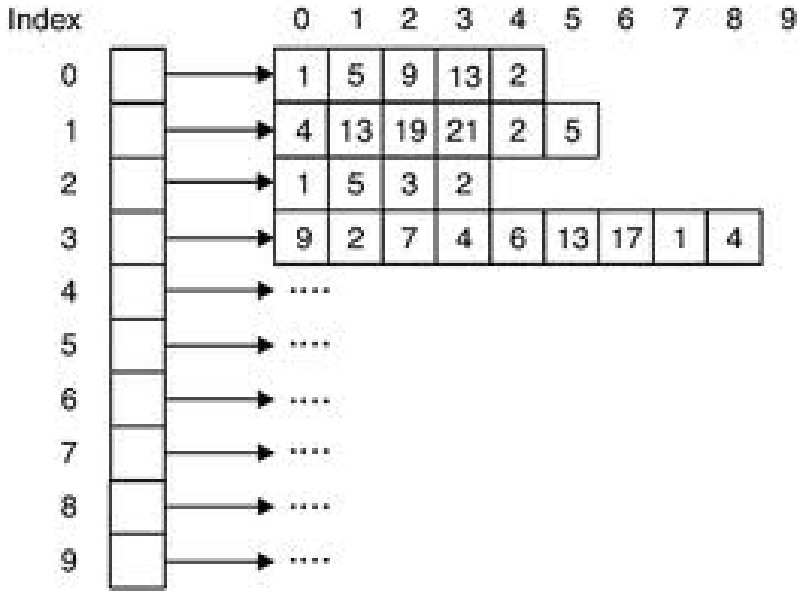
ARRAYS

What are Arrays?

- An **array** is a structure consisting of a fixed number of components with each component of the same type.
- Array components: 1) name; 2) data/component type; 3) indices of first and last component
- Array index starts at zero, last item would be total number of items – 1.
- Arrays can be **one dimensional** or **multidimensional** or even **jagged**
  - Single-Dimensional - used to store number of items of a predefined type; All items in a single dimension array are stored contiguously starting from 0 to the size of the array -1
  - Multidimensional arrays - also known as a rectangular array is an array with more than one dimension. The form of a multi-dimensional array is a matrix

	Column 1	Column 2	Column 3	Column 4
Row 1	x[0][0]	x[0][1]	x[0][2]	x[0][3]
Row 2	x[1][0]	x[1][1]	x[1][2]	x[1][3]
Row 3	x[2][0]	x[2][1]	x[2][2]	x[2][3]

- Jagged Arrays - arrays of arrays. The elements of a jagged array are other arrays.



- Arrays can also be classified to **static (fixed-length)** or **dynamic**
  - Fixed Length – array can store predefined number of items
  - Dynamic – does not have a predefined size. Size increases as new items are added.

Discuss:
What are some real life examples of arrays?

a) *Real life examples of one dimensional, multidimensional, and jagged arrays?*
b) *Real life examples of static and dynamic arrays?*

Arrays in C#

Watch These:
Arrays in Visual Studio C#
Video 1 (14:29):
https://www.youtube.com/watch?v=sCZ-u-NgwMI
Video 2 (46:34):
https://www.youtube.com/watch?v=gwvZjvnUFYc

Try This:
Visual Studio Arrays Tutorial
https://msdn.microsoft.com/en-us/library/aa288453(v=vs.71).aspx

- Initializing Arrays in C#

```
// Initialize a fixed array
int[] intArray = new int[3] {1, 3, 5};

// Initialize a fixed array one item at a time
int[] intArray = new int[3];
intArray [0] = 1;
intArray [1] = 3;
intArray [2] = 5;

// Initialize a dynamic array items during declaration
string[]strSocialArray = new string[] { "Facebook", "Twitter",
"Instagram", "Pinterest" };
```

- Accessing Arrays in C#

```
// Read array items one by one
Console.WriteLine(intArray[0]);
Console.WriteLine(intArray[1]);
Console.WriteLine(intArray[2]);


// Read array items using for loop
for (int i = 0; i < 3; i++)
{
```

```
intArray[i] = i * 16;
}

// Read array items using foreach loop
foreach (string str in strSocialArray)
{
Console.WriteLine(strSocialArray);
}
```

- Declare/Initialize Various Array Types in C#

```
// Single-dimensional arrays.
int[] myArray1 = new int [5];
string[] myArray2 = new string[6];

// Multidimensional arrays
int[,] numbers = new int[3, 2] { { 1, 2 }, { 3, 4 }, { 5, 6 } };
int[,] numbers = new int[,] { { 1, 2 }, { 3, 4 }, { 5, 6 } };
int[,] numbers = { { 1, 2 }, { 3, 4 }, { 5, 6 } };

// Jagged Arrays
int[][] intJaggedArray = new int[3][];

// Initializing jagged arrays
intJaggedArray[0] = new int[2];
intJaggedArray[1] = new int[4];
intJaggedArray[2] = new int[6];

// Initializing jagged arrays
intJaggedArray[0] = new int[2]{2, 12};
intJaggedArray[1] = new int[4]{4, 14, 24, 34};
intJaggedArray[2] = new int[6] {6, 16, 26, 36, 46, 56 };
```

In the .NET framework, array implementation is abstracted by the Array class

The .NET library provides methods for creating, manipulating, searching, and sorting arrays so you don't have to manually implement them!

Check out the MSDN documentation on the Array class to see the methods and properties exposed by .NET's Array class

Array Operations

Take Note:
After finishing this module, you should be able to:

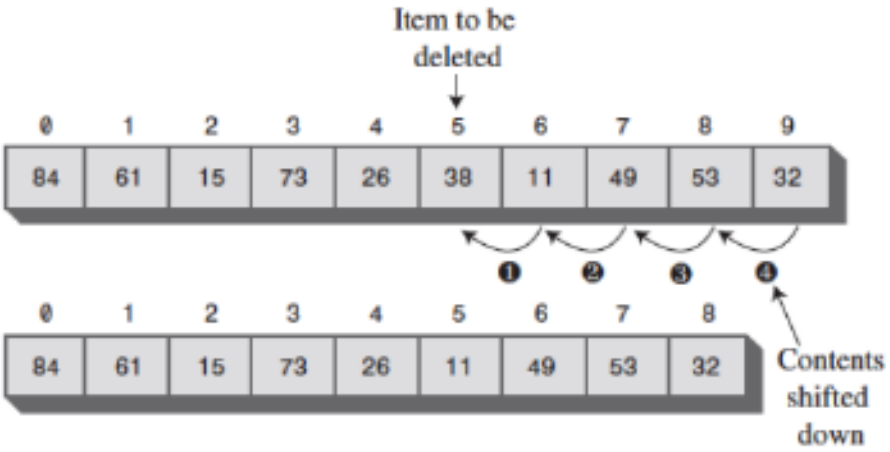
1. *Design algorithms for searching, deleting and inserting new elements into the basic data structure arrays; and*
2. *Solve programming problems involving the use of arrays.*

- Insert
  - A new item is always inserted in the first vacant cell in the array
- Search
  - Each cell is checked if it contains the value being search
  - Linear (Sequential) Search vs. Binary Search
    - Linear search looks at every single index value in the entire array
    - If there are duplicates, linear search works better when you want to find all matches
    - If there are no duplicates, a binary search is better. Binary search is what is used in the age guessing game, "Higher or Lower". Note that for a binary search to work, the array must be sorted first, before searching can happen.

How do you sort an array?
Check this out: http://visualgo.net/sorting.html

Which is your favorite sorting algorithm?

- Delete
  - Item to be deleted must first be found.
  - If the item in cell 5 is deleted, the item in 6 shifts into 5, the item in 7 shifts into 6, and so on to the last occupied cell.



Self-Assessment Questions

1. Write a procedure for reversing the elements of an array.
2. Write a procedure for merging two sorted arrays into one.
3. Formulate an algorithm for inserting a new element x into a sorted array A of size n.
4. Write a procedure for finding the minimum in an array and deleting it from the array.

Takeaway Thoughts and Questions:

1. *What new knowledge about arrays is the most interesting for you?*
2. *Give an example of a computer program/problem which will make use of an array. What kind of array is needed for this program?*