



Department of IT and Computer Science
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COMP-201L Data Structures and Algorithms Lab

Lab Report: 02

Class: Computer Science

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Submission Date:

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Lab No.2

Structures & Pointers Using C++

Objectives:

- To Revise the concepts of structures & pointers using C++.
- To Implement structures and pointers in C++

Tools/Software Required:

Dev C++ Compiler

Introduction:

Structure is a collection of variables of different data types under a single name. It is similar to a class in that, both holds a collection of data of different data types. We use pointers to point to different addresses and to access the values stored in them.

Lab Tasks:

Lab Task 01: Write a program to swap two values by passing pointers as argument to the function.

Code:

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

```
SwapValues(int *p,int *q)
```

```
{
    int *temp;

    temp=p;
    p=q;
    q=temp;

    cout<<"\n\nAfter Swapping :\na = "<<*p<<"\t"<<"\nb = "<<*q;
    delete p;
    delete q;
    p=q=NULL;
}
```

```
int main()
```

```
{
    int a,b;

    cout<<"Enter the first value : ";
    cin>>a;

    cout<<"Enter the second value : ";
    cin>>b;

    int *aptr=&a;
    int *bptr=&b;

    cout<<"\n\nBefore Swapping :\na = "<<*aptr<<"\t"<<"\nb = "<<*bptr;

    SwapValues(aptr,bptr);
```

```
    delete aptr;
    delete bptr;
    aptr=bptr=NULL;
}
```

Output:

```
Enter the first value : 1
Enter the second value : 9

Before Swapping :
a = 1
b = 9

After Swapping :
a = 9
b = 1
-----
Process exited after 8.86 seconds with return value 3221226356
Press any key to continue . . .
```

Lab Task 02: Write a program to convert Fahrenheit temperature to Celsius degrees by passing pointers as arguments to the function. The formula for the conversion is:
 $c = (f - 32) * 5.0 / 9.0$.

Code:

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

float ConvertToCelsius(float *fp)
{
    float c;
    float *cp=&c;

    c = (5.0/9.0) * (*fp-32);

    return *cp;
}
```

```

int main()
{
    float f;

    cout<<"Enter the temperature in Farenheit : ";
    cin>>f;

    float *fp=&f;

    cout<<"\nThe temperature in Celsius is "<<ConvertToCelsius(fp)<<"C";

    delete fp;
    fp=NULL;

}

```

Output:

```

Enter the temperature in Farenheit : 100

The temperature in Celsius is 37.7778C
-----
Process exited after 1.865 seconds with return value 0
Press any key to continue . . .

```

Lab Task 03: Create a structure(student) is which should contain name, roll and marks as its data member. Then, create a structure variable(s). Then take data (name, roll and marks) from user and store it in data members of structure variables. Display the data Entered by the user.

Code:

```

#include <iostream>
using namespace std;

```

struct student

```

{
    string Name;
    string RollNo;
    float Marks;

};

```

```
int main()
{
    student S;

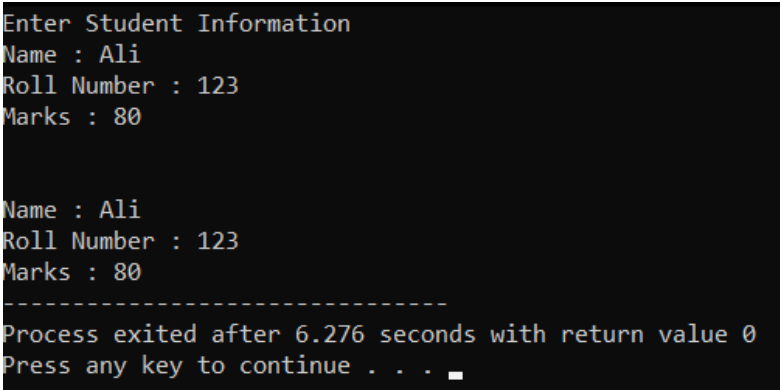
    cout<<"Enter Student Information\nName : ";
    cin>>S.Name;

    cout<<"Roll Number : ";
    cin>>S.RollNo;

    cout<<"Marks : ";
    cin>>S.Marks;

    cout<<"\n\nName : "<<S.Name<<"\nRoll Number : "<<S.RollNo<<"\nMarks : 
"<<S.Marks;
}
```

Output:

A screenshot of a terminal window showing the output of a C++ program. The output consists of two identical blocks of text, each representing a student's information. The first block shows 'Enter Student Information', followed by 'Name : Ali', 'Roll Number : 123', and 'Marks : 80'. The second block shows 'Name : Ali', 'Roll Number : 123', and 'Marks : 80'. Below the second block, there is a dashed line, followed by the text 'Process exited after 6.276 seconds with return value 0' and 'Press any key to continue . . .'.

```
Enter Student Information
Name : Ali
Roll Number : 123
Marks : 80

Name : Ali
Roll Number : 123
Marks : 80
-----
Process exited after 6.276 seconds with return value 0
Press any key to continue . . .
```

Lab Task 04: Declare a structure to represent a complex number (a number having a real part and imaginary part). Write C++ functions to add, subtract, multiply and divide two complex numbers. (Comment each line with information about it)

Code:

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

struct complex

```
{
    double real1;
    double img1;

    double real2;
    double img2;
}c;
```

void Add()

```
{
    cout<<"\n\nAddition : ";
    if(c.img1+c.img2>=0)
        cout<<c.real1+c.real2<<"+"<<c.img1+c.img2<<"i";
    else
        cout<<c.real1+c.real2<<c.img1+c.img2<<"i";
}
```

void Sub()

```
{
    cout<<"\n\nSubtraction : ";
    if(c.img1+c.img2>=0)
        cout<<c.real1-c.real2<<c.img1-c.img2<<"i";
    else
        cout<<c.real1-c.real2<<"+"<<c.img1-c.img2<<"i";
}
```

void Mul()

```
{
    cout<<"\n\nMultiplication : ";
    cout<<c.real1*c.real2<<" + ("<<c.real1*c.img2<<"i) + ("<<c.img1*c.real2<<"i) +
    ("<<c.img1*c.img2<<"i^2)\n";
}
```

```

        cout<<c.real1*c.real2<<" + ("<<(c.real1*c.img2)+ (c.img1*c.real2)<<"i) +
("<<c.img1*c.img2<<"i^2");
    }

```

void Div()

```

{
    cout<<"\n\nDivision : ";
    cout<<c.real1<<"+"("<<c.img1<<"i) / "<<c.real2<<"+"("<<c.img2<<"i";
}

```

int main()

```

{
    cout<<"First Equation :\nEnter Real Part : ";
    cin>>c.real1;

    cout<<"Enter Imaginary Part : ";
    cin>>c.img1;

    cout<<"\nSecond Equation :\nEnter Real Part : ";
    cin>>c.real2;

    cout<<"Enter Imaginary Part : ";
    cin>>c.img2;

    cout<<"\nFirst Equation : ";
    if(c.img1>=0)
        cout<<c.real1<<"+"<<c.img1<<"i";
    else
        cout<<c.real1<<c.img1<<"i";

    cout<<"\nSecond Equation : ";
    if(c.img2>=0)
        cout<<c.real2<<"+"<<c.img2<<"i";
    else
        cout<<c.real2<<c.img2<<"i";

    Add();
    Sub();
    Mul();
}

```



```
        Div();  
    }
```

Output:

```
First Equation :  
Enter Real Part : 2  
Enter Imaginary Part : -2  
  
Second Equation :  
Enter Real Part : 3  
Enter Imaginary Part : -3  
  
First Equation : 2-2i  
Second Equation : 3-3i  
  
Addition : 5-5i  
  
Subtraction : -1+1i  
  
Multiplication : 6 + (-6i) + (-6i) + (6i^2)  
6 + (-12i) + (6i^2)  
  
Division : 2+(-2i) / 3+(-3i)
```

Lab Task 05: Construct a structure to compute time difference of two time periods. The time periods should be entered by the user. (Comment each line with information about it)
Hint* use functions and pointers to struct the structure.

Code:

```
#include <iostream>  
using namespace std;  
  
struct Time  
{  
    int SHour;  
    int FHour;  
    int SMin;  
    int FMin;  
};  
  
int main()  
{  
    Time t;  
    int hour, minute;  
  
    cout<<"Starting Time\n\n";
```

```

do
{
    cout<<"Enter the Hour : ";
    cin>>t.SHour;
}
while(t.SHour<0 || t.SHour > 23);

do
{
    cout<<"Enter the Minutes : ";
    cin>>t.SMin;
}
while(t.SMin<0 || t.SMin > 59);

cout<<"\nEnding Time\n\n";

do
{
    cout<<"Enter the Hour : ";
    cin>>t.FHour;
}
while(t.FHour<0 || t.FHour > 23);

do
{
    cout<<"Enter the Minutes : ";
    cin>>t.FMin;
}
while(t.FMin<0 || t.FMin > 59);

minute = t.FMin - t.SMin;
hour = t.FHour - t.SHour;

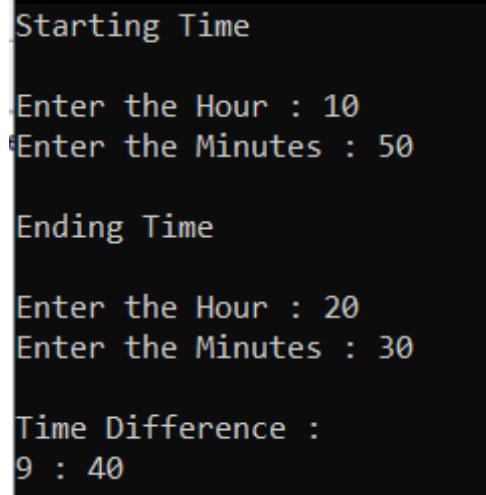
if(minute<0)
{
    minute = minute + 60;
    hour--;
}

```

```
        if(hour<0)
        {
            hour = hour + 24;
        }

        cout<<"\nTime Difference : \n"<<hour<<" : "<<minute;
    }
}
```

Output:



```
Starting Time
Enter the Hour : 10
Enter the Minutes : 50

Ending Time
Enter the Hour : 20
Enter the Minutes : 30

Time Difference :
9 : 40
```

Results & Observations:

In this lab, we have learnt the basics of structures and pointers. We can use structures for holding many types of data with a single handle and we can also use reusability of code in these cases.