Project 3: Dynamic-Programming Report

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CSCI 406: Algorithms

## Project Description:

Our goal for this project was to maximize the length of wood we would get from a sawmill by picking which end of the tree to cut at each turn, this is in direct competition with someone else implementing a proper algorithm.

The recurrence relation for this problem was as given:

Text, Word

Description automatically generated

# Recursive Algorithm:

For this step, I was tasked to create a recursive algorithm using the given recurrence relation, and run it on the array [33, 28, 35, 25, 29, 34, 28, 32].

1. Including the initial call, how many calls are made to the function?

Including the initial call, and all redundant calls, there are a total of 85 calls made to the function.

1. Derive the asymptotic complexity and provide an exact bound for the recursive algorithm.

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| --- | --- | --- | --- | --- | --- |
| **N (Resolution of 316ns)** | Function calls | Trial 1 (Seconds) | Trial 2 (Seconds) | Trial 3 (Seconds) | Average (Seconds) |
| 16 | 21845 | 0.006982 | 0.006985 | 0.006982 | 0.006983 |
| 20 | 349525 | 0.111217 | 0.104721 | 0.107738 | 0.107892 |
| 21 | 1398101 | 0.346079 | 0.350179 | 0.347102 | 0.347787 |
| 23 | 5592405 | 1.386711 | 0.1401835 | 0.1474536 | 1.420361 |
| 25 | 22369621 | 5.078328 | 5.174914 | 5.167092 | 5.140111 |

# Dynamic Programming Algorithm:

1. Implement this function:

Code found in Appendix A

1. Derive the asymptotic complexity and provide an exact bound for the dynamic programming algorithm.

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| **N (Resolution of 316ns)** | Function calls | Trial 1 (Seconds) | Trial 2 (Seconds) | Trial 3 (Seconds) | Average (Seconds) |
| 50 | 625 | 0.000998 | 0.001001 | 0.001001 | 0.001000 |
| 100 | 2500 | 0.004987 | 0.003989 | 0.004990 | 0.004655 |
| 200 | 10000 | 0.017614 | 0.016951 | 0.017952 | 0.017506 |
| 400 | 40000 | 0.072835 | 0.070843 | 0.071806 | 0.071828 |
| 800 | 160000 | 0.437882 | 0.464026 | 0.347999 | 0.416636 |