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Bubble Sort

It's a sorting algorithm, in which each pair of adjacent items are compared and swapped if they are in wrong order. The comparison is repeated until no swaps are needed, indicating that the list is sorted. The smaller elements 'bubble' to the top of the list, hence, the name Bubble Sort. In this like selection sort, after every pass the largest element moves to the highest index position of the list.

Algorithm:

It starts with the first element of the list. The comparison of the adjacent pair of elements and swapping is done until the list is sorted as follows
1. Compare two adjacent elements and check if they are in correct order (that is second one has to be greater than the first).
2. Swap them if they are not in correct order.

Let iter denotes the number of iterations, then for iter ranging from 1 to n-1 (where n is total number of elements in the list) check
1. If value of the second item at position iter is lesser than the value of the first item i.e. at position iter-1, then swap them.
2. Else, move to the next element at position iter+1.
The effective size of the list is hence reduced by one after every pass and the largest element is moved to its final position in the sorted array. Repeat the two steps until the list is sorted and no swap is required i.e. the effective size is reduced to 1.

To see a Java Applet Visualization of the Bubble Sort Mechanism, click on the image below :

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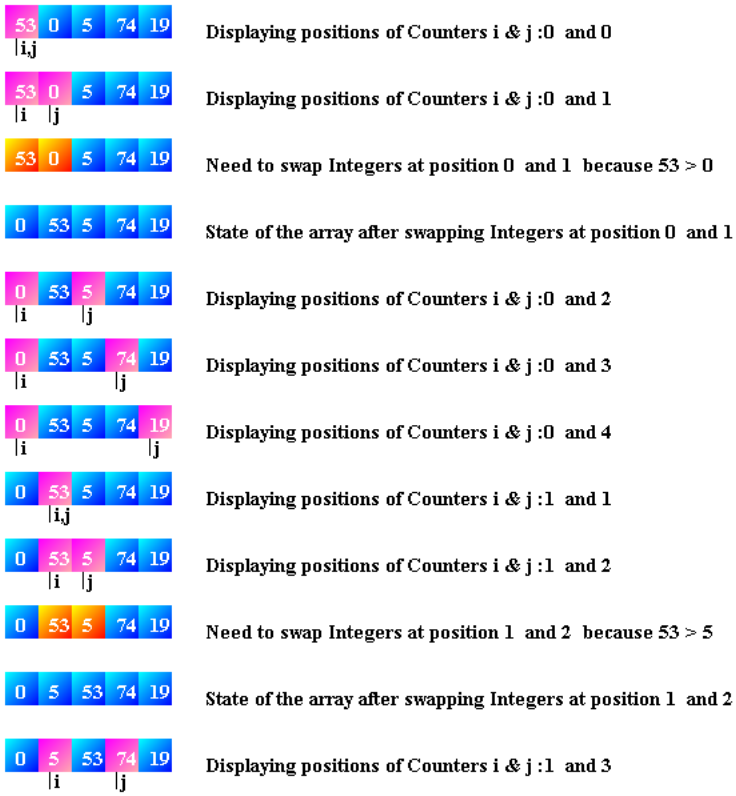

Properties:

1. Best Case performance – When the list is already sorted, we require only one pass to check, hence O(n).
2. Worst Case performance – When the list is in the reverse order, n number of comparisons and swap are required to be done n number of times, hence O(n2).
3. Average Case performance – O(n2)
4. It does not require any extra space for sorting, hence O(1) extra space.

Complete Tutorial with example :

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Bubble Sort - C Program Source Code

```
#include<stdio.h>
/* Logic : Do the following thing until the list is sorted
            (i) Compare two adjacent elements and check if they are in correct order(that is second one has
                to be greater than the first).
            (ii) Swap them if they are not in correct order.
 */
void BubbleSort(int *array,int number_of_elements)
{
        int iter, temp, swapped;
        do
        {
                swapped = 0; /* If no element is swapped array is sorted */
                /* In the following loop compare every pair of adjacent elements and check
                   if they are in correct order */
                for(iter = 1; iter < number_of_elements; iter++)
                {
                        if(array[iter-1] > array[iter])
                        {
                                temp = array[iter-1];
                                array[iter-1] = array[iter];
                                array[iter] = temp;
                                swapped = 1;
                        }
                }

        }while(swapped);
}
int main()
{
        int number_of_elements;
        scanf("%d",&number_of_elements);
        int array[number_of_elements];
        int iter;
```

```
        for(iter = 0;iter < number_of_elements;iter++)
        {
                scanf("%d",&array[iter]);
        }
        /* Calling this functions sorts the array */
        BubbleSort(array,number_of_elements);
        for(iter = 0;iter < number_of_elements;iter++)
        {
                printf("%d ",array[iter]);
        }
        printf("\n");
        return 0;

}
```

Related Tutorials :

Bubble Sort	One of the most elementary sorting algorithms to implement - and also very inefficient. Runs in quadratic time. A good starting point to understand sorting in general, before moving on to more advanced techniques and algorithms. A general idea of how the algorithm works and a the code for a C program.	Insertion Sort	Another quadratic time sorting algorithm - an example of dynamic programming. An explanation and step through of how the algorithm works, as well as the source code for a C program which performs insertion sort.	Selection Sort	Another quadratic time sorting algorithm - an example of a greedy algorithm. An explanation and step through of how the algorithm works, as well as the source code for a C program which performs selection sort.	Shell Sort	An inefficient but interesting algorithm, the complexity of which is not exactly known.	Merge Sort	An example of a Divide and Conquer algorithm. Works in O(n log n) time. The memory complexity for this is a bit of a disadvantage.	Quick Sort	In the average case, this works in O(n log n) time. No additional memory overhead - so this is better than merge sort in this regard. A partition element is selected, the array is restructured such that all elements greater or less than the partition are on opposite sides of the partition. These two parts of the array are then sorted recursively.	Heap Sort	Efficient sorting algorithm which runs in O(n log n) time. Uses the Heap data structure.	Binary Search Algorithm	C us al us th of el a s ar in tir

Some Important Data Structures and Algorithms, at a glance:

Arrays : Popular Sorting and Searching Algorithms			
Bubble Sort	Insertion Sort	Selection Sort	Shell Sort
Merge Sort	Quick Sort	Heap Sort	Binary Search Algorithm
Basic Data Structures and Operations on them			
Stacks	Queues	Single Linked	Double Linked

		List	List
Circular Linked List	1.		

Tree Data Structures			
Binary Search Trees	Heaps	Height Balanced Trees	
Graphs and Graph Algorithms			
Depth First Search	Breadth First Search	Minimum Spanning Trees: Kruskal Algorithm	Minumum Spanning Trees: Prim's Algorithm
Dijkstra Algorithm for Shortest Paths	Floyd Warshall Algorithm for Shortest Paths	Bellman Ford Algorithm	
Popular Algorithms in Dynamic Programming			
Dynamic Programming	Integer Knapsack problem	Matrix Chain Multiplication	Longest Common Subsequence
Greedy Algorithms			
Elementary cases : Fractional Knapsack Problem, Task Scheduling	Data Compression using Huffman Trees		

bubblesort.png (34k) Prashant Bhattacharji, Oct **v.1**