**Program Structure & Algorithms**

**INFO6205**

**Assignment 6**

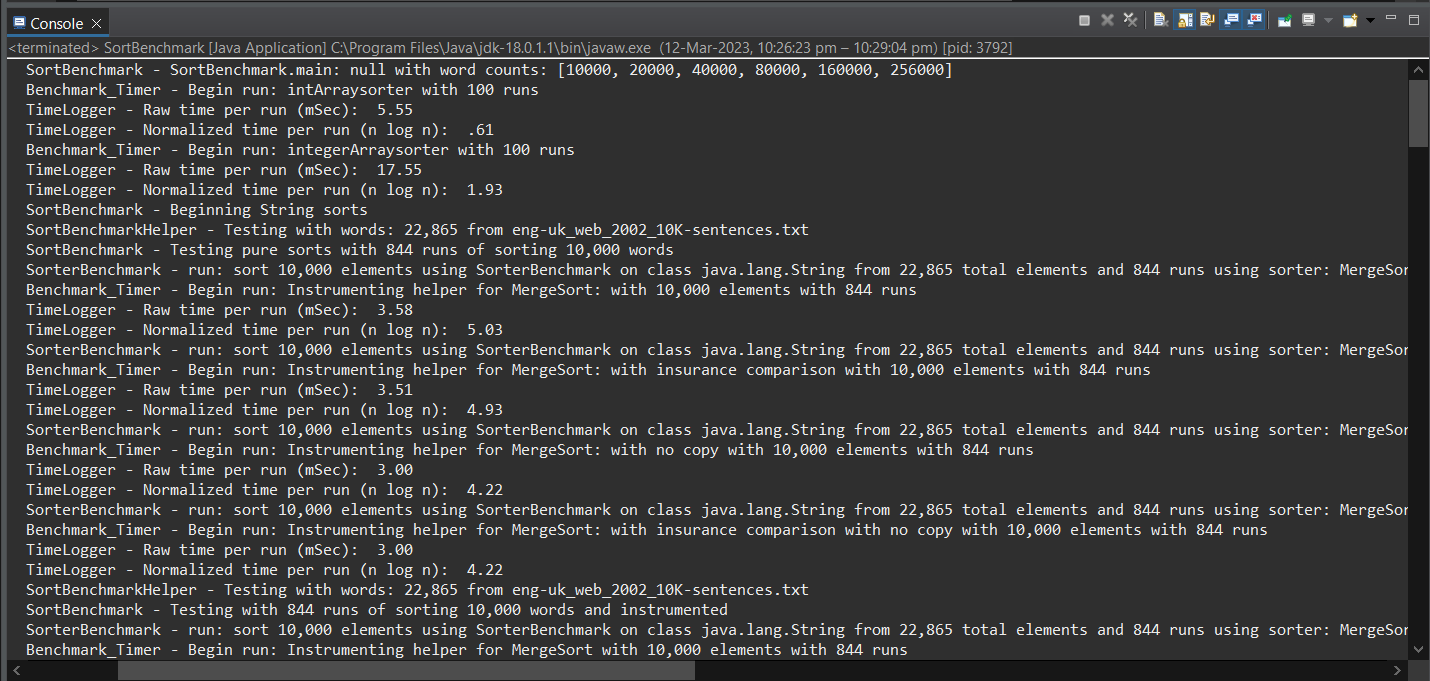
**Name:** Mayur Kenkre

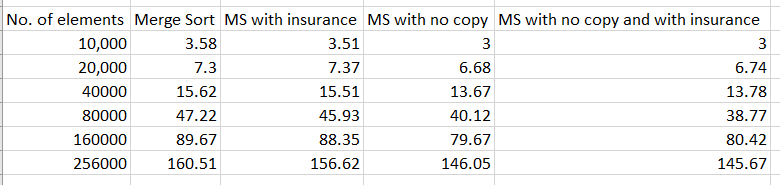
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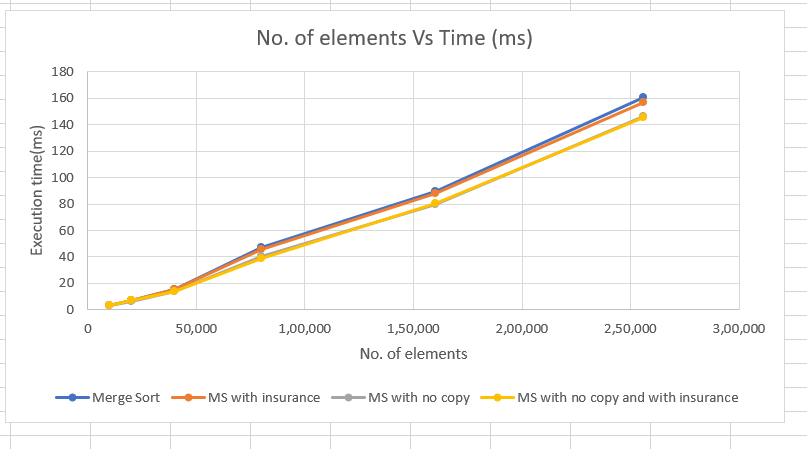
**Task:**

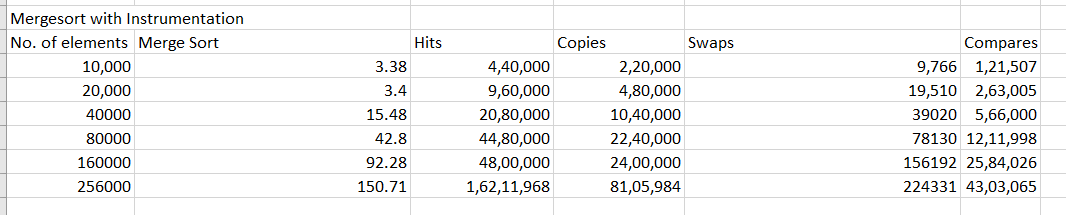
• Determine for sorting algorithms--what is the best predictor of total execution time: comparisons, swaps/copies, hits (array accesses), or something else.

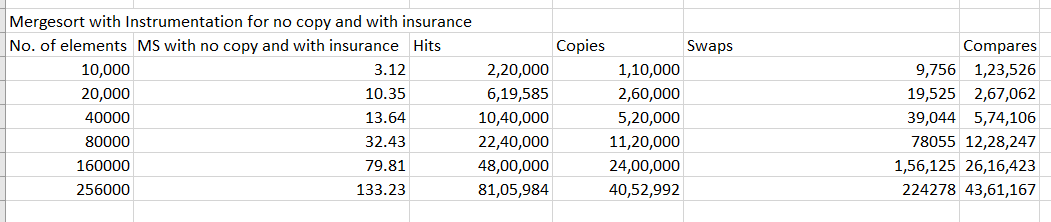
**Evidence:**

Console output of mergesort:  




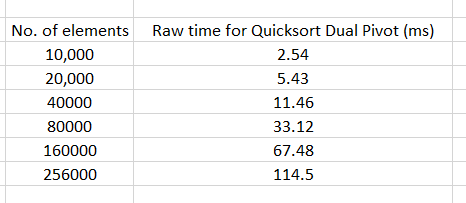


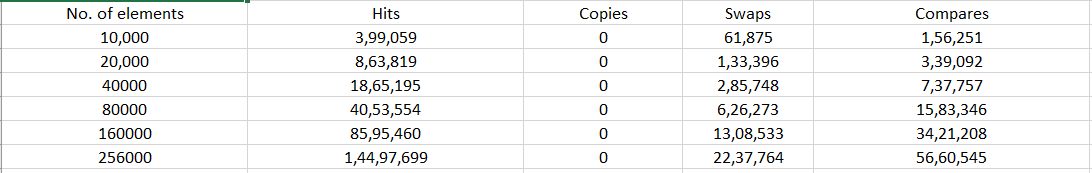




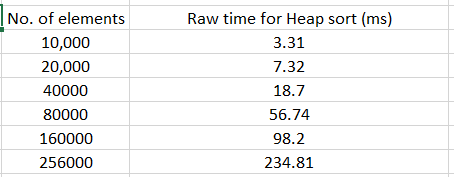
On a log-log graph, the correlation between the number of Hits, Copies, and Compares and the quantity of elements is linear. In Merge Sort, the time complexity is O(n log n), signifying that the number of Compares is the key factor in determining the algorithm's overall execution time. Although the number of Hits, Copies, and Swaps also rise as the number of elements increases, they have a lesser influence on the total time complexity compared to the number of Compares.

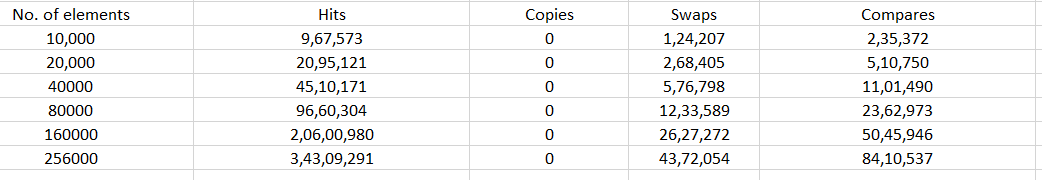
**Quicksort Dual Pivot:**

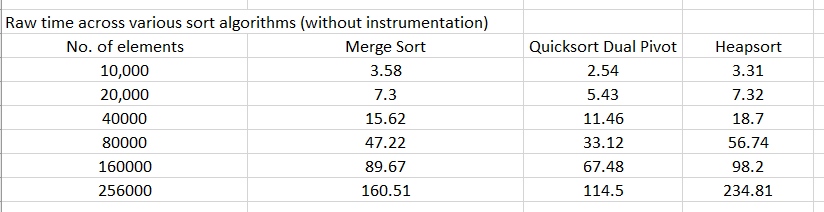
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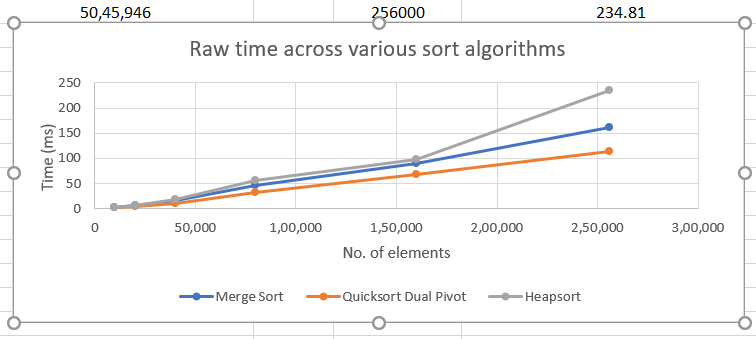
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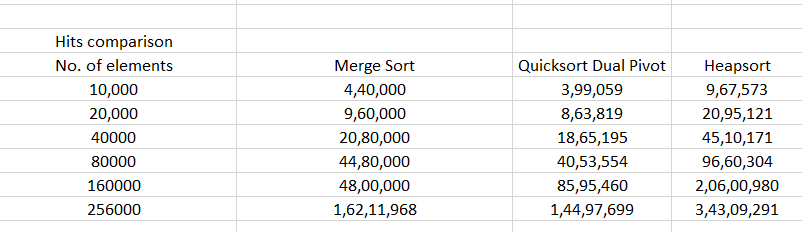
**Heapsort:**

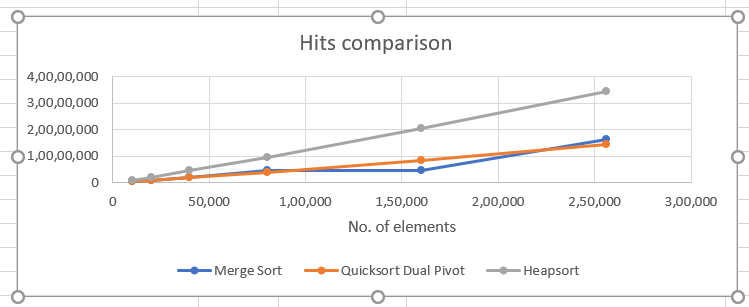
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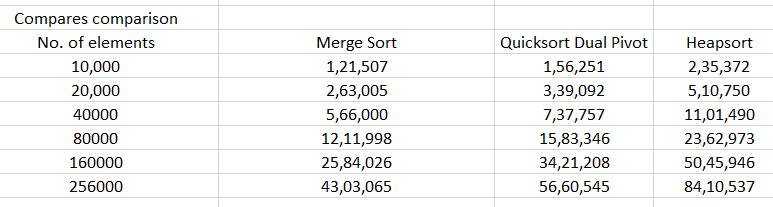


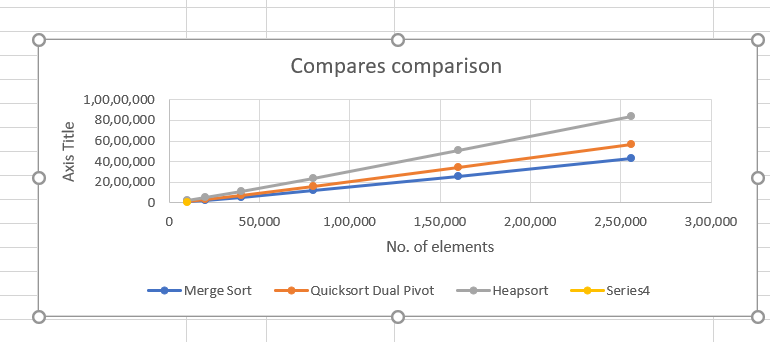












Quicksort demonstrated the highest speed among the three sorting algorithms tested, regardless of the size of the array. Merge sort was slightly slower than Quicksort, while Heapsort was the slowest.

**Relationship Conclusion:**

Sorting algorithms involve operations such as compares, copies, and swaps, which all require accessing the array. Each of these operations results in a "hit" to the array. Therefore, the number of hits can be a useful metric for comparing the efficiency of different algorithms. Generally, algorithms with more hits will perform worse than those with fewer hits, provided all other operations take the same amount of time. Consequently, the number of hits can predict the actual execution time of the algorithms. As shown in the above graphs, Heap sort has the highest number of hits, which resulted in the longest sorting time. In contrast, Merge sort and Quicksort have fewer hits, and thus require less time for sorting. Hence, the number of hits can be a reliable predictor of the sorting algorithm's efficiency.