DAA

HandsOn6

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3) Mathematically derive the average runtime complexity of the non-random pivot version of quicksort.

A) Considering the Array size → n

the Recurrence relation for quicksort → T(n)

$$T(n) = T(k) + T(n-k-1) + O(n)$$

In Average Case, we assume that the pivot divides the array into equal parts. , n/2

$$T(n) = O(n) + 2 \cdot T(n/2)$$

$2T(n/2)$ → Average Time for 2 recursive calls of size $n/2$.

From Above; $T(n) = 2 \cdot T(n/2) + O(n)$

$$= 2(O(n/2) + 2 \cdot T(n/4)) + O(n)$$

$$= 2 \cdot O(n/2) + 4 \cdot T(n/4)) + O(n)$$

⋮

$$T(n) = K \cdot O(n/2^k) + 2^k \cdot T(n/2^k)$$

Let's Assume 'k' iterations & array size be '1' when reaches base case

$$T(n) = \log_2 n \, O(1) + n \cdot T(1)$$

∴ RunTime complexity of Non-Random Pivot version of quicksort is $O(n \log n)$ //