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DESIGN TECHNIQUES

I. Divide and Conquer

- In computer science, divide and conquer is an algorithm design paradigm based on multibranch recursion. A divide and conquer algorithm works by recursively breaking down a problem into 2 or more subproblems of the same or related type, until these become simple enough to be solved directly.
- The divide & conquer approach involves 3 steps at each level of the recursion:
 - (i) Divide the problem into a no. of subproblems.
 - (ii) Conquer the subprobs. by solving them recursively.
 - (iii) Combine the solutions to the ~~prob~~ subproblems into the solution for the original problem.
- The no. of instances into which the input is divided is k .
- For an input of size n , let $D(n)$ be the no. of steps done by divide and $C(n)$ be the no. of steps done by combine.

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- Then the general form of the recurrence relation that describes the amount of work done by the algorithm is:

$$T(n) = D(n) + \sum_{i=1}^k T(\text{size}(I_i)) + C(n), \text{ for } n > \text{smallsize}$$

- Control Abstraction/Skeleton:

Solve (I)

{ $n = \text{size}(I);$

if ($n \leq \text{smallsize}$):

 solution = directly solve (I);

else:

 divide I into I_1, I_2, \dots, I_k ;

 for each $i \in \{1, 2, 3, \dots, k\}$:

$s_i = \text{solve}(I_i);$

 solution = combine (s_1, s_2, \dots, s_k);

return solution;

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