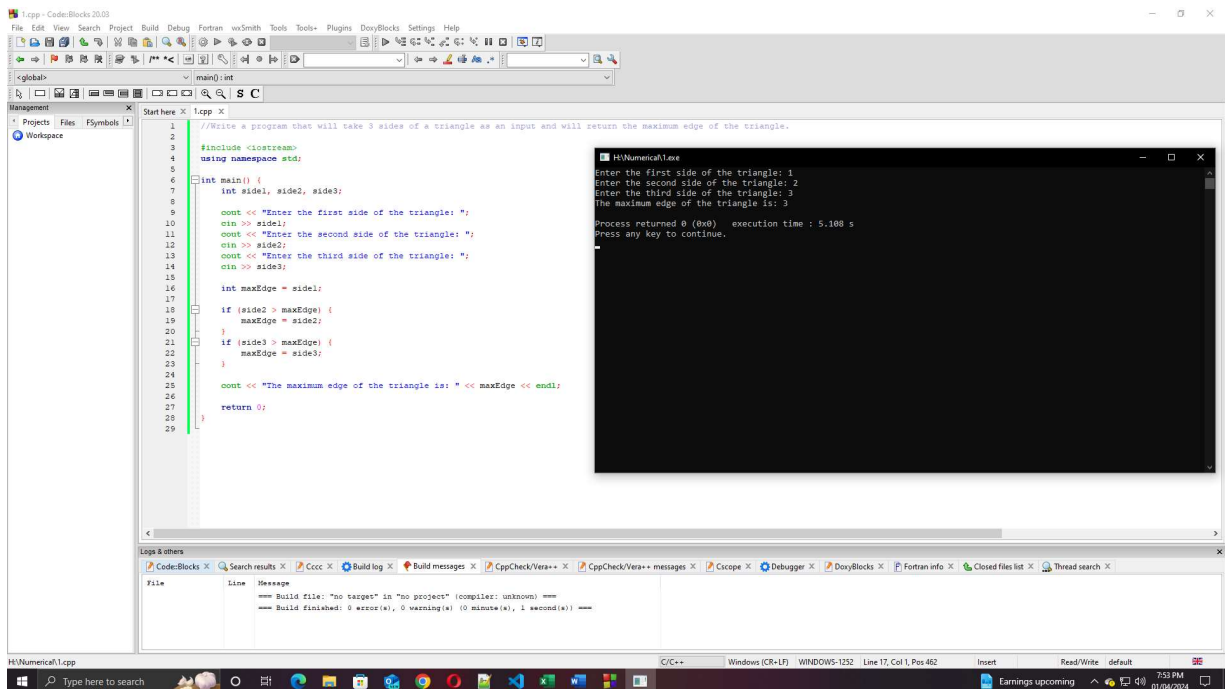


Course Title: Numerical Analysis and Computer Programming

1. Write a program that will take 3 sides of a triangle as an input and will return the maximum edge of the triangle.



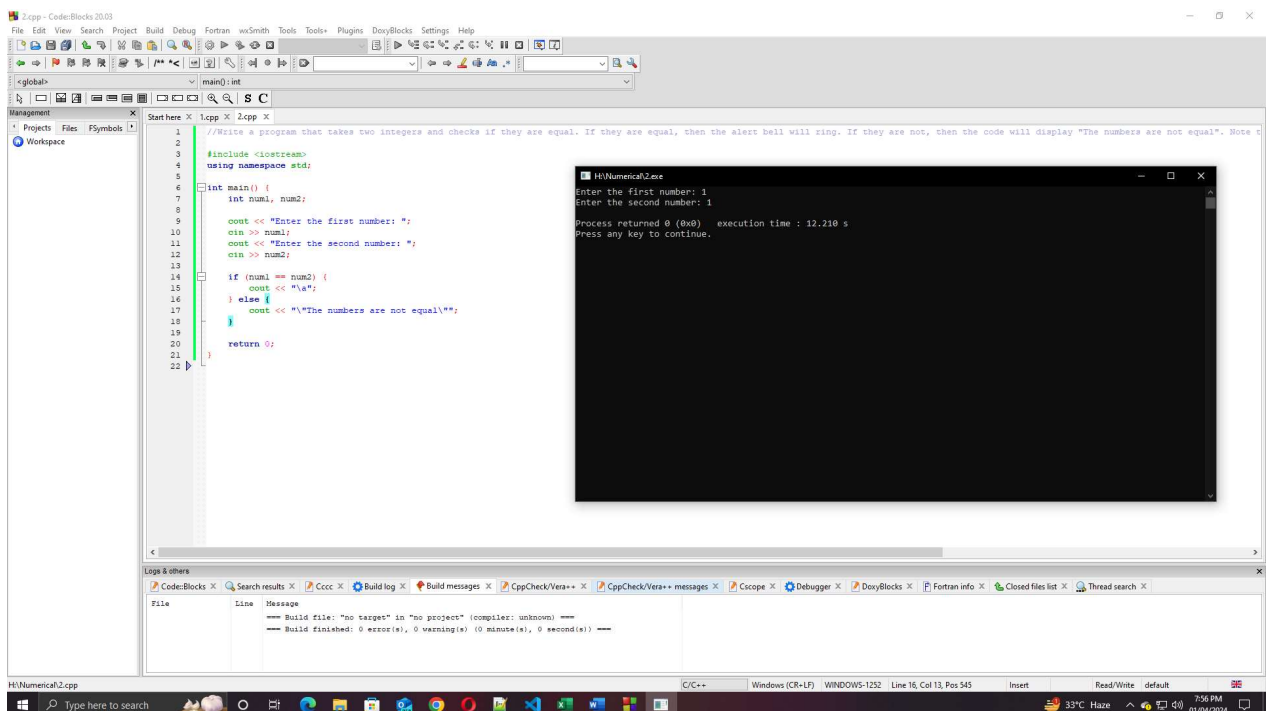
The screenshot shows the Code::Blocks IDE with a C++ project named '1.cpp'. The code is as follows:

```
1 //Write a program that will take 3 sides of a triangle as an input and will return the maximum edge of the triangle.
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     int side1, side2, side3;
8
9     cout << "Enter the first side of the triangle: ";
10    cin >> side1;
11    cout << "Enter the second side of the triangle: ";
12    cin >> side2;
13    cout << "Enter the third side of the triangle: ";
14    cin >> side3;
15
16    int maxEdge = side1;
17
18    if (side2 > maxEdge) {
19        maxEdge = side2;
20    }
21    if (side3 > maxEdge) {
22        maxEdge = side3;
23    }
24
25    cout << "The maximum edge of the triangle is: " << maxEdge << endl;
26
27    return 0;
28 }
29
```

The output window shows the following execution:

```
Enter the first side of the triangle: 1
Enter the second side of the triangle: 2
Enter the third side of the triangle: 3
The maximum edge of the triangle is: 3
Process returned 0 (0x0)   execution time : 5.108 s
Press any key to continue.
```

2. Write a program that takes two integers and checks if they are equal. If they are equal, then the alert bell will ring. If they are not, then the code will display "The numbers are not equal". Note that, 'The numbers are not equal' will be shown including the quotation marks.



The screenshot shows the Code::Blocks IDE with a C++ project named '2.cpp'. The code is as follows:

```
1 //Write a program that takes two integers and checks if they are equal. If they are equal, then the alert bell will ring. If they are not, then the code will display "The numbers are not equal". Note
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     int num1, num2;
8
9     cout << "Enter the first number: ";
10    cin >> num1;
11    cout << "Enter the second number: ";
12    cin >> num2;
13
14    if (num1 == num2) {
15        cout << "\a";
16    } else {
17        cout << "\nThe numbers are not equal!";
18    }
19
20    return 0;
21 }
22
```

The output window shows the following execution:

```
Enter the first number: 1
Enter the second number: 1
Process returned 0 (0x0)   execution time : 12.210 s
Press any key to continue.
```

3. Write a code that will take 2 numbers. It will return true if the sum of the two numbers is greater than 100. Otherwise, it will return false.

The screenshot shows the Code::Blocks IDE with a C++ project. The main window displays the source code for `H\Numerical3.cpp`. The code defines a function `isSumGreaterThan100` that takes two integers and returns a boolean. The `main` function prompts the user to enter two numbers, calls the function, and prints the result. A terminal window shows the execution with inputs 99 and 20, resulting in "The sum of the two numbers is not greater than 100." The status bar at the bottom indicates the file is in "no project" mode.

```
1 // Write a code that will take 2 numbers. It will return true if the sum of the two numbers is greater than 100. Otherwise, it will return false.
2
3 #include <iostream>
4 using namespace std;
5
6 bool isSumGreaterThan100(int num1, int num2) {
7     return (num1 + num2) > 100;
8 }
9
10 int main() {
11     int number1, number2;
12     cout << "Enter the first number: ";
13     cin >> number1;
14
15     cout << "Enter the second number: ";
16     cin >> number2;
17
18     bool result = isSumGreaterThan100(number1, number2);
19
20     if (result) {
21         cout << "The sum of the two numbers is greater than 100." << endl;
22     } else {
23         cout << "The sum of the two numbers is not greater than 100." << endl;
24     }
25
26     return 0;
27 }
```

Terminal output:

```
Enter the first number: 99
Enter the second number: 20
The sum of the two numbers is not greater than 100.
Process returned 0 (0x0)   execution time : 3.588 s
Press any key to continue.
```

4. Create a code that takes two arguments. Both arguments are integers, a and b. Return true if one of them is 10 or if their sum is 10. Otherwise, return false.

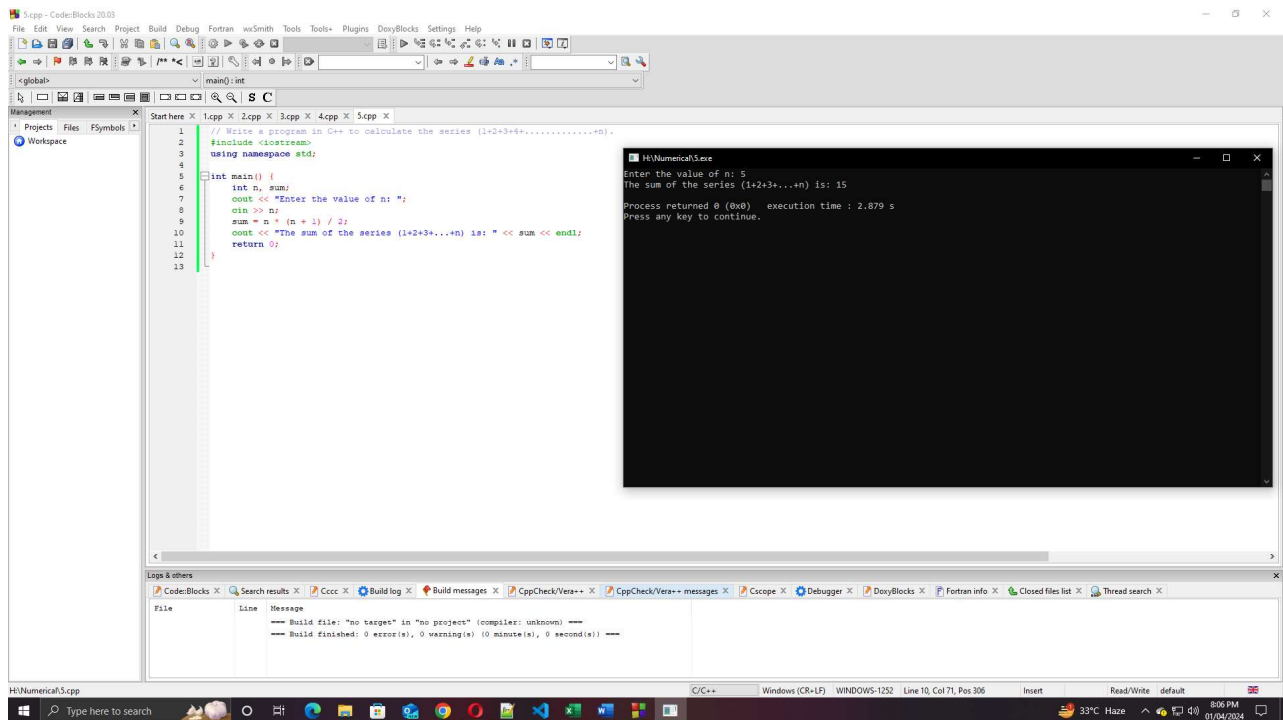
The screenshot shows the Code::Blocks IDE with a C++ project. The main window displays the source code for `H\Numerical4.cpp`. The code defines a function `isTenOrSumTen` that takes two integers and returns a boolean. The `main` function prompts the user to enter two integers, calls the function, and prints the result. A terminal window shows the execution with inputs 10 and 20, resulting in "True: One of the numbers is 10 or their sum is 10." The status bar at the bottom indicates the file is in "no project" mode.

```
1 // Create a code that takes two arguments. Both arguments are integers, a and b. Return true if one of them is 10 or if their sum is 10. Otherwise, return false.
2
3 #include <iostream>
4 using namespace std;
5
6 bool isTenOrSumTen(int a, int b) {
7     if (a == 10 || b == 10 || (a + b) == 10) {
8         return true;
9     } else {
10         return false;
11     }
12 }
13
14 int main() {
15     int a, b;
16     cout << "Enter two integers: ";
17     cin >> a >> b;
18
19     if (isTenOrSumTen(a, b)) {
20         cout << "True: One of the numbers is 10 or their sum is 10." << endl;
21     } else {
22         cout << "False: Neither of the conditions is met." << endl;
23     }
24
25     return 0;
26 }
```

Terminal output:

```
Enter two integers: 10
20
True: One of the numbers is 10 or their sum is 10.
Process returned 0 (0x0)   execution time : 4.562 s
Press any key to continue.
```

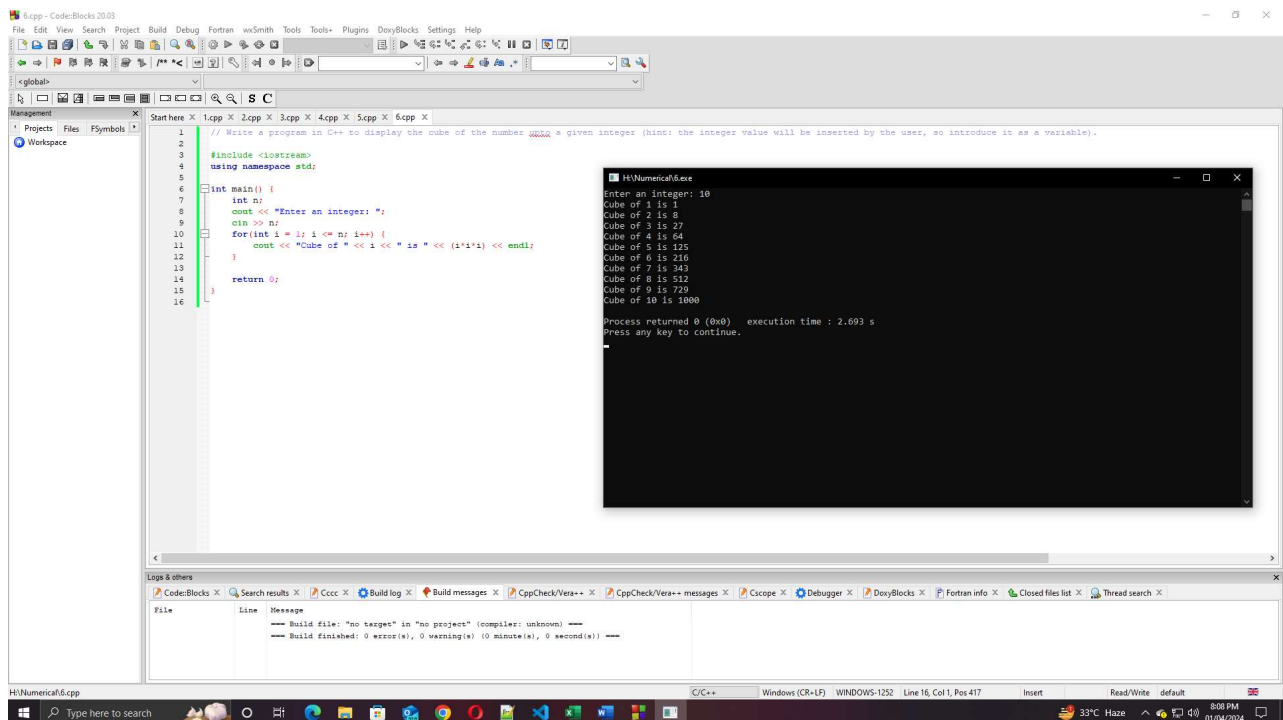
5. Write a program in C++ to calculate the series $(1+2+3+4+\dots+n)$.



```
1 // Write a program in C++ to calculate the series (1+2+3+4+.....+n).
2 #include <iostream>
3 using namespace std;
4
5 int main() {
6     int n, sum;
7     cout << "Enter the value of n: ";
8     cin >> n;
9     sum = n * (n + 1) / 2;
10    cout << "The sum of the series (1+2+3+...+n) is: " << sum << endl;
11    return 0;
12 }
13
```

Enter the value of n: 5
The sum of the series (1+2+3+...+n) is: 15
Process returned 0 (0x0) execution time : 2.879 s
Press any key to continue.

6. Write a program in C++ to display the cube of the number upto a given integer (hint: the integer value will be inserted by the user, so introduce it as a variable).



```
1 // Write a program in C++ to display the cube of the number upto a given integer (hint: the integer value will be inserted by the user, so introduce it as a variable).
2 #include <iostream>
3 using namespace std;
4
5 int main() {
6     int n;
7     cout << "Enter an integer: ";
8     cin >> n;
9     for(int i = 1; i <= n; i++) {
10        cout << "Cube of " << i << " is " << (i*i*i) << endl;
11    }
12    return 0;
13 }
14
15
16
```

Enter an integer: 10
Cube of 1 is 1
Cube of 2 is 8
Cube of 3 is 27
Cube of 4 is 64
Cube of 5 is 125
Cube of 6 is 216
Cube of 7 is 343
Cube of 8 is 512
Cube of 9 is 729
Cube of 10 is 1000
Process returned 0 (0x0) execution time : 2.693 s
Press any key to continue.

7. Write a program in C++ to display the n terms of even natural number and their sum.

```

1 // Write a program in C++ to display the n terms of even natural number and their sum.
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     int n, sum = 0;
8
9     cout << "Enter the number of terms: ";
10    cin >> n;
11
12    cout << "\nThe first " << n << " even natural numbers are:\n";
13
14    for(int i = 1; i <= n; i++) {
15        int evenNumber = i * 2;
16        cout << evenNumber << " ";
17        sum += evenNumber;
18    }
19
20    cout << "\n\nThe sum of the first " << n << " even natural numbers is: " << sum << endl;
21
22    return 0;
23 }

```

Output:

```

Enter the number of terms: 5
The first 5 even natural numbers are:
2 4 6 8 10
The sum of the first 5 even natural numbers is: 30
Process returned 0 (0x0)   execution time : 2.357 s
Press any key to continue.

```

8. Write a program that will find if a certain year is a leap year or not. (A leap year is exactly divisible by 4 except for century years (years ending with 00). The century year is a leap year only if it is perfectly divisible by 400).

```

1 // Write a program that will find if a certain year is a leap year or not. (A leap year is exactly divisible by 4 except for century years (years ending with 00). The century year is a leap year only if it is perfectly divisible by 400).
2
3 #include <iostream>
4 using namespace std;
5
6 bool isLeapYear(int year) {
7     return (year % 4 == 0 && (year % 100 != 0 || year % 400 == 0));
8 }
9
10 int main() {
11     int year;
12     cout << "Enter a year: ";
13     cin >> year;
14
15     if (isLeapYear(year)) {
16         cout << year << " is a leap year." << endl;
17     } else {
18         cout << year << " is not a leap year." << endl;
19     }
20
21     return 0;
22 }

```

Output:

```

Enter a year: 2100
2100 is not a leap year.
Process returned 0 (0x0)   execution time : 1.300 s
Press any key to continue.

```

9. Suppose, a shop gives you 10% discount for purchases above 10000 tk. Write a code that will display the total amount of bill payable by the customer by counting the number of products purchased. Given, unit price of the products is 75 tk.

```

1 // Suppose, a shop gives you 10% discount for purchases above 10000 tk. Write a code that will display the total amount of bill payable by the customer by counting the number of products purchased. Give
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     int numberOfProducts;
8     const int unitPrice = 75;
9     cout << "Enter the number of products purchased: ";
10    cin >> numberOfProducts;
11
12    int totalCost = numberOfProducts * unitPrice;
13
14    if (totalCost > 10000) {
15        double discount = totalCost * 0.1;
16        totalCost -= discount;
17    }
18
19    cout << "The total amount payable by the customer is: " << totalCost << " Tk." << endl;
20
21    return 0;
22 }
23

```

```

H:\Numerical9.exe
Enter the number of products purchased: 1000
The total amount payable by the customer is: 67500 Tk.
Process returned 0 (0x0)   execution time : 3.304 s
Press any key to continue.

```

10. Suppose, a construction labor works at the rate of 200tk/hr. If the daily payable bills of all the workers exceed 20000 tk, then only 80% of the total payable amounts are given to the workers. The rest will be paid the next day. Now, write a code that will show the total amount of bill payable by the owner on a certain day. Assume each labor works for 8hr/day (Hint: Take the number of workers and the bill payable from the previous day as variables).

```

1 // Suppose, a construction labor works at the rate of 200tk/hr. If the daily payable bills of all the workers exceed 20000 tk, then only 80% of the total payable amounts are given to the workers. The
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     int numberOfWorkers;
8     float billPayableFromPreviousDay;
9
10    cout << "Enter the number of workers: ";
11    cin >> numberOfWorkers;
12    cout << "Enter the bill payable from the previous day: ";
13    cin >> billPayableFromPreviousDay;
14
15    float dailyRatePerWorker = 200.0;
16    int workingHoursPerDay = 8;
17    float totalDailyBill = numberOfWorkers * dailyRatePerWorker * workingHoursPerDay;
18
19    // If the daily payable bills of all workers exceed 20000 tk,
20    // then only 80% of the total payable amounts are given to the workers.
21    if (totalDailyBill > 20000) {
22        totalDailyBill = (totalDailyBill * 0.8) + (totalDailyBill * 0.2);
23    }
24
25    // Add the bill payable from the previous day
26    totalDailyBill += billPayableFromPreviousDay;
27
28    cout << "The total amount of bill payable by the owner on a certain day is: " << totalDailyBill << " Tk" << endl;
29
30    return 0;
31 }
32

```

```

H:\Numerical10.exe
Enter the number of workers: 50
Enter the bill payable from the previous day: 250
The total amount of bill payable by the owner on a certain day is: 80250 tk
Process returned 0 (0x0)   execution time : 15.361 s
Press any key to continue.

```

11. Suppose, you are the owner of the construction company "Court of Owls". You want to track the weekly payable bill for your ongoing projects. You have total 4 ongoing projects. You hire construction laborers on weekly basis and distribute them to 4 projects. Each labor works at the rate of 130tk/hr. If the weekly payable bills of all the workers exceed 1,50,000 tk, then only 75% of the total payable amounts are given to the workers. The rest will be paid the next week. Now, create a code using C++ language that will show the total amount of bill payable by you on a certain week. Assume each labor works for 8hr/day and 5 days/week.

```

1 // Suppose, you are the owner of the construction company "Court of Owls". You want to track the weekly payable bill for your ongoing projects. You have total 4 ongoing projects. You hire construction
2
3 #include <iostream>
4 using namespace std;
5
6 int main() {
7     const int hourlyRate = 130;
8     const int dailyHours = 8;
9     const int workingDays = 5;
10    const int thresholdAmount = 150000;
11    const float payableRatio = 0.75;
12
13    int totalLaborers;
14    cout << "Enter the total number of laborers working across all projects: ";
15    cin >> totalLaborers;
16
17    int totalWeeklyHours = totalLaborers * dailyHours * workingDays;
18    int totalWeeklyBill = totalWeeklyHours * hourlyRate;
19
20    cout << "Total weekly bill without any conditions: " << totalWeeklyBill << " TK." << endl;
21
22    if (totalWeeklyBill > thresholdAmount) {
23        int payableAmount = totalWeeklyBill * payableRatio;
24        int deferredAmount = totalWeeklyBill - payableAmount;
25        cout << "Total payable amount this week (75%): " << payableAmount << " TK." << endl;
26        cout << "Deferred amount to be paid next week: " << deferredAmount << " TK." << endl;
27    } else {
28        cout << "Total payable amount this week: " << totalWeeklyBill << " TK." << endl;
29    }
30
31    return 0;
32 }

```

Output:

```

Enter the total number of laborers working across all projects: 50
Total weekly bill without any conditions: 260000 TK.
Total payable amount this week (75%): 195000 TK.
Deferred amount to be paid next week: 65000 TK.
Process returned 0 (0x0)   execution time : 18.577 s
Press any key to continue.

```

12. The bending moment M at any point x along a beam can be expressed as: $M(x) = x^3 - 2x^2 - 19x + 20$. You have to determine the position x where the bending moment is exactly zero. This point is critical for the stability and design of the structure. Create a C++ program to solve the equation $M(x) = 0$ using either the Bisection method or the Regula Falsi method. Consider the beam length to be in the range $[0, 4]$ meters, and precision up to 0.001 meters is acceptable. Your program should output the position x where the bending moment is zero.

```

1 // The bending moment M at any point x along a beam can be expressed as: M(x)=x^3-2x^2-19x+20 You have to determine the position x where the bending moment is exactly zero. This point is critical for the stability and design of the
2
3 #include <iostream>
4 using namespace std;
5
6 double polynomialM(double x) {
7     return x*x*x - 2*x*x - 19*x + 20;
8 }
9
10 // Bisection Method
11 double bisectionMethod(double a, double b, double tolerance) {
12     if (M(a) * M(b) >= 0) {
13         cout << "You have not assumed right a and b\n";
14         return 0;
15     }
16
17     double c = a;
18     while ((b-a) >= tolerance) {
19         // Find middle point
20         c = (a+b)/2;
21
22         // Check if middle point is root
23         if (M(c) == 0) break;
24
25         // Decide the side to repeat the steps
26         else if (M(c) * M(a) < 0) b = c;
27         else a = c;
28     }
29
30     return c;
31 }
32
33 int main() {
34     double a = 0, b = 4, tolerance = 0.001;
35     cout << "The function used is M(x) = x^3 - 2x^2 - 19x + 20\n";
36     cout << "Root found using bisection method is : " << bisectionMethod(a, b, tolerance) << endl;
37
38     return 0;
39 }

```

Output:

```

The function used is M(x) = x^3 - 2x^2 - 19x + 20
Root found using bisection method is : 1
Process returned 0 (0x0)   execution time : 0.028 s
Press any key to continue.

```


13. Suppose, you are the owner of a construction company. You want to create a code for the laborer hiring purpose of a recent multistoried apartment construction project. Given, the carrying rate of different components is as follows: Stone chips: 1 laborer/10000kg; Sand: 1 laborer/20000kg; Cement: 1 laborer/200bag; Now, create a code using C++ that will show the number of laborers needed on a particular day for the variable amount of stone chips, sand and cement carrying purpose. Also show the amount of bill payable each day for the hired laborers (laborer hiring cost is 800tk/day/laborer).

```

1 // Suppose, you are the owner of a construction company. You want to create a code for the laborer hiring purpose of a recent multistoried apartment construction project. Given, the carrying rate of different components is as follows: Stone chips: 1 laborer/10000kg; Sand: 1 laborer/20000kg; Cement: 1 laborer/200bag; Now, create a code using C++ that will show the number of laborers needed on a particular day for the variable amount of stone chips, sand and cement carrying purpose. Also show the amount of bill payable each day for the hired laborers (laborer hiring cost is 800tk/day/laborer).
2 #include <iostream>
3 using namespace std;
4
5 int main() {
6     double stoneChipsKg, sandKg;
7     int cementBags;
8
9     int laborersForStone, laborersForSand, laborersForCement;
10
11     cout << "Enter the amount of stone chips (in kg): ";
12     cin >> stoneChipsKg;
13
14     cout << "Enter the amount of sand (in kg): ";
15     cin >> sandKg;
16
17     cout << "Enter the amount of cement (in bags): ";
18     cin >> cementBags;
19
20     // Calculate the number of laborers required
21     laborersForStone = ceil(stoneChipsKg / 10000);
22     laborersForSand = ceil(sandKg / 20000);
23     laborersForCement = ceil(static_cast<double>(cementBags) / 200);
24
25     // Total number of laborers needed
26     int totalLaborers = laborersForStone + laborersForSand + laborersForCement;
27
28     // Calculate the total bill
29     int totalBill = totalLaborers * 800; // 800tk per laborer
30
31     cout << "Total laborers needed: " << totalLaborers << endl;
32     cout << "Total bill payable: " << totalBill << "tk" << endl;
33
34     return 0;
35 }
36

```

```

H:\Numerical\13
Enter the amount of stone chips (in kg): 50
Enter the amount of sand (in kg): 100
Enter the amount of cement (in bags): 100
Total laborers needed: 5
Total bill payable: 2400tk

Process returned 0 (0x0)   execution time : 16.178 s
Press any key to continue.

```

Build log: Build file: "no target" in "no project" (compiler: unknown) --- Build finished: 0 error(s), 0 warning(s) (0 minute(s), 0 second(s)) ---