Problem Set 3

CS 331

Due Monday, February 17

1. (Making Change) There’s a Jupyter Notebook linked from the class webpage, at https://www.cs.utexas.edu/~ecprice/courses/331/psets/makingchange.ipynb. Run through it, fix the missing expressions in the code, and answer the questions.

2. You are planning to buy a set of fancy lenses for your DSLR camera. The camera store has \( n \) lenses, where lens \( i \) has a cost \( c_i \) and works over a range of focal lengths \( [s_i, f_i] \). (If you’re unfamiliar with cameras, you can think of “focal length” as “zoom level”.) You would like to buy a set of lenses that covers a wide range \( [L, H] \) of focal lengths, so every length in this range is supported by at least one of your lenses.

You may assume all the parameters are integers.

(a) Give an \( O(n(H - L)) \) time dynamic programming algorithm to find the cheapest set of lenses that covers the entire range \( [L, H] \).

Recall that you should:

- Define a subproblem, which you describe in English.
- Give a recurrence to solve the subproblem.
- Show that the recurrence is correct.
- Describe how to solve the problem quickly, and analyze the resulting running time.

(b) The camera store is now having an amazing sale, where every lens has the same cost \( c_i = \$100 \)! Give a simple greedy algorithm that finds the answer in \( O(n \log n) \) time.

(c) (Optional): Show how to solve part (a) in \( O(n \log n) \) time.