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**Assignment**: Runtime comparison between Selection Sort and Insertion Sort.

**Objective**:

Both Selection and Insertion Sort are used to sort an array in a particular order. Here, we will sort randomly generated arrays of various sizes in an ascending order using these two algorithms and carry out a comparison between their running time for multiple cases i.e. average, best and worst.

**Machine Specifications:**

Processor: Intel® Core™ i7-8550U CPU @ 1.80 GHz 1.99GHz

Ram: 8 GB

System Type: 64-bit operation system

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| --- | --- | --- | --- | --- | --- | --- |
| **Array Size** | **Time in best case**  **(microseconds)** | | **Time in average case**  **(microseconds)** | | **Time in worst case**  **(microseconds)** | |
| **Selection Sort** | **Insertion Sort** | **Selection Sort** | **Insertion Sort** | **Selection Sort** | **Insertion Sort** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 200 | 0 | 1 | 0 | 0 | 0 | 0 |
| 500 | 996 | 1 | 0 | 0 | 0 | 1000 |
| 1000 | 1026 | 2 | 1961 | 1008 | 997 | 993 |
| 2000 | 4986 | 5 | 4952 | 1999 | 3989 | 3989 |
| 5000 | 36902 | 13 | 27926 | 14961 | 34940 | 26928 |
| 10000 | 112680 | 30 | 112700 | 53856 | 126642 | 110703 |

**Data Table:**

**Complexity Analysis:**

For selection sort,

The time complexity in best case: O (n2)

The time complexity in average case: O (n2)

The time complexity in worst case: O (n2)

For insertion sort,

The time complexity in best case: O (n)

The time complexity in average case: O (n2)

The time complexity in worst case: O (n2)

Both the algorithms generally run in O (n2), except for the insertion sort when the array is already sorted. In this case, the nested loop of the sorting algorithm is never executed because the condition never fulfills. Therefore, the time complexity for the best case of insertion sort is O (n).

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