Divide and Conquer Algorithm.

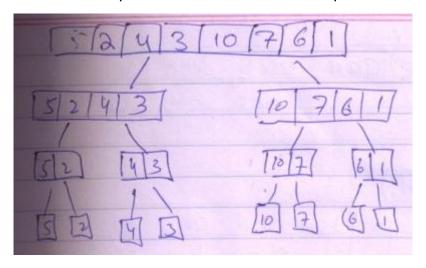
## **Divide and Conquer**

The divide and conquer is a strategy employed to solve a large number of computational problems:

- Divide: the problem into a small number of pieces
- Conquer: solve each piece by applying divide and conquer to it recursively
- Combine: the pieces together into a global solution.

#### • MERGE SORT:

Which uses a recursive technique known as Divide-and-Conquer.



### **Merge Sort**

- Divide and conquer strategy is applicable in a huge number of computational problems.
- The first example of divide and conquer algorithm we will discuss is a simple and efficient sorting procedure called Merge Sort.

### **Merge Sort**

- We are given a sequence of n numbers A, which we will assume are stored in an array A[1..n].
- The objective is to output a permutation of this sequence sorted in increasing order.
- This is normally done by permuting the elements within the array A.

### **Merge Sort**

Here is how the merge sort algorithm works:

### **Merge Sort**

- Divide: split A down the middle into two subsequences, each of size roughly n/2
- Conquer: sort each subsequence by calling merge sort recursively on each.
- Combine: merge the two sorted subsequences into a single sorted list.

### **Merge Sort**

- The dividing process ends when we have split the subsequences down to a single item.
- A sequence of length one is trivially sorted.
- The key operation is the combine stage which merges together two sorted lists into a single sorted list.

#### **Merge Sort**

- A sequence of length one is trivially sorted.
- The key operation is the combine stage which merges together two sorted lists into a single sorted list.
- Fortunately, the combining process is quite easy to implement.

# Merge Sort Algorithm

MERGE-SORT( array A, int p, int r)

- 1 if (p < r)
- 2 then
- $3 q \leftarrow (p+r)/2$
- 4 MERGE-SORT(A, p, q) // sort A[p..q]
- 5 MERGE-SORT(A, q+1, r)//sort A[q+1..r]
- 6 MERGE(A, p, q, r) // merge the two pieces

Where p is beginning index of array list A and r is ending index of array list A

# Merge Sort Algorithm

```
MERGE( array A, int p, int q, int r)
1 int B[p..r]; int i \leftarrow k \leftarrow p; int j \leftarrow q + 1
    while (i \le q) and (j \le r)
2
    do if (A[i] \le A[j])
3
          then B[k++] \leftarrow A[i++]
4
5
          else B[k++] \leftarrow A[j++]
6
   while (i \le q)
   do B[k++] \leftarrow A[i++]
7
   while (j \le r)
8
```

```
9 do B[k++] ← A[j++]
10 for i ← p to r
11 do A[i] ← B[i]
```