



THE UNIVERSITY OF TEXAS AT ARLINGTON

DESIGN AND ANALYSIS OF ALGORITHM (CSE 5311)

PROJECT – 1

Project report by:

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- **Sources Referred**

- i. Python docs. ([link](#))
- ii. Geeks for Geeks ([link](#))
- iii. W3school ([link](#))
- iv. Programiz ([link](#))
- v. Tutorials-point ([link](#))

- **Time Complexity of the Algorithm**

- **Insertion Sort**

For best-case scenario (i.e., when array is already sorted) is $O(n)$.

For average case scenario (i.e., When array is unordered) is $O(n^2)$.

For the worst-case scenario (i.e., when array is reserve sorted) is $O(n^2)$.

- **Merge Sort**

For best-case scenario (i.e., when array is already sorted) is $O(n \log n)$.

For average case scenario (i.e., When array is unordered) is $O(n \log n)$.

For the worst-case scenario (when array is reserve sorted) is $O(n \log n)$.

- **Quick Sort**

For best-case scenario (i.e., when array is already sorted) is $O(n \log n)$.

For average case scenario (i.e., When array is unordered) is $O(n \log n)$.

For the worst-case scenario (i.e., when array is reserve sorted) is $O(n^2)$.

▪ Experimental Results

Input (N)	Insertion Sort	MergeSort	QuickSort
20	0.0010004043579101562 Seconds	0.0063288211822509766 Seconds	0.008188962936401367 Seconds
100	0.003001689910888672 Seconds	0.0020024776458740234 Seconds	0.00952911376953125 Seconds
1000	0.044573307037353516 Seconds	0.01200413703918457 Seconds	0.020440340042114258 Seconds
4000	0.689997673034668 Seconds	0.045000314712524414 Seconds	0.10554385185241699 Seconds

▪ Differences between Experimental and Theoretical Results

As seen from the above given data of experimental results we can conclude that, theoretical results are bounding the time complexity between bounds but experimental data can confirm that bound by giving exact measures.

▪ Comparison and contrast between the three algorithms

We could make out two things from these results: -

- First, the time taken by all of the algorithms increases with the size of input. That is as the size increases from 20 to 100 to 1000 the time taken by algorithm increases.
- Secondly, when the size of the input array is small (i.e., 20) Insertion sort out performs both merge sort and quick sort but as the size of the input file increases from 20 to 1000 and then 4000 we can observe that insertion sort performs poorly in comparison to other algorithm , it takes way more time than either merge sort or quick sort.

Therefore, we can conclude that If the size of the input is less it is better to use insertion sort but if the size of the input is comparably larger then it is better to go with Quick sort.

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JAY SHAH
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8th October '2022

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