**Time Complexity Analysis:**

Sorted Case Analysis:

In sorted case, time complexity of merge sort is O(n\*logn).

But the sorted array is the worst case for quick case. That’s why, time complexity of quick sort in sorted array case in O(n^2);

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **n =** | 10 | 100 | 1000 | 10000 | 100000 | 1000000 |
|  |  |  |  |  |  |  |  |
| **Case** | **Sort** |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| best | merge | 1970 | 7880 | 76670 | 814422 | 8856866 | 95789967 |
|  |  |  |  |  |  |  |  |
|  | quick | 271 | 1452 | 9793 | 121166 | 1493523 | 17017371 |
|  |  |  |  |  |  |  |  |
| worst | merge | 1913 | 7521 | 78483 | 852521 | 8799605 | 98614302 |
|  |  |  |  |  |  |  |  |
|  | quick | 480 | 6149 | 536126 | 42559592 | 171759466 |  |
|  |  |  |  |  |  |  |  |
| average | merge | 2150 | 9262 | 109658 | 1660734 | 14220731 | 212289497 |
|  |  |  |  |  |  |  |  |
|  | quick | 340 | 2825 | 37671 | 506153 | 5867922 | 69931217 |
|  |  |  |  |  |  |  |  |

Random Case Analysis:

In random case, the time complexity of merge sort is O(n\*logn)

and the time complexity of quick sort is also O(n\*logn)

Reversed Sorted Case Analysis:

In reversed sorted case, time complexity of merge sort is O(n\*logn).

But the reversed sorted array is also the worst case for quick case. That’s why, time complexity of quick sort in reversed sorted array case in O(n^2);

**Machine Configuration:**

Processor: Intel® Core(TM) i7-7500U CPU @ 2.70GHz 2.90GHz

RAM : 8.00 GB (7.80 GB usable)

Operating System: 64 bit Windows 10 pro

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Size(n) | Merge (random) | Merge(Reversed) | Merge(sorted) | Quick(Random) | Quick(Reversed) | Quick(Sorted) |
|  | Time (Nano seconds) | Time (Nano seconds) | Time (Nano seconds) | Time (Nano seconds) | Time (Nano seconds) | Time (Nano seconds) |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 0 | 995000 | 0 | 0 | 0 | 0 |
| 150 | 0 | 990000 | 0 | 0 | 0 | 0 |
| 200 | 0 | 992000 | 0 | 0 | 0 | 0 |
| 300 | 997000 | 997050 | 0 | 0 | 0 | 0 |
| 500 | 997000 | 999000 | 987000 | 0 | 1002000 | 1994000 |
| 700 | 997000 | 997000 | 998000 | 0 | 1984000 | 2025000 |
| 1000 | 1993000 | 997000 | 1001000 | 0 | 3988000 | 6982000 |
| 1200 | 995000 | 998000 | 998000 | 1012000 | 5983000 | 9973000 |
| 1500 | 996000 | 1993000 | 996000 | 997000 | 7977000 | 12965000 |
| 1800 | 1995000 | 2003000 | 1998000 | 0 | 9970000 | 16953000 |
| 2000 | 997000 | 999000 | 1010000 | 0 | 11966000 | 19943000 |
| 2200 | 995000 | 998000 | 975000 | 998000 | 14960000 | 24930000 |
| 2500 | 1996000 | 997000 | 998000 | 999000 | 19944000 | 31946000 |
| 2800 | 998000 | 998000 | 998000 | 997000 | 24936000 | 39892000 |
| 3200 | 1967000 | 1995000 | 1988000 | 0 | 30947000 | 50862000 |
| 3500 | 2992000 | 996000 | 1996000 | 997000 | 38926000 | 60838000 |
| 4000 | 1994000 | 1994000 | 1000000 | 0 | 48868000 | 79816000 |
| 4300 | 1993000 | 1996000 | 1992000 | 0 | 56847000 | 91790000 |
| 4500 | 1998000 | 1995000 | 1995000 | 1000000 | 64831000 | 102725000 |
| 4800 | 1997000 | 1995000 | 2025000 | 1000000 | 70841000 | 114692000 |
| 5000 | 2984000 | 2992000 | 1997000 | 0 | 76793000 | 123667000 |
| 5500 | 2995000 | 2993000 | 1995000 | 997000 | 92751000 | 151624000 |
| 6000 | 2992000 | 2994000 | 1994000 | 1000000 | 111702000 | 177525000 |
| 6500 | 2994000 | 2020000 | 2991000 | 2029000 | 130654000 | 208441000 |
| 7000 | 3997000 | 2993000 | 2991000 | 1000000 | 150596000 | 242352000 |
| 7500 | 4006000 | 2995000 | 2993000 | 1001000 | 171538000 | 276259000 |
| 8000 | 4987000 | 2994000 | 2993000 | 1995000 | 195516000 | 314194000 |
| 8500 | 4989000 | 3989000 | 2993000 | 998000 | 223405000 | 425861000 |
| 9000 | 5016000 | 2991000 | 4022000 | 1000000 | 249332000 | 399929000 |
| 9500 | 4987000 | 3989000 | 3993000 | 1993000 | 273303000 | 443851000 |
| 10000 | 3989000 | 4028000 | 5019000 | 996000 | 305217000 | 493678000 |