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Insertion Sort

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Insertion sort is a simple sorting algorithm that works the way we sort playing cards in our hands.

Algorithm
// Sort an arr[] of size n
insertionSort(arr, n)
Loop from i = 1 to n-1.
……a) Pick element arr[i] and insert it into sorted sequence arr[0…i-1]

Example:

12, 11, 13, 5, 6

Let us loop for i = 1 (second element of the array) to 5 (Size of input array)

i = 1. Since 11 is smaller than 12, move 12 and insert 11 before 12
11, 12, 13, 5, 6

i = 2. 13 will remain at its position as all elements in A[0..I-1] are smaller than 13
11, 12, 13, 5, 6

i = 3. 5 will move to the beginning and all other elements from 11 to 13 will move one position ahead of their current position.
5, 11, 12, 13, 6

i = 4. 6 will move to position after 5, and elements from 11 to 13 will move one position ahead of their current position.
5, 6, 11, 12, 13

```c
// C program for insertion sort
#include <stdio.h>
#include <math.h>

/* Function to sort an array using insertion sort*/
void insertionSort(int arr[], int n)
{
    int i, key, j;
    for (i = 1; i < n; i++)
    {
        key = arr[i];
        j = i-1;

        /* Move elements of arr[0..i-1], that are
           greater than key, to one position ahead
           of their current position */
        while (j >= 0 && arr[j] > key)
        {
            arr[j+1] = arr[j];
            j = j-1;
        }
        arr[j+1] = key;
    }
}
```

```c
// A utility function ot print an array of size n
void printArray(int arr[], int n)
{
    int i;
    for (i=0; i < n; i++)
        printf("%d ", arr[i]);
    printf("\n");
}



/* Driver program to test insertion sort */
int main()
{
    int arr[] = {12, 11, 13, 5, 6};
    int n = sizeof(arr)/sizeof(arr[0]);

    insertionSort(arr, n);
    printArray(arr, n);

    return 0;
}
```

Output:

5 6 11 12 13

Time Complexity: O(n*n)

Auxiliary Space: O(1)

Boundary Cases: Insertion sort takes maximum time to sort if elements are sorted in reverse order. And it takes minimum time (Order of n) when elements are already sorted.

Algorithmic Paradigm: Incremental Approach

Sorting In Place: Yes

Stable: Yes

Online: Yes

Uses: Insertion sort is uses when number of elements is small. It can also be useful when

input array is almost sorted, only few elements are misplaced in complete big array.

Quizzes: Sorting Questions

Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above.

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gwpark · 4 months ago

I love this sort rather than quick sort.

In real world, an ARRAY or DATA to be sorted is usually NOT static, rather

If one element is inserted during sort process, other algorithms cannot res

But, only this algorithm is not interrupted and can respond with the additio

6 ⌃ | ⌄ ·

Sumit Khatri · 7 hours ago

this is the sorting technique which can work even all the numbers to be so
time.....hence called online algorithm

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