**Lab Sections**

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

|  |
| --- |
|  |

Dynamic Arrays

**Dynamic Arrays**

1. **Objectives**

**After you complete this experiment you will be able to implement and use dynamic arrays.**

1. **Introduction**

There are two types of arrays in C++, dynamic and static. Dynamic arrays can grow in size while the program is executing, whereas static arrays cannot. Their size must be known before runtime. Because dynamic arrays can grow during runtime, it is unnecessary to estimate their maximum size before compile time. You just grow their size as needed.

1. **Definitions**

We will define several terms that you need to know to understand arrays. They are as follows:

1. The name of a **dynamic array** is a pointer to the first element in the array.
2. The name of a **static array** is a **constant** pointer to the first element in the array.
3. The **size/capacity** is the number of memory cells allocated to an array.
4. An **index /subscript** is used to access the memory cells in an array.
5. **[ ]** is called the subscript operator.
6. The **index** is a non-negative integer.
7. The **range** of an index is between 0 and the size-1.
8. **Declaration Syntax**

**To declare a dynamic array of type:**

type \*array\_name; // e.g. char \*ch;

**Examples allocating memory for two Dynamic Arrays:**

char \*ch = new char[20];

int \*p;

p = new int[5];

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

1. **Experiments**

**Step 1: In this experiment you will explain the output of a program that uses static and dynamic arrays. Enter, save, compile and execute the following program in MSVS. Call the new directory “DynamicArraysExp1” and the program “DynamicArrays1.cpp”. Answer the question that follows.**

#include <iostream>

using namespace std;

int main()

{

int static\_Array[5];

int \*dynamic\_Array = new int[5];

int i;

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

{

static\_Array[i]=i;

dynamic\_Array[i]=i;

}

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

return 0;

}

1. Please explain each line of code and the output.

**Step 2: In this experiment you will explain the output of a program that uses static and dynamic arrays. Enter, save, compile and execute the following program in MSVS. Call the new directory “DynamicArraysExp2” and the program “DynamicArrays2.cpp”. Answer the question that follows.**

#include <iostream>

using namespace std;

int main()

{

int static\_Array[5];

int \*dynamic\_Array;

dynamic\_Array = new int[5];

int i;

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

{

static\_Array[i]=i;

dynamic\_Array[i]=5;

}

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

cout<<endl<<endl<<endl;

static\_Array = dynamic\_Array;

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

return 0;

}

1. Please list and explain any error message(s).

**Step 3: In this experiment you will investigate the output of a program that uses static and dynamic arrays. Enter, save, compile and execute the following program in MSVS. Call the new directory “DynamicArraysExp3” and the program “DynamicArrays3.cpp”. Answer the question that follows.**

#include <iostream>

using namespace std;

int main()

{

int static\_Array[5];

int \*dynamic\_Array;

dynamic\_Array = new int[5];

int i;

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

{

static\_Array[i]=i;

dynamic\_Array[i]=5;

}

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

cout<<endl<<endl<<endl;

dynamic\_Array = static\_Array;

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

return 0;

}

1. Why did the program in Step 3 compile and run without any errors, and the program in Step 2 did not? Explain your answer.

**Step 4: In this experiment you will explain the output of a program that uses static and dynamic arrays. Enter, save, compile and execute the following program in MSVS. Call the new directory “DynamicArraysExp4” and the program “DynamicArrays4.cpp”. Answer the question that follows.**

#include <iostream>

using namespace std;

int main()

{

int \*static\_Array = new int[5];

int \*dynamic\_Array;

dynamic\_Array = new int[5];

int i;

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

{

static\_Array[i]=i;

dynamic\_Array[i]=5;

}

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

cout<<endl<<endl<<endl;

static\_Array = dynamic\_Array;

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

{

cout<<"static\_Array["<<i<<"] = "<<static\_Array[i]<<endl;

cout<<"dynamic\_Array["<<i<<"] = "<<dynamic\_Array[i]<<endl;

}

return 0;

}

1. Compare the programs that were presented in Steps 1, 2, 3 and 4. What are your observations?