School Of Mechanical & Manufacturing Engineering, NUST

Department of Mechanical Engineering

CS-114 - Fundamental of Programing

Lab Manual # 1 & 2

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1. **Write a C++ program to calculate distance between two points. The values of coordinates should be input by the user.** $(x_2 - x_1)^2 + (y_2 - y_1)^2$

In this program we will use float command to declare variables. This program will be programmed in such a way that the computer will take input from user using cin command, then proceed further to calculate value of distance using distance formula.

Code:

```cpp
#include <iostream>
#include <cmath>

using namespace std;

int main() {
    //declaring variables using float command
    float x1, x2, y1, y2;

    // Input the coordinates of the first point
    cout << "Enter the x-coordinate of the first point in cm: ";
    cin >> x1;                                          //user will put value which will be assigned to x1
    cout << "Enter the y-coordinate of the first point in cm: ";
    cin >> y1;                                          //user will put value which will be assigned to y1

    // Input the coordinates of the second point
    cout << "Enter the x-coordinate of the second point in cm: ";
    cin >> x2;                                          //user will put value which will be assigned to x2
    cout << "Enter the y-coordinate of the second point in cm: ";
    cin >> y2;                                          //user will put value which will be assigned to y2

    // Calculate the distance using the distance formula
    float distance = sqrt((x2 - x1)*(x2 - x1) + (y2 - y1)*(y2 - y1)); //formula to calculate distance
    // Display the result
    cout << "The distance between the two (x1,y1) and (x2,y2) is " <<distance <<" cm^2"<<endl;
    return 0;
}
```

Result:

```
Enter the x-coordinate of the first point in cm: 56
Enter the y-coordinate of the first point in cm: 78
Enter the x-coordinate of the second point in cm: 60
Enter the y-coordinate of the second point in cm: 80
The distance between the two (x1,y1) and (x2,y2) is 4.47214 cm^2

--------------------------------
Process exited after 10.87 seconds with return value 0
Press any key to continue . . .
```

Using Given Formula :

Code:

```cpp
#include <iostream>

using namespace std;

int main() {
    //declaring variables using float command
    float x1, x2, y1, y2;

    // Input the coordinates of the first point
    cout << "Enter the x-coordinate of the first point: ";
    cin >> x1;                                          //user will put value which will be assigned to x1
    cout << "Enter the y-coordinate of the first point: ";
    cin >> y1;                                          //user will put value which will be assigned to y1

    // Input the coordinates of the second point
    cout << "Enter the x-coordinate of the second point: ";
    cin >> x2;                                           //user will put value which will be assigned to x2
    cout << "Enter the y-coordinate of the second point: ";
    cin >> y2;                                           //user will put value which will be assigned to y2

    // Calculate the distance using the distance formula
    float distance = (x2 - x1)*(x2 - x1) + (y2 - y1)*(y2 - y1); //formula to calculate distance as given
    // Display the result
    cout << "The distance between the two (x1,y1) and (x2,y2) is " <<distance;
    return 0;
}
```

Result:

```
Enter the x-coordinate of the first point: 90
Enter the y-coordinate of the first point: 80
Enter the x-coordinate of the second point: 100
Enter the y-coordinate of the second point: 90
The distance between the two (x1,y1) and (x2,y2) is 200
--------------------------------
Process exited after 12.21 seconds with return value 0
Press any key to continue . . .
```

2. **Write a code in C++ to take length from user in centimeter and convert it into meter and kilometer.**

In this task we need to write code in C++, in which the computer will take input from user and give result in meters and kilometers. We will use cin, cout, and variables will be declared using float as the result will come out in decimal.

Code:

```cpp
#include<iostream>

using namespace std;

int main(){
    float y;                                    //variables declared using float variable for sake of consistency
    cout<<"put value of length in centimeter = y = "; //computer will ask for values
    cin>>y;                                     //user entered value will be assigned to y
    float x;                                   //variable will be declared using float for result in meters
    x = y/100;                                 //formula to calculate result in meters
    cout<<"value of length in meters =  "<<x<< "m" <<endl;  //print out value of length in meters
    float z;                                        //variable declared for vlaue of length in kilometers
    z = y/1000;                                    //to convert length in kilometers
    cout<<"Value of length in Kilometers = "<<z<< "km" <<endl; //to print value of length in kilometers
    return 0;
}
```

Result:

```
put value of length in centimeter = y = 67
value of length in meters =  0.67m
Value of length in Kilometers = 0.067km

--------------------------------
Process exited after 4.114 seconds with return value 0
Press any key to continue . . .
```

3. Write a code in C++ that takes values of a and b from the user and displays result of $a^2 + 2ab + b^2$.

The written program we will also initiate math functions using #include <cmath>. Then the computer will take inputs from user and then calculate it according to given polynomial and give results.

Code:

```cpp
#include <iostream>

using namespace std;

int main() {
    int a, b, c;//declaring variables using float command
    cout<<"Put value of a = "; //computer asking for input value to be assigned to a
    cin>>a;                    //command to assign value to a
    cout<<"Put value of b = ";//computer asking for input value to be assigned to b
    cin>>b;                   //command used to be assigned to b
    c= (a*a + 2*a*b + b*b);    //given polynomail
    cout<<"The value of given polynomial is "<<c;
    return 0;
}
```

Result:

```
Put value of a = 5
Put value of b = 6
The value of given polynomial is 121
--------------------------------
Process exited after 4.999 seconds with return value 0
Press any key to continue . . .
```

4. Write a program in C++ to convert temperature in Fahrenheit to Celsius.

In this program the computer will ask for input of temperature in Celsius and will automatically calculate and show the result in Fahrenheit.

Code:

```cpp
#include <iostream>

using namespace std;

int main()
{
    float fahrenheit, celsius; //declaring variables on to store input and one to store output
    cout << "Enter temperature in Fahrenheit =  ";//computer will ask for input from use
    cin >> fahrenheit;                          //command to store input
    celsius = ((fahrenheit - 32) * 5) / 9;        //formula to convert temperature fro farenheit to celsius
    cout << "Temperature in Celsius is: " << celsius << endl; //final result
    return 0;
}
```

Result:

```
Enter temperature in Fahrenheit: 56
Temperature in Celsius is: 13.3333

--------------------------------
Process exited after 33.92 seconds with return value 0
Press any key to continue . . .
```

5. Write a program that determines if a person is eligible to vote based on their age (e.g., 18 years or older) using logical operators.

In this program the computer will ask for age and show the result whether the person is allowed to vote or not, depending on the age, user entered.

Code 1 using or operator:

```cpp
#include <iostream>

using namespace std;

int main()
{
    int x;
    cout<< "Enter your age ";
    cin>>x;
if  (x=18||x>18)//to check wether a person is eligible or not
    cout<< "You are eligible to vote"; //if condition is true then print this
else
    cout<<"You are not eligible to vote";//if condition is not true then print this

return 0;
}
```

Code 2 without Logical operator:

```cpp
#include <iostream>

using namespace std;

int main()
{
    int x;
    cout<< "Enter your age ";
    cin>>x;
if  (x>=18)//to check wether a person is eligible or not
    cout<< "You are eligible to vote"; //if condition is true then print this
else
    cout<<"You are not eligible to vote";//if condition is not true then print this

return 0;
}
```

Result:

```
Enter your age = 20
 You are eligible to vote

--------------------------------
Process exited after 8.712 seconds with return value 0
Press any key to continue . . .
```

```
Enter your age = 10
 You are not eligible to vote
--------------------------------
Process exited after 2.288 seconds with return value 0
Press any key to continue . . .
```

6. Write a program that takes an integer as input and checks if it falls within the range [10, 50] using logical operators.

By using logical operators and if statement, a program will be written in which the computer will ask for input. After the user gives a value and check whether it belongs to [10,50] or not and shows its result correspondingly.

Code:

```cpp
#include<iostream>
using namespace std;

int main()
{
    int age;                //age is declared as variable
    cout << "Enter your age = "; //asked from user to input his age
    cin >> age;                 //age will be stored in variable age
    if (age >= 18)              //if statement to check the condition
        cout << " You are eligible to vote"<< endl ;
    else
        cout << " You are not eligible to vote";

return 0;
}
```

Result:

```
Enter a number = 50
 The number is within the range [10, 50]

--------------------------------
Process exited after 3.891 seconds with return value 0
Press any key to continue . . .
```

```
Enter a number = 80
 The number is not within the range [10, 50]
--------------------------------
Process exited after 4.134 seconds with return value 0
Press any key to continue . . .
```

7. Write a C++ program to compare two integers and find the maximum value.

This program will take input from user, then compare it and compare it and then will show the number which would be greatest.

Code:

```cpp
#include<iostream>
using namespace std;

int main()
{
    int x, y; //variables to be compared
    cout<<"Put value of x = ";
    cin>>x;                  //value stored in x
    cout<<"Put calue of y = ";
    cin>>y;                 //value stored in y
    if(x>y)                  //if statement to check which number is greater
    cout<<"x is greater than y =" <<x<<">"<<y <<endl;
        else                                    //if first condition is not true
        cout<<"y is greater than x =" <<y<<">"<<x <<endl;
return 0;
}
```

Results:

```
Put value of x = 78
Put calue of y = 90
y is greater than x =90>78

--------------------------------
Process exited after 8.184 seconds with return value 0
Press any key to continue . . .
```

```
Put value of x = 1008
Put calue of y = 500
x is greater than y =1008>500

--------------------------------
Process exited after 15.02 seconds with return value 0
Press any key to continue . . .
```

8. Write a C++ program to calculate the average of three exam scores and determine if it's above a passing grade (e.g., average >= 60).

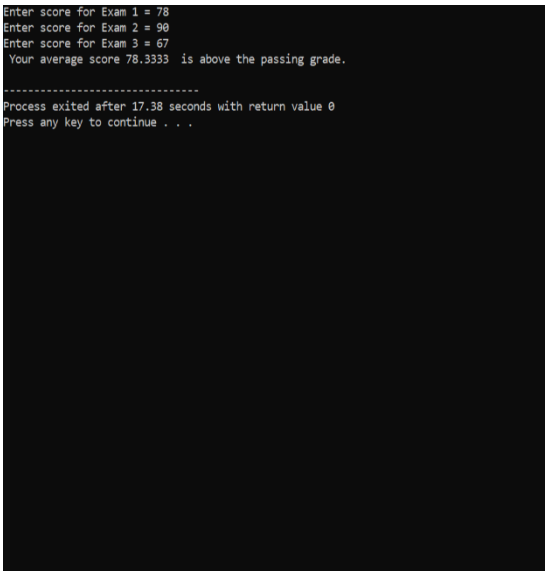
This program will take input of three exam results from user and then according to instructions will calculate the average and shows the result either above passing grade or not as shown below:

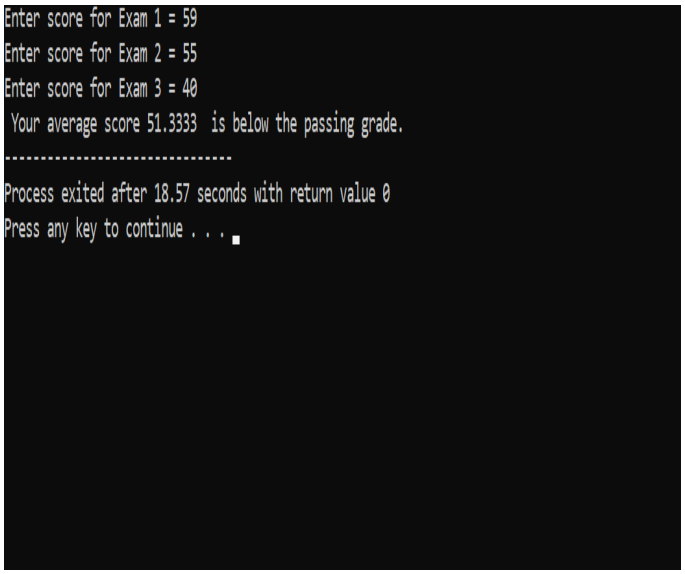
Code:

```cpp
#include<iostream>
using namespace std;

int main()
{
    float S1, S2, S3; //three variables to store three values
    double average;   //average is also declared as variables, in which result will be stored
    cout << "Enter score for Exam 1 = ";
    cin >> S1;                         //first exam stored in S1
    cout << "Enter score for Exam 2 = ";
    cin >> S2;                         //2nd exam result stored in S2
    cout << "Enter score for Exam 3 = ";
    cin >> S3;                         //3rd exam result stored in S3
    average = (S1 + S2 + S3) / 3;      //Formula to calculate average
    if (average >= 60)                 //if statement to check whether it is above passing percentage or not
        cout << " Your average score " << average << "  is above the passing grade." << endl ;
    else
        cout << " Your average score " << average << "  is below the passing grade.";
return 0;
}
```

Results:





9. Create a program that takes a student's score as input and assigns a grade based on predefined criteria using logical operators (e.g., A, B, C, D, F). A-Grade: 90-100 Marks B-Grade: 75-90 Marks C-Grade: 60-75 Marks D-Grade: 45-60 Marks F-Grade: 0-45 Marks.

This program will take the student score in exam as input from user and after processing will assign grade depending on the condition defined in if statement.

Code:

```cpp
#include<iostream>

using namespace std;

int main()
{
    int marks;   //marks declared as variable to store students marks

    cout << "Enter your marks = ";  //computer asks for input
    cin >> marks;       //marks will be stored

    if (marks >= 90 && marks <= 100)   //if , else if statement is used to check the given conditions (1st condition)
        cout<< " Student gets a grade of A";
    else if (marks >= 75 && marks <= 90)  //2nd condition
        cout<< "Student gets a grade of B";
    else if (marks >= 60 && marks <= 75)  //3rd condition
        cout<< "Student gets a grade of C";
    else if (marks >= 45 && marks <= 60)  //4th condition
        cout<< "Student gets a grade of D";
    else if (marks >= 0 && marks <= 45)   //5th condition
        cout<< "Student gets a grade of F";
 return 0;
}
```

Results:

```
Enter your marks = 30
Student gets a grade of F
------------------------------
Process exited after 5.374 seconds with return value 0
Press any key to continue . . .
```

```
Enter your marks = 50
Student gets a grade of D
------------------------------
Process exited after 3.764 seconds with return value 0
Press any key to continue . . .
```

```
Enter your marks = 86
Student gets a grade of B
------------------------------
Process exited after 8.257 seconds with return value 0
Press any key to continue . . .
```

```
Enter your marks = 61
Student gets a grade of C
------------------------------
Process exited after 9.769 seconds with return value 0
Press any key to continue . . .
```

```
Enter your marks = 99
 Student gets a grade of A
--------------------------------
Process exited after 5.097 seconds with return value 0
Press any key to continue . . .
```

10. Write a program that takes an integer as input and determines if it is both even and divisible by 5.

In this program the computer will take input from user, which will be a integer number and after checking both conditions that is number should be even and divisible by 5, computer will give result as defined in program.

Code:

```cpp
#include <iostream>
using namespace std;

int main()
{
    int N ;           //integer to be provided by user will be stored in N
    cout << "Enter a number : "; //computer asks for integer
    cin >> N ;
    if (N % 2 == 0 && N % 5 == 0) //if statement to check that given number is both even and divisible by 5
        cout << "The number is both even and divisible by 5 .";
else                  //if first condition is not true
cout<<"This number is not even or not divisible by 5 ";
return 0;
}
```

Results:

```
Enter a number : 1000
The number is both even and divisible by 5 .
--------------------------------
Process exited after 6.785 seconds with return value 0
Press any key to continue . . .
```

```
Enter a number : 999
This number is not even or not divisible by 5
--------------------------------
Process exited after 7.66 seconds with return value 0
Press any key to continue . . .
```

11. Create a C++ program that checks if a user-provided year is a leap year.

This program is written to check whether the year which the computer will take from user is leap year or not. The program will use if statement to give desired results.

Code:

```cpp
#include<iostream>
using namespace std;

int main() {
    int year;                  //year declared as variable
    cout << "Enter a year = "; //computer asking to input year
    cin >> year;              //provided year will be stored in "year"
    if ((year % 4) == 0)            //if statement to check if year is leap or not
        cout << year << " is a leap year" << endl;  //if condition is true this will be print this statement
    else
        cout << year << " is not a leap year" << endl; //if condition is not true print this statement
return 0;
}

```

Results:

```
Enter a year = 1978
1978 is not a leap year

--------------------------------
Process exited after 3.617 seconds with return value 0
Press any key to continue . . .
```

```
Enter a year = 2004
2004 is a leap year

--------------------------------
Process exited after 9.012 seconds with return value 0
Press any key to continue . . .
```

12. Create a C++ program that determines if a student is eligible for a scholarship based on their GPA (must have GPA >= 3.5) and attendance (must have attended at least 80% of classes).

This program will take the student GPA and attendance and shows whether the student is eligible for the scholarship or not. To be eligible for the scholarship the student must have GPA above or equal to 3.5 and attendance must be greater than or equal to 80%.

Code:

```cpp
#include<iostream>
using namespace std;

int main()
{
    float gpa, attper;    //variables declared for gpa and attendence percentage
    cout << "Enter your GPA = ";  //asking for input
    cin >> gpa;                  //gpa input stored in "gpa"
    cout << "Enter your Attendance Percentage = " ; //asking for 2nd input
    cin >> attper ;                                 //attendence stored in attper
    if (gpa >= 3.5 && attper >= 80)                 //if statement to check given condition
        cout << " You are eligible for a scholarship"<< endl ; //if given condition is true
    else
        cout << " You are not eligible for a scholarship";    //if given condition is not true

return 0;
}
```

Result:

```
Enter your GPA = 3.8
Enter your Attendance Percentage = 79
 You are not eligible for a scholarship
------------------------------
Process exited after 21.52 seconds with return value 0
Press any key to continue . . .
```

```
Enter your GPA = 3.8
Enter your Attendance Percentage = 85
 You are eligible for a scholarship

------------------------------
Process exited after 58.12 seconds with return value 0
Press any key to continue . . .
```

13. Write a program that checks if a given character is a vowel (a, e, i, o, u) or a consonant using logical operators.

This program will compare whether the number input by user is vowel or consonant and will give the result as show below:

Code:

```
#include<iostream>
using namespace std;

int main() {
   char c;
   cout<< "Enter chracter: ";
   cin>>c;
   if ((c=='i')||(c=='a')||(c=='e')||(c=='o')||(c=='u'))
   cout<<c<<" is vowel";
   else if((c>='a'&&c<='z')||(c>='A'&&c<='Z'))
   cout<<c<<" is consonant";
   return 0;
}
```

Result:

```
Enter chracter: e
e is vowel
--------------------------------
Process exited after 11.03 seconds with return value 0
Press any key to continue . . .
```

```
Enter chracter: f
f is consonant
--------------------------------
Process exited after 8.251 seconds with return value 0
Press any key to continue . . .
```