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Practical 6

Aim :- Implement selection Problem (Deterministic approach)

Theory :

The steps involved in selection problem (deterministic approach) is are.

Input : A set of n elements & k the index of element

Output : The element at index 'k' after the n elements are sorted

Approach :

Step 1 : If |S| <= 5 apply Brute force method

Step 2 : Divide S into n/5 sublists each containing atmost 5 elements

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Step 3: Sort each sublists using any sorting algorithm

Step 4: Recursively find p as median of median of each sublists

Step 5: Partition S into S_1 & S_2 such that S_1 contains all elements less then or equal to p & S_1 contains all elements greater than p

Step 6: Now there can be 3 cases:
(a) If $|S_1| == K$ then $S_1(K)$ will be Kth smallest
(b) if $|S_1| > K$ then K^{th} smallest must be present in S_1
(c) otherwise K^{th} smallest must be in S_2

• Proof of time complexity

Step 2 takes $O(n/5)$ time, step 3 takes $O(n)$

Now we claim that $3/10$ out of the array are $\leq p$

Step 4 takes $7n/10$ time
∴ $T(n) \leq cn + T(n/5) + T(7n/10)$

now we know that

$$T(n) \leq T \cdot (a_1 n) + T_2 (a_2 n) + \cdots + T(a_k n) + cn$$
$$T(n) = O(n)$$

Conclusion: Hence the selection problem (deterministic) is studied. The time complexity proof is also made.