Algorithms and Data Structures

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11 Sheet 11

11.1 Longest Ordered Sub array

(a) Implemented in los.cpp

11.2 Sum of Triangles

(a) Implemented in triangle.cpp

(b) Runtime Analysis

This dp version of the algorithm will take $\Theta(\frac{n(n+1)}{2})$ therefore the time complexity will be $\Theta(n^2)$. On the other hand, the brute force approach will take $\Theta(2^n)$. At each level it makes two comparisons and if we have k rows, then it will make $\Theta(2^{k-1})$ computations, therefore the running time is $\Theta(2^n)$. The dp solution solves the same problem in a polynomialic time as compared to exponential.

(c) Greedy Approach?

The greedy approach is to select the maximum number at each level from the 2 children.The greedy approach however will not provide the optimal solution. It will make a locally optimal choice by selecting the largest number , however it fails at providing a globally optimal solution. Consider the tree to be:

$$\begin{array}{ccccc} & & 1 & & \\ & 5 & & 2 & \\ 3 & & 1 & & 10 \end{array}$$

The greedy approach goes through $1 \to 5 \to 3$, which gives a sum of 9. However the optimal solution $1 \to 2 \to 10$, results in a sum of 13. Thus the greedy approach fails.