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The Learning House

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Louisville KY 40202

Arrays in C#

.NET Cohort

Coding Bootcamp

SOFTWARE GUILD

Definitions

- An array is a set of uniform data elements represented by a variable
- Elements are individual data items. All elements must be of the same type.
- Rank/dimensions are the number of positions available.
- Dimension Length is the number of positions in a direction.
- Array Length is the total number of elements across all dimensions.

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Array Types

- C# supports two types of arrays:
  - One-dimensional arrays are a single line, or vector, of elements.
  - Multi-dimensional arrays are composed such that each position in the primary vector is also an array, or subarray. Positions in subarrays can also be subarrays.
    - Multi-dimensional arrays can be rectangular (all subarrays the same length) or jagged (subarrays are different lengths)
- Arrays are reference types whose elements are automatically initialized.

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Important Things to Know

- After an array is created, its size is fixed (some languages allow for dynamic arrays, but C# does not).
- Array positions are referred to as *indexes*. Indexes start at 0.
- Arrays are class objects, and must be instantiated before you use them.

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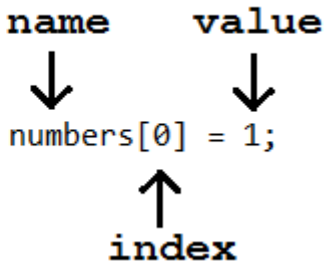
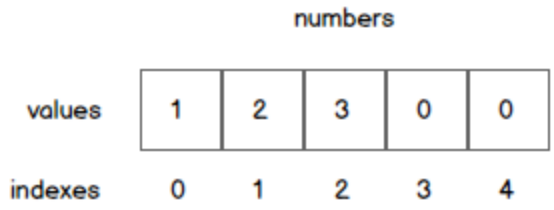
Creating and Populating a One-Dimensional Array

```
int[] numbers = new int[5];

numbers[0] = 1;
numbers[1] = 2;
numbers[2] = 3;
```





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One-Dimensional and Rectangular Arrays

- To declare a one-dimensional or rectangular array use square brackets after the type
  - Ex: int[] myIntArray; // array of ints
- Rank Specifiers are commas between the brackets. They are used to specify the number of dimensions
  - Ex: int[,] arr2; // a 2D array of ints
  - Ex: int[,,] arr3; // a 3D array of ints
- Arrays must be instantiated with the length of each dimension
  - Ex: int[] arr4 = new int[5]; // an int array with 5 positions

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Creating and Populating a Two-Dimensional Array

```
int[,] numbers = new int[2,5];

numbers[0,1] = 1;
numbers[0,2] = 2;
numbers[0,3] = 3;
numbers[1,0] = 5;
numbers[1,2] = 6;
numbers[1,4] = 7;
```

numbers

1	5	6	0	0	7
0	1	2	3	0	0
indexes	0	1	2	3	4

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Accessing Array Elements

To access an individual element for reading or assigning values, refer to it by index.

```
int[] intArr1 = new int[15];     // Declare a 1D array of 15 elements
intArr1[2] = 10;                 // Write to element 2 of the array
int var1 = intArr1[2];           // Read from element 2 of the array

int[,] intArr2 = new int[5,10]; // Declare a 2D array
intArr2[2, 3] = 7;               // Write to position 2 dimension 3
var1 = intArr2[2, 3];            // Read from position 2 dimension 3
```

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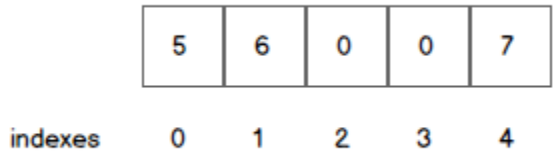
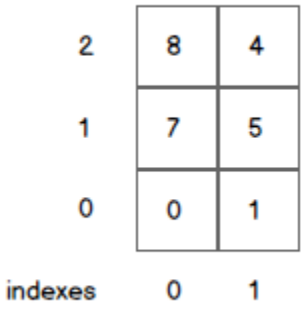
Explicit Initialization

Pre-populates the values during initialization

```
int[] numbers = new int[]
{
   5,6,0,0,7
};
```




```
int[,] numbers = new int[,]
{
    {0,1}, {7,5}, {8,4}
};
```



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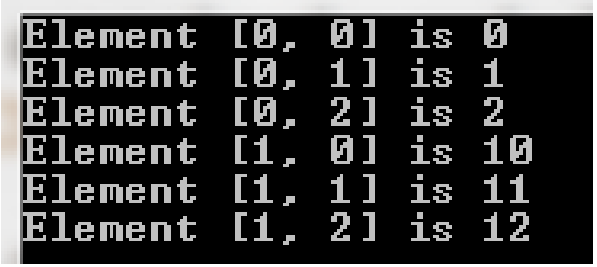
Iterating an Array

```
//Declare, create, and initialize an implicitly typed array.
int[,] arr = new int[,] {{ 0, 1, 2}, {10, 11, 12}};

// Print the values.
for( int i = 0; i < 2; i++)
    for(int j = 0; j < 3; j++)
        Console.WriteLine("Element [{0}, {1}] is {2}", i, j, arr[i,j]);
```



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Jagged Arrays

Jagged arrays have subarrays of different lengths.

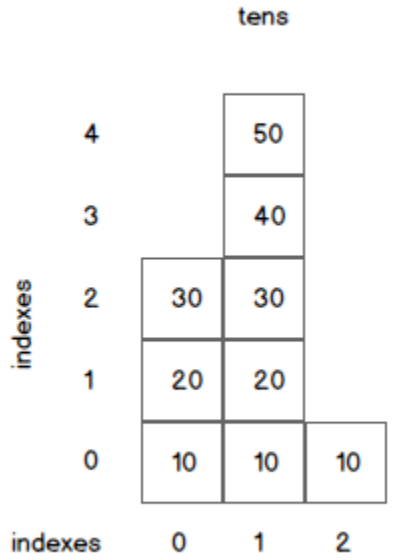
Jagged arrays are declared using square brackets [] instead of an absolute dimension.

For example: “tens is an array of three arrays of ints”

Notice: in memory, there are four array objects. One is for the container and three for the subarrays.

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

tens[0] = new int[] { 10, 20, 30 };
tens[1] = new int[] { 10, 20, 30, 40, 50 };
tens[2] = new int[] { 10 };
```



Now, it's Time to Cover foreach

- foreach is an awesome loop that executes a block of code once for each element of an array or other enumerable (lists, etc).
- The syntax is:
  - foreach(type variable in sourcevariable)

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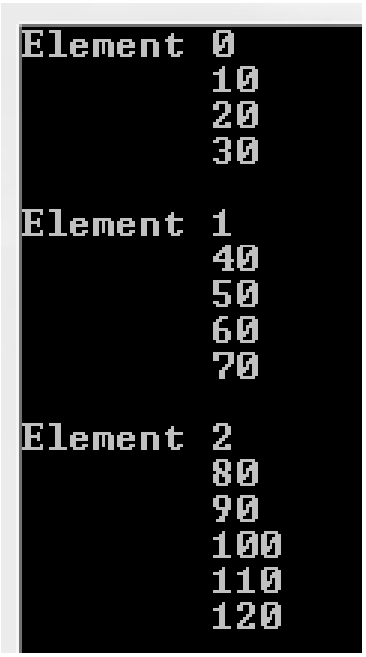
Using foreach to Output a Jagged Array

```
int[][] Arr = new int[3][];                     // 1. Instantiate top level.

Arr[0] = new int[] { 10, 20, 30 };              // 2. Instantiate subarray.
Arr[1] = new int[] { 40, 50, 60, 70 };          // 3. Instantiate subarray.
Arr[2] = new int[] { 80, 90, 100, 110, 120 };   // 4. Instantiate subarray.

int outercount = 0;

foreach(int[] element in Arr)
{
    Console.WriteLine("Element {0}", outercount);

    foreach (int subelement in element)
    {
        Console.WriteLine("\t{0}", subelement);
    }

    Console.WriteLine();
    outercount += 1;
}
```



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Useful Array Members

Member	Type	Lifetime	Usage
Length	Property	Instance	Gets the number of elements in **all dimensions** of an array
Rank	Property	Instance	Gets the total dimensions in an array
GetLength(n)	Method	Instance	Gets the number of elements in a specified dimension (n)
Clear()	Method	Static	Resets a range of elements to the default type (0 for numeric, null for reference types)
Sort()	Method	Static	Sorts all elements in a one-dimensional array
Reverse()	Method	Static	Reverses the order of the elements

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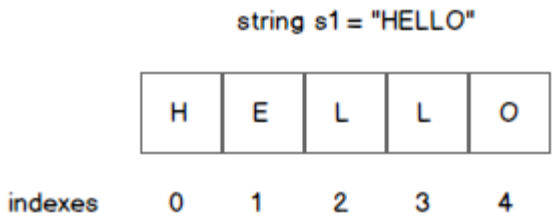
Remember I Mentioned Strings Are Arrays?

```
string s1 = "This is a string of characters";

foreach (char c in s1)
{
    Console.WriteLine(c);
}

Console.WriteLine("The character at position 3 is {0}", s1[3]);
Console.WriteLine("The length of s1 is {0}", s1.Length);
```



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Strings and arrays

DEMO

Write some code to read a string from the console and print it back in reverse order.

LAB EXERCISE

Write some code to roll a die 100 times and count the number of times each number comes up.

LAB EXERCISE