

## Lecture 9-Sorting Algorithms

---

Sorting is a storage of data in sorted order, it can be in ascending or descending order. The term Sorting comes into picture with the term Searching. There are so many things in our real life that we need to search, like a particular record in database, a particular telephone number, any particular page in a book etc.

**Sorting** arranges data in a sequence which makes searching easier. Every record which is going to be sorted will contain one key. Based on the key the record will be sorted. For example, suppose we have a record of students, every such record will have the following data:

- Roll No.
- Name
- Age
- Class

Here Student roll no. can be taken as key for sorting the records in ascending or descending order. Now suppose we have to search a Student with roll no. 15, we don't need to search the complete record we will simply search between the Students with roll no. 10 to 20.

### ***Types of Sorting Techniques:***

There are many types of Sorting techniques, differentiated by their efficiency and space requirements. Following are some sorting techniques which we will be covering in next sections.

1. Bubble Sort
2. Insertion Sort
3. Selection Sort
4. Quick Sort
5. Merge Sort
6. Heap Sort

## Bubble sort :

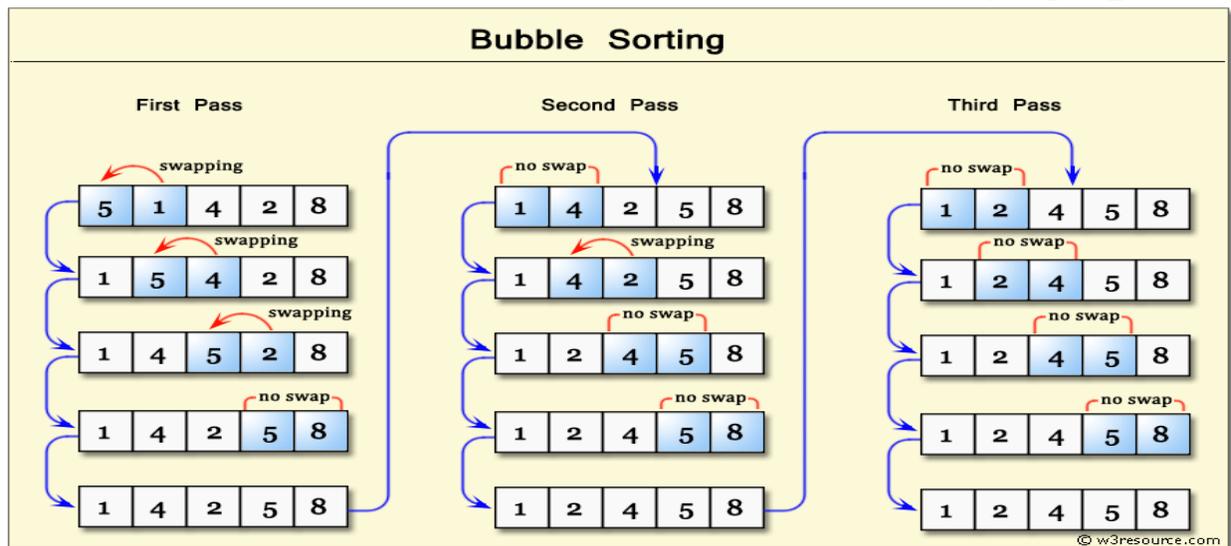
Bubble sort changes the position of numbers or changing an unordered sequence into an ordered sequence.

Bubble sort follows a simple logic. It compares adjacent elements in a loop and swaps them if they are not in order.

Bubble sort is named this way because, in this sorting method, the smaller elements gradually bubble up to the top of the list.

Bubble sort has worst-case and average complexity both  $O(n^2)$ , where  $n$  is the number of items being sorted.

Example:



## Algorithm

We assume **list** is an array of **n** elements. We further assume that **swap** function swaps the values of the given array elements.

```
begin BubbleSort(list)

  for all elements of list
    if list[i] > list[i+1]
      swap(list[i], list[i+1])
    end if
  end for

  return list

end BubbleSort
```

Program:

```
namespace ConsoleApplication1
{
    class Program
    {
        public void BubbleSort( )
        {
            Console.WriteLine("Enter the total number of elements: ");
            int max = int.parse(Console.ReadLine());
            int[] numarray = new int[max];
            for (int i = 0; i < max; i++)
            {
                Console.WriteLine("Enter [" + i + "] element: ");
                numarray[i] = int.parse(Console.ReadLine());
            }
            Console.WriteLine("Before Sorting :");
            for (int k = 0; k < max; k++)
                Console.WriteLine(numarray[k]);

            for (int i = 0; i < max; i++)
            {
                for (int j = 0; j < max - 1; j++)
                {
                    if (numarray[j] > numarray[j + 1])
                    {
                        int temp = numarray[j];
                        numarray[j] = numarray[j + 1];
                        numarray[j + 1] = temp;
                    }
                }
            }

            Console.WriteLine("The numbers in ascending orders are given below:");
        }
    }
}
```

```
for (int i = 0; i < max; i++)
{
    Console.WriteLine("Sorted [" {0} "] element: ",i);
    Console.WriteLine(numarray[i]);
}
}

static void Main(string[] args)
{
    BubbleSort();
    Console.Read();
}
}
```

د. بیان شریف مصطفیٰ & م. ربی طلال