Sorting 2 October
Monday, October 2, 2023

Q. Given an array, find the max and min using 1 pass and 1 pass.

Q.

Q. The best we can do is 3/2 N comparisons

→ Every pair has a distinct min
→ Every pair has a corresponding max

① The best approach is to find max & min separately

② ——— LCM ———

③ The best yet approach = N + N/2

→ For every pair, find the max & min.

① Find the max

② ——— LCM ———

$T(n) = 2T(n/2) + 2n$

$= 2[2T(n/4) + 2(n/2)] + 2n$

$\vdots$

$= N\log N$

10^6 → 1 sec

10^9 → 1000 sec

Q. A:

$T(n) = 2T(n/2) + n$

$O(n\log n)$

$O(n)$

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

$O(n^2)$

$O(n)$

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

$(T(n-2) + n-1) + n$

$\vdots$

$\sim n^2$

N

N-1

①

Best Case	Worst Case	Avg Case
$T(n) = 2T(\frac{n}{2}) + n$	$T(n) = T(n-1) + n$	
$O(n\log n)$	$O(n^2)$	$O(n\log n)$

$\frac{1}{n}T(n) = \frac{1}{n}T(n/2) + \frac{1}{n}T(n/4) + \cdots + \frac{1}{n}T(1) + \frac{1}{n}(n)$

$\sum_{i=1}^{n} \frac{1}{i}$

$T(n) = T(\frac{n}{3}) + N$

$T(n) = N\log_{3/2} N$ → $T(n) = O(n\log n)$

$N\log_2 N$ → $N\log_{3/2} N$

$\log_{3/2} N$

SC: $O(\log n)$

① Bucket Sort

MSB

$N\log(N/10)$

① Radix Sort

SC: $O(n+k+\log n)$ $\log(n-n)$

Q. Given an unsorted array.
If the array was sorted, what would have been the MAX gap b/w elements?

A: 7, 3, 2, 1, 6 → 3

$\frac{max - min}{n-1}$

$g = \frac{max - min}{n-1}$

$n_{num_buckets} = \frac{max - min}{g}$

$\frac{(max - min)}{max - min} \times (n-1)$

TC: $O(n)$