Advanced Algorithms and Data Structures

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Homework 5

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Task 1 (Complexity of the recursive rod-cutting algorithm) *5 points*

The course book contains a procedure CUT-ROD for computing the maximum revenue from cutting a rod. This procedure corresponds to the second recursive rod-cutting algorithm presented in the lecture. Let $T(n)$ be the number of times CUT-ROD is called when treating a rod of length n.[1] Equation (15.3) of the book gives a recurrent equation defining T that is directly derived from the procedure, and (15.4) states that $T(n)$ is actually 2^n. Prove that (15.4) follows from (15.3).

Task 2 (Complexity of the efficient matrix chain multiplication algorithm) *5 points*

It was shown in the lecture that the time complexity of the matrix chain multiplication algorithm that uses dynamic programming is in $O\left(n^3\right)$. Show that it is also in $\Omega\left(n^3\right)$ and thus in $\Theta\left(n^3\right)$.

Task 3 (Implementation of the activity selection algorithm) *5 points*

The course website contains Ada code for activity selection that lacks the implementation of the actual activity selection function. Add this implementation, using the greedy algorithm for activity selection. A set of activities is represented by an array that contains the activities sorted by finish time in increasing order. So the function *Selection* can expect the given array to contain the activities in that order, but is also required to return the selected activities in that order.

[1] This includes the initial call and all recursive calls.