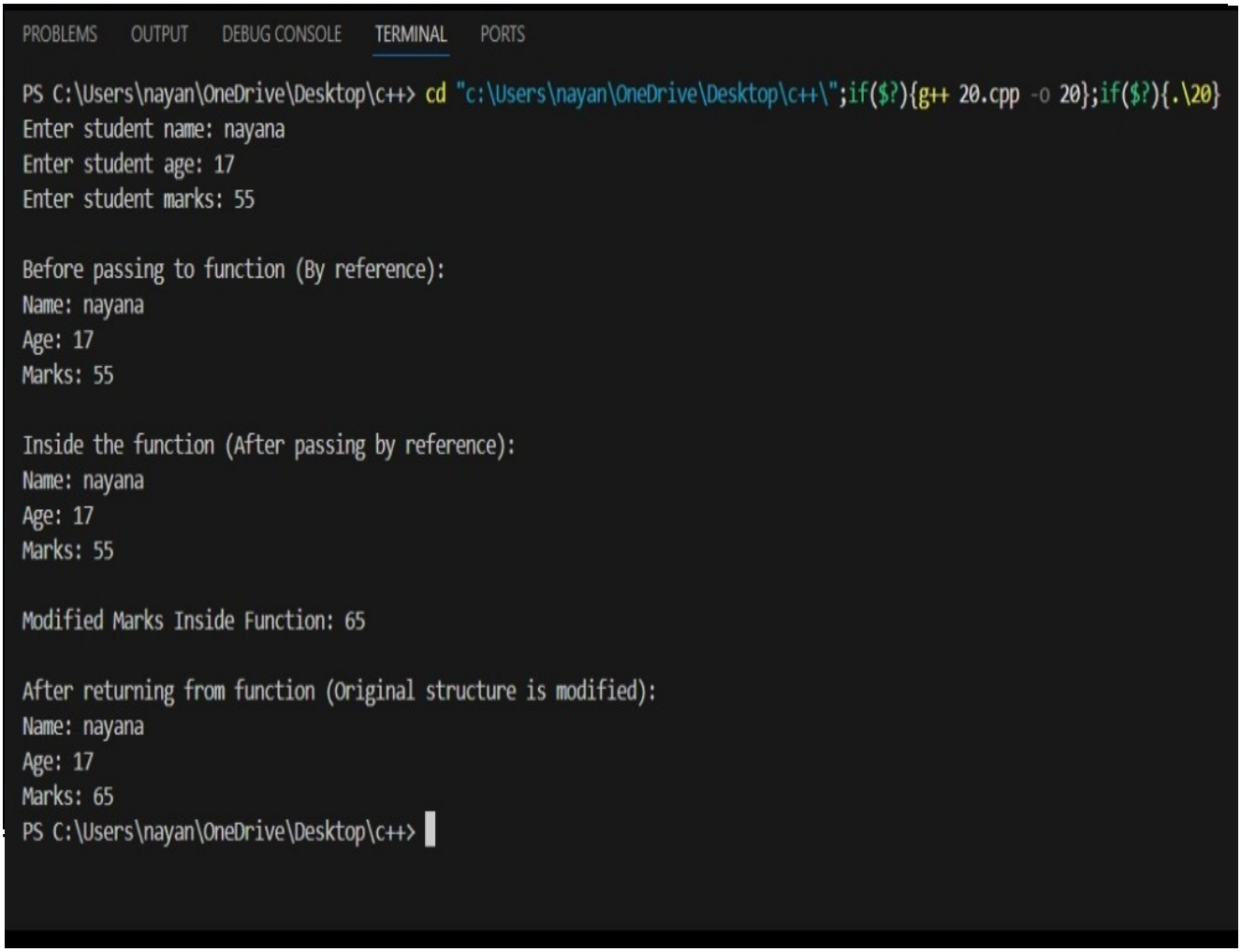
Solution:

```
#include <iostream>

#include <string>

using namespace std;


// Define a structure for Student

struct Student {

   string name;

   int age;

   float marks;

};


// Function to display and modify student details (passing by reference)

void modifyStudentDetails(Student &student) {

   cout << "\nInside the function (After passing by reference):\n";

   cout << "Name: " << student.name << endl;

   cout << "Age: " << student.age << endl;

   cout << "Marks: " << student.marks << endl;
```

```
    // Modify the student's marks inside the function (this will affect the original structure)
    student.marks += 10;  // Increase marks by 10
    cout << "\nModified Marks Inside Function: " << student.marks << endl;
}

// Main function
int main() {
    Student student1;

    // Input student details
    cout << "Enter student name: ";
    getline(cin, student1.name);

    cout << "Enter student age: ";
    cin >> student1.age;

    cout << "Enter student marks: ";
    cin >> student1.marks;

    // Display student details before calling the function
    cout << "\nBefore passing to function (By reference):\n";
```

```
    cout << "Name: " << student1.name << endl;
    cout << "Age: " << student1.age << endl;
    cout << "Marks: " << student1.marks << endl;

    // Pass structure by reference to the function
    modifyStudentDetails(student1);

    // Display student details after calling the function
    cout << "\nAfter returning from function (Original structure is modified):\n";
    cout << "Name: " << student1.name << endl;
    cout << "Age: " << student1.age << endl;
    cout << "Marks: " << student1.marks << endl;

    return 0;
}
```

Output :


PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\nayan\OneDrive\Desktop\c++> cd "c:\Users\nayan\OneDrive\Desktop\c++\";if($?){g++ 20.cpp -o 20};if($?){.\20}
Enter student name: nayana
Enter student age: 17
Enter student marks: 55
Before passing to function (By reference):
Name: nayana
Age: 17
Marks: 55
Inside the function (After passing by reference):
Name: nayana
Age: 17
Marks: 55
Modified Marks Inside Function: 65
After returning from function (Original structure is modified):
Name: nayana
Age: 17
Marks: 65
PS C:\Users\nayan\OneDrive\Desktop\c++>

Q. Presentation based on research :

Research Documentation: AI Innovations in India

1. Introduction

This documentation explores two groundbreaking AI-powered innovations developed in India, showcasing the country's contributions to the fields of artificial intelligence (AI) and machine learning (ML). These projects highlight India’s commitment to leveraging technology for solving critical challenges.

---

2. Innovations

2.1 August AI Doctor

Origin: August AI Doctor is a revolutionary healthcare innovation developed by Indian researchers to address challenges such as doctor shortages and healthcare access disparities. It combines expertise in AI, medicine, and public health.

Objectives :

Provide accurate diagnostics for common and complex health conditions.

Enable remote consultations and second opinions.

Reduce the burden on healthcare professionals.

Ensure accessibility in rural and underserved regions of India.

Core Team and Collaborators:

AI specialists from IITs and IISc.

Medical professionals from AIIMS and other top healthcare institutions.

Supported by India’s Ministry of Health and Family Welfare.

Features and Functionalities:

AI-Powered Diagnostics: Analyzes medical images and provides risk assessments.

Natural Language Processing (NLP): Interprets symptoms and generates reports.

Remote Consultation Platform: Enables real-time consultations and AI-assisted triaging

Integration with Indian Healthcare Ecosystem: Supports EHR initiatives and pharmacy networks.

Impact:

Addresses doctor shortages by providing instant medical insights.

Offers affordable diagnostic services accessible in rural areas.

Improves healthcare efficiency by automating routine tasks.

Limitations:

Data Privacy and Security: Requires robust measures for patient data protection.

Training Bias: Efforts are needed to diversify training datasets.

Technological Barriers: Limited internet access in rural areas.

Future Scope:

Expand diagnostic capabilities to include rare diseases and mental health.

Explore global applications in developing countries.

Collaborate with tech companies and NGOs for broader adoption.

2.2 Bharat AI Agriculture System

Origin: Bharat AI Agriculture System is an innovative AI-driven solution developed in India to optimize agricultural practices and enhance productivity. It addresses challenges such as unpredictable weather, pest infestations, and resource inefficiency faced by Indian farmers.

Objectives:

Provide real-time insights on crop health and soil conditions.

Predict weather patterns and suggest optimal sowing times.

Reduce resource wastage through precision farming techniques.

Core Team and Collaborators:

Developed in collaboration with agricultural universities and research centers across India.

Supported by government initiatives such as Digital India and Make in India.

Features and Functionalities :

Crop Monitoring: Uses satellite imagery and drones to assess crop health.

Pest Control: AI algorithms detect pest infestations early and recommend solutions.

Weather Prediction: ML models analyze meteorological data to provide accurate forecasts.

Resource Optimization: Suggests efficient usage of water, fertilizers, and pesticides.

Impact :

Increases crop yields by providing actionable insights.

Reduces costs for farmers through efficient resource management.

Promotes sustainable farming practices to protect the environment.

Limitations:

Data Availability: Requires consistent data collection from farms.

Adoption Challenges: Farmers need training to use AI tools effectively.

Infrastructure Gaps: Limited access to technology in remote farming areas.

Future Scope:

Expand the system to include livestock management and aquaculture.

Develop multilingual interfaces to cater to farmers across India.

Collaborate with international organizations to implement similar systems globally.

---

3. Conclusion

These two innovations—August AI Doctor and Bharat AI Agriculture System—demonstrate India's ability to harness AI and ML for addressing critical challenges in healthcare and agriculture. By leveraging cutting-edge technology and fostering collaboration among experts, India continues to pave the way for a smarter, more sustainable future.

References

- Government of India, Ministry of Health and Family Welfare Reports.

- Research papers and AI publications from IITs and IISc.

- Case studies on AI in Indian agriculture by ICAR and NITI Aayog.

Q : Device specification :

Record of the configuration of computer system used by the student in the computer lab (by exploring inside computer system in the first two lab classes).

Device specifications

Processor: Intel(R) Core (TM) i3-4130 CPU @ 3.40GHz
Installed RAM: 4.00 GB
Device ID: E2948359-B732-4233-B97E-4DF27C034F23
Product ID: 0031-10000-00001-AA019
System type: 64-bit operating system, x640-based processor
Pen and touch: No pen or touch input is available for this display
OS: Windows 10