15210: Parallel and Sequential Data Structures and Algorithms

DPLab

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4.1

substring of S from i to j, inclusive

**Recursive Solution**:

represents whether or not S[i,n] can be split into valid words.

Go from DP(n) to DP(0), DP(0) is the final answer.

**Sharing:**

There are distinct calls (between any of the two letters) for isWord(), and n+1 call of the DP function

**DAG and Cost:**

We have nodes in the DAG. Each represents a substring from i to j.

For each sub-problem, the work is O(n) since there are at most n words to check. And we have n+1 problems, 0~n. Therefore the work is

4.2

**Transform**:

Label villages on the left side of the river 0 ~n-1 and assume their locations are following the ascending order.

Label corresponding villages on the right side of the river 0 ~ n-1, too, but it can be in any order. Represent the order of these villages with an array S. S is a permutation of 0~n-1.

To avoid crossing, the order of S should be also in the ascending order. Therefore, the problem is to find a longest increasing subsequence of S.

**Recursive Solution**:

DP(i): length of longest increasing subsequence that ends with S(i)

DP(n) is the solution

**Sharing:**

We need to calculate n states, one for each position. And for each position i, we need to do i-1 comparisons.

**DAG and Cost:**

There are n nodes in the DAG, each represents the length of longest increasing sequence that ends on this element.

For each position, we need to do at most n-1 comparisons. There are n positions. Therefore the cost is

4.3

4.4

**Recursive Solution:**

: rules,

: substring from to , inclusive

: min number of steps needed to go from to . if it is not reachable.

Final solution is

**Sharing:**

There are DP sub-problems. For each one we need to go through at most m rules and n characters.

**DAG and Cost:**

Each node represents the steps from one character to a substring of S; there are substrings and characters therefore nodes. For each node we have work. Total work is .