

CSCI 3100: Homework 2

Sep 21, 2018

Overview

For this assignment, you will be working with the “Rod cutting” problem, discussed in class and covered in chapter 15.1 of the textbook.

This assignment has two parts:

- Algorithm implementation [100 points]
- Algorithm analysis [50 points]

Algorithm implementation [100 points]

Instructions

Implement dynamic programming solution to the rod cutting problem. Specifically:

Implement `find_optimal_revenue()` function of `rod_cut.cpp` file. This function returns maximum possible profit of cutting a rod of size N into some number of pieces C , where $C \geq 0$.

1. The inputs to this function are:
 - P – an array of prices for each rod size, where $P[0]$ is 0, $P[1]$ – price of a rod of size 1, ..., $P[N]$ – price of a rod of size N .
 - N – the largest rod length available
2. Implement `find_optimal_cut()` function of `rod_cut.cpp` file. This function returns maximum possible profit of cutting a rod of size N into some number of pieces C , where $C \geq 0$. The inputs to this function are:
 - P – an array of prices for each rod size, where $P[0]$ is 0, $P[1]$ – price of a rod of size 1, ..., $P[N]$ – price of a rod of size N .
 - N – the largest rod length available
 - `pieces` – an array to be filled by `find_optimal_cut()` function with optimal piece sizes
 - `num_pieces` – the number of pieces in the optimal cut

Note that starter code is provided for you in your git repositories under `hw2` directory. You may add whatever code you deem necessary.

Submission:

For this part of the assignment, you will check-in all your code and “push” it to `git.cs.slu.edu`.

Algorithm analysis [50 points]

Instructions

Run your algorithm on inputs of various sizes, and time how it takes to run for each input size. Provide a table with observed times for the following rod lengths. Use consistent time units.

Rod Length	Time of <code>find_optimal_revenue()</code>	Time of <code>find_optimal_cut()</code>
10		
100		
1000		
2000		
5000		
10000		
15000		
30000		
60000		
100000		

Submission

For this part of the assignment, you will write a report, print it out, and bring it to class. The report will include the following sections:

- **Overview** - a brief overview of your implementation, discussing design decisions and any known problems
- **Expected running time** - expected running time of your two functions, expressed as a function of the rod length.
- **Observed running times** - containing
 - a table of observed running times
 - One chart containing plots of observed running times for `find_optimal_revenue()` and `find_optimal_cut()` functions. Here x-axis is the length of the rod, and the y-axis is the observed running time.
- **Discussion** – analysis of whether observed running times are consistent with expected algorithm running time as well as how the running times of two functions compare and why.