Machine Configuration:

Processor: Intel(R) Core(TM) i5-8250U CPU

1.60 GHz up to 1.80 GHz

RAM: 8.00 GB

Operating System: Windows 10 64-bit

Data and Complexity analysis:

1. **Selection Sort:**

The selection sort algorithm sorts an array by repeatedly finding the minimum element from unsorted part and putting it at the beginning.

For best case scenario (when the array is already sorted) selection sort doesn’t swap any element with the unsorted part for minimum value. For worst case scenario (when the array is sorted in descending order) it has to swap with every element from unsorted part for minimum value. Though for both cases time complexity will be O(n^2) as swapping is done in constant time. So the time difference is negligible among best, average and worst case scenario.

Time Complexity: O(n^2) as there are two nested loops.

Space Complexity: O(1)

The table is attached herewith.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Time Analysis for Selection Sort ( Time in microseconds) | |  |
| **Number of elements** | **Best Case (Selection)** | **Average Case (Selection)** | **Worst Case (Selection)** |
| 10 | 0 | 0 | 0 |
| 100 | 18 | 20 | 22 |
| 200 | 56 | 61 | 64 |
| 500 | 335 | 367 | 403 |
| 1000 | 1299 | 1578 | 1677 |
| 2000 | 5561 | 5426 | 5068 |
| 5000 | 31345 | 31459 | 35092 |
| 10000 | 127693 | 171457 | 124030 |

2. **Insertion Sort:**

Insertion sort runs in O(n) time in its best case and runs in O(n^2) in its worst and average cases.

Insertion sort performs two operations: it scans through the list, comparing each pair of elements, and it swaps elements if they are out of order. Each operation contributes to the running time of the algorithm. If the input array is already sorted, insertion sort compares elements and performs no swaps. Therefore, in the best case, insertion sort runs in O(n) time. But for average and worst case scenario the inner loop performs some swaps and the running time becomes O(n^2).

Time Complexity: O(n^2) for worst case and O(n) for best case.

Space Complexity: O(1)

The table is attached herewith.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Time Analysis for Insertion Sort ( Time in microseconds) | |  |
| **Number of elemnts** | **Best Case (Insertion)** | **Average Case (Insertion)** | **Worst Case (Insertion)** |
| 10 | 0 | 0 | 0 |
| 100 | 0 | 8 | 13 |
| 200 | 1 | 25 | 58 |
| 500 | 2 | 196 | 397 |
| 2000 | 7 | 2758 | 4782 |
| 5000 | 20 | 14807 | 34296 |
| 10000 | 41 | 103697 | 119927 |