|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sorting Method** | **Run time for 100 Elements**  **(ns)(10-9s)** | **Run time for 500 Elements**  **(ns)(10-9s)** | **Run time for 2000 Elements**  **(ns)(10-9s)** | **Run time for**  **10000 Elements**  **(ns)(10-9s)** |
| Bubble Sort  (Ascending) | 99.66666 | 280.6666667 | 1566.666667 | 28627.00 |
| Bubble Sort  (Descending) | 155.3333333 | 341.3333333 | 2578.333333 | 57517.00 |
| Bubble Sort  (In random order) | 133.00 | 293.6666667 | 2881.333333 | 65774.66667 |
| Bubble Sort  [nearly sorted  (10% moved)] | 99.00 | 336.00 | 2040.666667 | 39911.33333 |
|  |  |  |  |  |
| Insertion Sort  (Ascending) | 1.33333333 | 9.00 | 39.66666667 | 185.00 |
| Insertion Sort  (Descending) | 136.00 | 295.00 | 1899.666667 | 26787.66667 |
| Insertion Sort  (In random order) | 68.00 | 185.33333 | 2175.666667 | 13711.33333 |
| Insertion Sort  [nearly sorted  (10% moved)] | 11.00 | 240.3333333 | 325.00 | 2557.666667 |
|  |  |  |  |  |
| Selection Sort  (Ascending) | 78.00 | 244.6666667 | 1241.666666 | 7668.666666 |
| Selection Sort  (Descending) | 80.00 | 257.6666666 | 3501.333333 | 28250.66666 |
| Selection Sort  (In random order) | 78.33333333 | 201.6666667 | 1732.00 | 27228.66667 |
| Selection Sort  [nearly sorted  (10% moved)] | 77.00 | 262.3333333 | 1922.00 | 26667.33333 |

Exploring Sorting Runtimes (Activity 4)

Thilina Prasad Athukorala

Curtin ID: 21038875 | SLIIT ID : SI22458056

**Discussion**

The table shows time records of 3 sorting methods tested using 4 different types of data arrangements for 4 different array sizes. The 3 sorting techniques tested are Bubble sort, Insertion sort and Selection sort in which bubble sort uses the method of comparing adjacent pairs and swapping them if they are not in order, insertion sort checks each element and adds it to the correct place comparing values in either side and selection sort Select smallest item and swap it with the necessary item to build the sorted array.

When the time Complexity of bubble sort and insertion sort is considered, they show O(N) Complexity in the best case and O(N2) Complexity in average and worst cases But Insertion sort is considered to be better due lesser number of swaps unlike bubble sort. Time complexity of selection sort in best, average and worst case is given as O(N2) since it has equal number of passes in all 3 cases.

In the table of records, a common property (time increment) is seen with increase of the array size. It is crystal clear that insertion sort uses lesser amount of time in sorting the data in all the four cases ascending, descending, random order and nearly sorted, and with lesser amount of data it is nearly 4% to 5% of the time used by other sorting methods. But Ascending data arrangement type consumes significantly lower values compared to all the time durations in the shown records. An average of five readings were obtained for each value of the shown table and from it, insertion sort showed solid stable values in each attempt than other two methods.

Generally, the time used to sort the array in Ascending order, descending order, random order and nearly sorted is lesser in selection sorting method that use bubble sort method. Bubble sorting method uses lesser time in Ascending and nearly sorted methods than other the other two types (descending order and random order).