



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF MCA

19CAT602 – DATA STRUCTURES & ALGORITHMS

I YEAR I SEM

UNIT III - SORTING AND SEARCHING

TOPIC 14 – Insertion Sort



Insertion sort: Algorithm

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]
```



Insertion Sort in C

- Initial Array

8	6	4	20	24	2	10	12
---	---	---	----	----	---	----	----

- Since, $6 < 8$

8	6	4	20	24	2	10	12
---	---	---	----	----	---	----	----

6 will get **inserted** before 8

- Since, $4 < 6$

6	8	4	20	24	2	10	12
---	---	---	----	----	---	----	----

4 will get **inserted** before 6

- 20 is at correct position, no insertion needed

4	6	8	20	24	2	10	12
---	---	---	----	----	---	----	----

- 24 is at correct position, no insertion needed

4	6	8	20	24	2	10	12
---	---	---	----	----	---	----	----

- Since, $2 < 4$

4	6	8	20	24	2	10	12
---	---	---	----	----	---	----	----

2 will get **inserted** before 4

- Since, $10 < 20$

4	6	8	20	24	2	10	12
---	---	---	----	----	---	----	----

10 will get **inserted** before 20

- Since, $12 < 20$

2	4	6	8	20	24	10	12
---	---	---	---	----	----	----	----

12 will get **inserted** before 20

2	4	6	8	10	20	24	12
---	---	---	---	----	----	----	----

2	4	6	8	10	12	20	24
---	---	---	---	----	----	----	----

2	4	6	8	10	12	20	24
---	---	---	---	----	----	----	----



Advantages

- 1.It is simple, small and easy to write.
- 2.It doesn't use a lot of overhead.
- 3.It uses in place sorting, thus $O(1)$ space requirements
- 4.If data is almost sorted, then it can be very fast approaching $O(n)$ and faster than Merge sort(for sorted data, and small N , else merge sort is faster)
- 5.Efficient for (quite) small data sets.



Disadvantages

1. Poor average time complexity of $O(n^2)$
2. If there are many elements then it is inefficient
3. Many items needs to be shifted to one insertion



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