# Department of Computing

# School of Electrical Engineering and Computer Science

**CS-250: Data Structure and Algorithms**

**Class: BSCS 10C**

# 

# Lab 1: Revision of Pointers in C++

**Date: 17th September, 2021**

**Time: 9:00 am – 11:50 am**

# Instructor: Prof. Dr. Faisal Shafait

# Lab Engineer: Aftab Farooq

# Lab 1: Pointers in C++

**Introduction**

This lab is about the pointers. In C++, a pointer refers to a variable that holds the address of another variable. Like regular variables, pointers have a data type. For example, a pointer of type integer can hold the address of a variable of type integer. A pointer of character type can hold the address of a variable of character type.

**Objectives**

This lab will revise the old concepts taught to the students in the previous semesters.

**Tools/Software Requirement**

Visual Studio C++

**Description**

Pointers are used to point towards a particular memory address. In this lab we will use the pointers and perform task with the help of them.

**Lab Tasks**

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**Task 1**

Consider the following program and answer the questions.

void main()

{

int a, \*pa; // Statement 1

pa = &a; // Statement 2

cout<<"pa = &a --> pa = "<<pa<<endl<<endl;

pa = pa + 1; // Statement 3

cout<<"pa = pa + 1 --> pa = "<<pa<<endl<<endl;

pa = pa + 3; // Statement 4

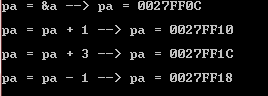
cout<<"pa = pa + 3 --> pa = "<<pa<<endl<<endl;

pa = pa - 1; // Statement 5

cout<<"pa = pa - 1 --> pa = "<<pa<<endl<<endl;

}

Output:



1. Why does the memory address stored in pointer “pa” vary by 4?

***The memory address vary by 4 because the memory of int data type is 4 and when we are incrementing the pointer by 1 or by 3 it vary by 4 and by 12 in this way. So it basically adds the number of bytes.***

1. Will the address still vary by 4if the data type of the above mentioned code changed from “int” to “long”? Explain your answer.

***There will be no change as long data type also has 4 bytes so there will be no change in the output.***

1. If we try to multiply the address pointed to by “pa” what will happen? Is this logically or programmatically correct? Attach screen shot of the output you get when you try this multiplication.

***No, its programmatically not correct to multiply the pointer and the program will give an error.***

A screen shot of a computer

Description automatically generated with low confidence

Text

Description automatically generated

**Task 2**

Write output of the following C++ codes in your document without executing it.

**Example code a)**

int a;

int b;

int \*p=&a;

int \*q=&b;

a=20;

b=35;

p=q;

\*p=83;

cout<<"a : "<<a<<" b: "<<b<<endl;

cout<<\*p<<" "<<\*q<<endl;

**Output:**

**a:20 b: 83**

**83 83**

**Example code b)**

int x[4] = {0,4,6,9};  
int \*p, a=3;  
p=x;  
(\*p)++;  
cout<<\*p<<endl;  
cout<<\*(p+1)<<endl;  
p++;  
\*p=\*p+a;  
cout<<\*p<<endl;  
p=p+2; //What is happening here?

/\*It is going to the last element of the array so now the pointer will point towards 9\*/  
cout<<\*p<<endl;

**Output:**

**1**

**4**

**7**

**9**

**Example code c)**

int a, \*p, \*q;

int arr[4]= {0};

p=arr;

q=p;

\*p=4;

for(int i=0; i<3; i++){

a=\*p;

p++;

\*p=(a+i);

}

for (int j=0; j<4; j++){

cout<<\*q<<" ";

q++;

}

**Output:**

**4 4 5 7**

**Task 3**

int a=5, b=10;

int \*pa=&a; //pa and pb are pointer variables of type int.

int \*pb=&b;

int \*\*ppa=&pa; //ppa and ppb are called double pointers or pointers-to-pointers.

int \*\*ppb=&pb;

1. Write code of a function that swaps values of variables a and b. Input to the function should be the address of both the variables.

#include<iostream>

using namespace std;

void swap(int\* p, int\* q) {

int temp = \*p;

\*p = \*q;

\*q = temp;

}

int main(){

int a = 5;

int b = 10;

cout << "Before swapping a: " << a << " and b: " << b << endl;

swap(&a, &b);

cout << "After swapping a: " << a << " and b: " << b << endl;

}

**Output:**



1. Write code of a function that swaps values of pointer variables pa and pb. Input to the function should be the address of both the pointer variables.

#include<iostream>

using namespace std;

void swap(int\*\* p, int\*\* q) {

int temp = \*\*p;

\*\*p = \*\*q;

\*\*q = temp;

}

int main(){

int a = 5;

int b = 10;

int\* pa=&a;

int\* pb=&b;

cout << "Before swapping a: " << a << " and b: " << b << endl;

swap(&pa, &pb);

cout << "After swapping a: " << a << " and b: " << b << endl;

}

**Output:**



1. Write code of a function that swaps values of the variables a and b using pointer-to-pointer variables ppa and ppb.

#include<iostream>

using namespace std;

void swap(int\*\*\* p, int\*\*\* q) {

int temp = \*\*\*p;

\*\*\*p = \*\*\*q;

\*\*\*q = temp;

}

int main(){

int a = 5;

int b = 10;

int\* pa=&a;

int\* pb=&b;

int\*\* ppa = &pa;

int\*\* ppb = &pb;

cout << "Before swapping a: " << a << " and b: " << b << endl;

swap(&ppa, &ppb);

cout << "After swapping a: " << a << " and b: " << b << endl;

}

**Output**



**Task 4**

int list[5]={3,6,9,12,15};

int \*pArr= list;

Your task is to write a piece of code that prints all values stored in the array **list** using only pointer variable pArr. Do not use the conventional way of printing values by numbering indexes.

#include<iostream>

using namespace std;

int main(){

int list[5] = { 3,6,9,12,15 };

int\* pArr = list;

//Local declaration

/\*Now we will print the list by using

pointer and incrementing it with the help of for loop

\*/

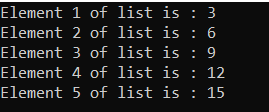
for (int i = 0; i < 5; i++) {

cout << "Element " << i + 1 << " of list is : " << \*(pArr + i)<<endl;

}

}

**Output:**



**Task 5**

Write code to find the memory in bytes occupied by int, long, double, float and char.

#include<iostream>

using namespace std;

int main(){

cout << "The size of int in bytes is: " << sizeof(int) << endl;

cout << "The size of long in bytes is: " << sizeof(long) << endl;

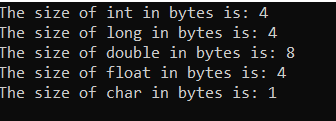
cout << "The size of double in bytes is: " << sizeof(double) << endl;

cout << "The size of float in bytes is: " << sizeof(float) << endl;

cout << "The size of char in bytes is: " << sizeof(char) << endl;

}

**Output:**

****

**Lab Grading:**

|  |  |
| --- | --- |
| **Task** | **Marks** |
| Lab Viva/Quiz | 5 |
| Comments/ Indentation | 2 |
| Solution Document | 2 |
| Output Screen Shots | 1 |
| -- | -- |
| Total | 10 |

**Deliverables**

Compile a single word document by filling in the solution part and submit this Word file on LMS. The name of word document should follow this format. i.e. **YourFullName(reg)\_Lab#.** This lab grading policy is as follows: The lab is graded between 0 to 10 marks. The submitted solution can get a maximum of 5 marks. At the end of each lab or in the next lab, there will be a viva related to the tasks. The viva has a weightage of 5 marks. Insert the solution/answer in this document. You must show the implementation of the tasks in the designing tool, along with your complete Word document to get your work graded. You must also submit this Word document on the LMS. In case of any problems discuss it by emailing it to [aftab.farooq@seecs.edu.pk](mailto:aftab.farooq@seecs.edu.pk).

**Note:** Students are required to upload the lab on LMS before deadline.

Use proper indentation and comments. Lack of comments and indentation will result in deduction of marks.