Contents

Single-Dimensional Arrays

Introduction

You can define a single-dimensional array as follow:

```
<type>[] arrayName;
```

where

- `<type>` can be any data-type and specifies the data-type of the array elements.
- `arrayName` is an identifier that you will use to access and modify the array elements.

Before using an array, you must specify the number of elements in the array as follows:

```
arrayName = new <type>[<number of elements>];
```

where `<type>` is a type as before, and `<number of elements>`, called the *size declarator*, is a strictly positive integer which will correspond to the size of the array.

- An element of a single-dimensional array can be accessed and modified by using the name of the array and the index of the element as follows:

```
// Assigns <value> to the <index> element of the array
 ↪  arrayName.
arrayName[<index>] = <value>;

// Display the <index> element of the array arrayName.
Console.WriteLine(arrayName[<index>]);
```

The index of the first element in an array is always *zero*; the index of the second element is one, and the index of the last element is the size of the array minus one. As a consequence, if you specify an index greater or equal to the number of elements, a run-time error will happen.

Indexing starting from 0 may seem surprising and counter-intuitive, but this is a largely respected convention across programing languages and

computer scientists. Some insights on the reasons behind this (collective) choice can be found in this answer on Computer Science Educators[1].

Example

In the following example, we define an array named `myArray` with three elements of type integer, and assign 10 to the first element, 20 to the second element, and 30 to the last element.

```
int[] myArray;
myArray = new int[3]; // 3 is the size declarator
// We can now store 3 ints in this array,
// at index 0, 1 and 2

myArray[0] = 10; // 0 is the subscript, or index
myArray[1] = 20;
myArray[2] = 30;
```

If we were to try to store a fourth value in our array, at index 3, using e.g.

```
myArray[3] = 40;
```

our program would compile just fine, which may seems surprising. However, when executing this program, *array bounds checking* would be performed and detect that there is a mismatch between the size of the array and the index we are trying to use, resulting in a quite explicit error message:

```
Unhandled Exception: System.IndexOutOfRangeException:
↪  Index was outside the bounds of the array at
↪  Program.Main()
```

Abridged Syntaxes

If you know the number of elements when you are defining an array, you can combine declaration and assignment on one line as follows:

```
<type>[] arrayName = new <type>[<number of elements>];
```

So, we can combine the first two lines of the previous example and write:

```
int[] myArray = new int[3];
```

We can even initialize *and* give values on one line:

```
int[] myArray = new int[3] { 10, 20, 30 };
```

And that statement can be rewritten as any of the following:

[1] https://cseducators.stackexchange.com/a/5026

```
int[] myArray = new int[] { 10, 20, 30 };
int[] myArray = new[] { 10, 20, 30 };
int[] myArray = { 10, 20, 30 };
```

But, we should be careful, the following would cause an error:

```
int[] myArray = new int[5];
myArray = { 1, 2 ,3, 4, 5}; // ERROR
```

If we use the shorter notation, we *have to* give the values at initialization, we cannot re-use this notation once the array has been created.

Other datatypes, and even objects, can be stored in arrays in a perfectly similar way:

```
string[] myArray = { "Bob", "Mom", "Train", "Console" };

// Assume there is a class called Rectangle.
Rectangle[] arrayOfRectangle = new Rectangle[5];
```