

Assignment 1: Profiling

2020BTEIT00020

classmate

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Algorithm quicksort(list, left, right)

Pre list is an array of elements to be sorted
left & right are first & last elements of list

Post list is sorted

```
1 if ((right - left) > minSize)
    QuickSort
    1 medianLeft (list, left, right)
    2 Set pivot to left element
    3 Set SortLeft to left + 1
    4 set SortRight to right
    5 loop (SortLeft <= SortRight)
        Find key on left that belongs to right
        1 loop (SortLeft key < pivot key)
            1 increment SortLeft
        2 End loop
        Find key on right that belongs to left
        3 loop (SortRight key >= pivot key)
            1 decrement SortRight
        4 end loop
        5 if (SortLeft <= SortRight)
            1 swap
        6 end if
    6 end loop
    7 move SortLeft - 1 element to left element
    8 move pivot to SortLeft - 1
    9 if (left < SortRight) quickSort(list, left, SortRight - 1)
    10 if (SortLeft < right) quickSort(list, SortLeft, right)
2 else insertionsort(list, left, right)
3 end if
end quickSort
```

* Total no. of comparisons:

For the quicksort algorithm,

Best case is if the partitioning is in the middle.

For best case, the no. of comparisons are order of $n \log_2 n$.

Worst case is if the list is already sorted in ascending or descending order.

For worst case, no. of comparisons are $O(n^2)$ which can be calculated using $n(n-1)/2$.

eg. i] $n = 10$

$$\begin{aligned}\text{Worst case: no. of comparisons} &= n(n-1)/2 \\ &= 10 \times 9 / 2 \\ &= 45\end{aligned}$$

$$\begin{aligned}\text{Best case: no. of comparisons} &= n \log_2 n \\ &\approx 33\end{aligned}$$

ii] $n = 100$

$$\begin{aligned}\text{Worst case: no. of comparisons} &= n(n-1)/2 \\ &= 4950\end{aligned}$$

$$\begin{aligned}\text{Best case: no. of comparisons} &= n \log_2 n \\ &\approx 660\end{aligned}$$

iii] $n = 1000$

$$\begin{aligned}\text{Worst case: no. of comparisons} &= n(n-1)/2 \\ &= 1000(999)/2 \\ &= 499500\end{aligned}$$

$$\begin{aligned}\text{Best case: no. of comparisons} &= n \log_2 n \\ &= 9900\end{aligned}$$