**Lab Sections**

1. Objectives
2. Introduction
3. Definitions
4. Declaration Syntax
5. Experiments

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Pointers & References

**Pointers & References – The Basics**

1. **Objectives**

**After you complete this experiment you will be able to declare and use pointers and references in a C++ program.**

1. **Introduction**

Variables name the memory locations where values are stored. Declarations tell the compiler how much memory to use when assigning values to a variable, and what operations can be performed on a variable. Consider the following figure:

**2048:**

**90**

**X**

**address**

**value**

**variable name**

A pointer holds the address of a memory location. In other words, a pointer contains a reference to another variable. A reference in C++ is a variable that references a memory address. References are often referred to as “aliases” of other variables. Consider the following figure:

**2048:**

**90**

**2048:**

**x**

**y is an alias for x**

**p**

**int x = 90;**

**int \*p;**

**int &y = x;**

**p = &x**

**address of x**

**pointer to int**

**y is an alias for x**

1. **Definitions**

We will define several terms to help you understand pointers. They are as follows:

1. **Pointers** hold memory addresses.
2. When you **de-reference** a pointer, you retrieve the contents of the memory address that is stored in the pointer.
3. A **reference** is an alias for memory that is allocated elsewhere.
4. The “**\***” operator is used to declare and de-reference a pointer. Please pay close attention to the context in which the operator is used.
5. The “**&**” operator is called the “address of” operator.
6. The “**&**” operator is also used to declare references in C++.
7. **Declaration Syntax**

**Declaration for a pointer:**

type \* pointer\_name;

**Declaration for a reference:**

type & reference\_name;

More information on pointers can be found in your course textbook and on the web.

1. **Experiments**

**Step 1: In this experiment you will investigate the use of pointers and references in a C++ program.**

**Enter, save, compile and execute the following program in MSVS. Call the new project “PtrsAndRefsExp1” and the program “ptrsAndrefs1.cpp”. Answer the questions below:**

#include <iostream>

using namespace std;

int main()

{

int i;

int \*p;

cout<<&i<<endl;

cout<<p<<endl;

cout<<&p<<endl<<endl;

i=90;

p = &i;

cout<<i<<endl;

cout<<(\*p)<<endl;

return 0;

}

1. Please discuss the output (if any), and any errors or warnings your compiler gives. (Hint: Describe how the different operators are being used in different statements. Be as complete as possible in your description.)

**Step 2: In this experiment you will investigate the use of pointers and references in a C++ program.**

**Enter, save, compile and execute the following program in MSVS. Call the new project “PtrsAndRefsExp2” and the program “ptrsAndrefs2.cpp”. Answer the questions below:**

#include <iostream>

using namespace std;

int main()

{

int i;

int \*p=0;

int &temp=i;

cout<<&i<<endl;

cout<<p<<endl;

cout<<&temp<<endl<<endl;

i=90;

p = &i;

cout<<i<<endl;

cout<<(\*p)<<endl;

cout<<temp<<endl;

return 0;

}

1. Please discuss the output (if any), and any errors or warnings your compiler gives. (Hint: Describe how the different operators are being used in different statements. Be as complete as possible in your description.)