Neel Katrodiya 1002254987 DAA

→ * Mathematically derive the average runtime complexity of the non random pivot version of quicksort.

→ Running time of average case is mostly same as or closer to the best case.

→ Let's suppose the partitioning algorithm produce 9 to 1 proportional split the reccurrence will be

→ $\Theta(n)$ is time complexity for partioning step

$$T(n) = T(9n/10) + T(n/10) + \Theta(n)$$

expand $T\left(\frac{9n}{10}\right) = T\left(\frac{9n}{1000}\right) + T\left(\frac{81n}{100}\right) + T\left(\frac{81n}{1000}\right) + \left(\frac{729n}{1000}\right) + \cdots$

Let establish general algorithm

$$n\left(\frac{9}{10}\right)^k \approx 1 \Rightarrow k \approx \log_{10/9} n$$

→ At each level the work have been done is $\theta(n)$ and these are approx $\log_{10/9} n$ level.

$$T(n) = \theta(n) \cdot \log_{10/9} n$$

$$\therefore T(n) = O(n \log n)$$