TRIBHUVAN UNIVERSITY

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HIMALAYA COLLEGE OF ENGINEERING

CHYASAL, LALITPUR

Lab Report No: -01

Title: -Basic OOP concepts

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Objectives:

- To understand and apply C++ control structures, functions, and standard libraries.
- To implement mathematical computations using the quadratic formula.
- To develop logic for triangle validation and classification.
- T apply string handling and character checking for password strength.

Tools and Libraries Used

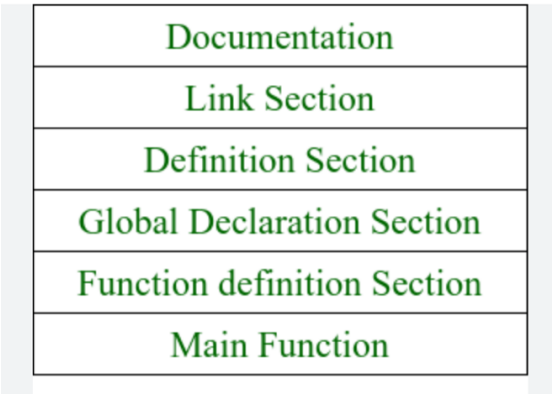
- Programming Language: C++
- IDE: Clang
- Libraries: #include <iostream>, #include <cmath>, #include <string>

THEORY

INTRODUCTION

C++ is a powerful, high-performance programming language widely used for system/software development, game programming, and competitive coding. It supports **object-oriented programming (OOP), procedural programming,** and **generic programming**. C++ provides low-level memory manipulation while maintaining high-level abstractions, making it efficient for complex computations.

Structure of C++ Program:



Key features of C++:

- **Speed & Efficiency:** Compiles directly to machine code.
- **Rich Library Support (STL):** Includes data structures and algorithms.

- **Control Structures:** Like `if-else`, loops, and switch-case for decision-making.
- **Modularity:** Supports functions and classes for code reusability.

Conditional Statements in C++

In C++, **conditional statements** allow programs to make decisions based on certain conditions. The primary conditional structures are:

- **`if` statement** (single condition check).
- **`if-else` statement** (two possible paths).
- **`else-if` ladder** (multiple conditions).

These structures help control the flow of execution based on logical comparisons.

- **IF STATEMENT :**

SYNTAX:

```
if (condition) {
// Code executes if condition is true
}
```

- **IF-ELSE STATEMENT:**

SYNTAX:

```
if (condition) {
// Executes if condition is true  }
else {
/ Executes if condition is false
}
```

- **IF-ELSE LADDER**

SYNTAX:

```
if (condition1) {
/ Runs if condition1 is true  }
else if (condition2) {
// Runs if condition2 is true
}
else if (condition3) {
// Runs if condition3 is true
}
else {
// Default case (if all conditions fail)
}
```

- **NESTED IF-ELSE STATEMENT**

SYNTAX:

```
if (condition1) {
if (condition2) {
// Runs if both conditions are true
}
else {
// Runs if condition1 is true but condition2 is false
}
}
```

LOOPS IN C++

- **FOR LOOP**

```
for (initialization; condition; increment/decrement)

{

// code to be executed

}
```

- **while loop**

Syntax:

```
while (condition) {

// code to be executed

}
```

- **do while loop**

Syntax:

```
do {

// code to be executed

} while (condition);
```

Certain Programs of C++ are:

Solve $ax^2+bx+c=0$ and handle all the discriminant cases.

```
# include < iostream >
# include < cmath >
 using namespace std ;
 int main () {
double a , b , c , discriminant , root1 , root2 ;
cout << " Enter coefficients a, b, and c: ";
cin >> a >> b >> c ;

discriminant = b * b - 4* a * c ;

if ( discriminant > 0) {
 root1 = ( - b + sqrt ( discriminant ) ) / (2* a ) ;
 root2 = ( - b - sqrt ( discriminant ) ) / (2* a ) ;
 cout << " Real and distinct roots : " << root1 << " and "
<< root2 ;
 } else if ( discriminant == 0) {
 root1 = -b / (2* a ) ;
cout << " Real and equal roots : " << root1 ;
 } else {
double realPart = -b / (2* a ) ;
double imagPart = sqrt ( - discriminant ) / (2* a ) ;
cout << " Complex roots : " << realPart << " " <<
imagPart << "i";
}

return 0;
}
```

The output of the program:

```
Enter coefficients a, b, and c: 1 2 3
Complex roots : -1 1.41421i
```

```
 Enter coefficients a, b, and c: 1
3
2
 Real and distinct roots : -1 and -2
```

2)Check if three angles form a triangle and classify it

```
#include<iostream>
using namespace std;
int main()
{
    int a,b,c;
    cout<<"Enter 1st angle: ";
    cin>>a;
    cout<<"Enter 2nd angle: ";
    cin>>b;
    cout<<"Enter 3rd angle: ";
    cin>>c;
    if(a+b+c==180)
    {
        if(a==90 || b==90 || c==90)
        {
            cout<<"Figure is right angled triangle. ";
        }
        else if(a>90 || b>90 || c>90)
        {
            cout<<"Figure is obtuse angled triangle. ";
        }
        else
        {
            cout<<"Figure is acute angled triangle. ";
        }
    }
    else
    {
        cout<<"Given angles don't form a triangle.";
}
}
```

Output of the program

```
Enter 1st angle: 60
Enter 2nd angle: 90
Enter 3rd angle: 30
Figure is right angled triangle.
```

```
Enter 1st angle: 100
Enter 2nd angle: 40
Enter 3rd angle: 40
Figure is obtuse angled triangle.
```

```
Enter 1st angle: 70
Enter 2nd angle: 60
Enter 3rd angle: 50
Figure is acute angled triangle.
```

```
Enter 1st angle: 10
Enter 2nd angle: 20
Enter 3rd angle: 30
Given angles don't form a triangle.
```

3) Password Strength Checker

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

class Password {
    int hasUpper = 0, hasSymbol = 0, hasLower = 0, hasNumber = 0;

public:
    int isUpper(char ch) {
        if (ch >= 65 && ch <= 90) return 1;
        return 0;
    }

    int isLower(char ch) {
        if (ch >= 97 && ch <= 122) return 1;
        return 0;
    }

    int isNumber(char ch) {
        if (ch >= 48 && ch <= 57) return 1;
        return 0;
    }

    int isSymbol(char ch) {
        if ((ch >= 33 && ch <= 47) ||
            (ch >= 58 && ch <= 64) ||
            (ch >= 91 && ch <= 96) ||
            (ch >= 123 && ch <= 126)) {
            return 1;
        }
        return 0;
```

```
int checkPass(string password) {
        if (password.length() <= 8) {
            return 0;
        }

        for (int i = 0; i < password.length(); i++) {
            char ch = password[i];
            if (isUpper(ch)==1) hasUpper = 1;
            else if (isLower(ch)==1) hasLower = 1;
            else if (isNumber(ch)==1) hasNumber = 1;
            else if (isSymbol(ch)==1) hasSymbol = 1;
        }

        if (hasUpper == 1 && hasLower == 1 && hasNumber == 1 && hasSymbol == 1)
            return 1;
        else
            return 0;
    }
};

int main() {
    Password pa;
    string pass;
    cout << "Enter password: ";
    cin >> pass;

    if (pa.checkPass(pass) == 1) {
        cout << "Password is strong." << endl;
    } else {
        cout << "Password is not strong." << endl;
```

Output :

```
Enter password: gaurab123
Password is not strong.
```

```
Enter password: Gaurab#123
Password is strong.
```

CONCLUSION

This lab session successfully demonstrated the power and versatility of C++ programming through practical implementations of key mathematical and logical concepts. By developing solutions for quadratic equations, triangle classification, password strength validation , we gained valuable hands-on experience. The exercises not only strengthened our understanding of fundamental programming principles but also showcased C++'s efficiency in solving real-world computational problems. The lab effectively bridged theoretical knowledge with practical application, reinforcing essential programming skills that will prove invaluable in future software development endeavours.