CSE 204: Data Structures Sessional

**Offline 7: Comparison of Merge Sort and Quick Sort**

Submitted By,

Sihat Afnan

Lab Group : B2

Student Id : 1705098

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Machine Configuration:

Operating System- Windows 7 Professional

Processor- Intel(R) Core(TM) i3 CPU @2.70GHz up 3.19 GHz

Installed Memory (RAM)- 2.00 GB (1.74 GB Available)

System Type- 64-bit operating system

Data & Complexity Analysis:

Merge Sort:

The merge sort algorithm only depends on the size of the array, not on the values of the array. An amount of similar memory required to replace the values of the array in sorted order. The algorithm follows divide and conquer rule. So in all circumstances-

Time Complexity: O(nlogn)

Memory Complexity: O(n)

The table is attached herewith.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Merge | Sort | Time (ms) |
| n | Best | Average | Worst |
| 10 | 0.0025 | 0.0034 | 0.0034 |
| 20 | 0.0066 | 0.0076 | 0.0082 |
| 50 | 0.019 | 0.0215 | 0.018 |
| 100 | 0.039 | 0.048 | 0.033 |
| 200 | 0.044 | 0.05 | 0.05 |
| 500 | 0.14 | 0.11 | 0.115 |
| 1000 | 0.27 | 0.33 | 0.26 |
| 2000 | 0.48 | 0.6 | 0.54 |
| 5000 | 1.45 | 1.7 | 1.25 |
| 10000 | 2.9 | 3.8 | 3 |
| 20000 | 6 | 7.4 | 7 |

Quick Sort:

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

The best case for the quick sort is the position of the pivot divides the array equally. On the contrary, the worst case is that all other elements are at one side of the pivot. Constant number of variables are required for this sorting.

Time Complexity: O(n^2) for worst case (increasing or decreasing sequence) and O(nlogn) for average case.

Memory Complexity: O(1)

The table is attached herewith.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Quick | Sort | Time (ms) |
| n | Best | Average | Worst |
| 10 | 0.0006 | 0.0004 | 0.0006 |
| 20 | 0.0016 | 0.0008 | 0.0012 |
| 50 | 0.0065 | 0.004 | 0.0075 |
| 100 | 0.043 | 0.008 | 0.022 |
| 200 | 0.15 | 0.022 | 0.102 |
| 500 | 0.93 | 0.055 | 0.665 |
| 1000 | 3.78 | 0.07 | 2.52 |
| 2000 | 15.04 | 0.2 | 9.94 |
| 5000 | 92.15 | 0.65 | 58.8 |
| 10000 | 368.5 | 1.4 | 219.3 |
| 20000 | 1492.2 | 3 | 797 |

Graph Plots:

The graphs for comparison between merge sort and quick sort is attached herewith.

|  |  |  |
| --- | --- | --- |
| Best | Case | Time (ms) |
| n | Merge Sort | Quick sort |
| 10 | 0.0025 | 0.0006 |
| 20 | 0.0066 | 0.0016 |
| 50 | 0.019 | 0.0065 |
| 100 | 0.039 | 0.043 |
| 200 | 0.044 | 0.15 |
| 500 | 0.14 | 0.93 |
| 1000 | 0.27 | 3.78 |
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| 1000 | 0.33 | 0.07 |
| 2000 | 0.6 | 0.2 |
| 5000 | 1.7 | 0.65 |
| 10000 | 3.8 | 1.4 |
| 20000 | 7.4 | 3 |

|  |  |  |
| --- | --- | --- |
| Worst | Case | Time (ms) |
| n | Merge Sort | Quick sort |
| 10 | 0.0034 | 0.0006 |
| 20 | 0.0082 | 0.0012 |
| 50 | 0.018 | 0.0075 |
| 100 | 0.033 | 0.022 |
| 200 | 0.05 | 0.102 |
| 500 | 0.115 | 0.665 |
| 1000 | 0.26 | 2.52 |
| 2000 | 0.54 | 9.94 |
| 5000 | 1.25 | 58.8 |
| 10000 | 3 | 219.3 |
| 20000 | 7 | 797 |