

# Problem Set 2

CS 331

Due Wednesday, February 5

1. (Exercise 37 from <http://jeffe.cs.illinois.edu/teaching/algorithms/book/03-dynprog.pdf>)

You have mined a large slab of marble from a quarry. For simplicity, suppose the marble slab is a rectangle measuring  $m$  inches in height and  $n$  inches in width. You want to cut the slab into smaller rectangles of various sizes—some for kitchen counter tops, some for large sculpture projects, others for memorial headstones. You have a marble saw that can make either horizontal or vertical cuts across any rectangular slab. At any time, you can query the spot price  $P[x, y]$  of an  $x$ -inch by  $y$ -inch marble rectangle, for any positive integers  $x$  and  $y$ . These prices depend on customer demand, and people who buy marble counter tops are weird, so don't make any assumptions about them; in particular, larger rectangles may have significantly smaller spot prices. Given the array of spot prices and the integers  $m$  and  $n$  as input, describe an algorithm to compute how to subdivide an  $m \times n$  marble slab to maximize your profit.

2. (Fibonacci numbers) There's a Jupyter Notebook linked from the class webpage, at <https://www.cs.utexas.edu/~ecprice/courses/331/psets/fib.ipynb>. Run through it, then answer the questions at the end. Don't wait till the last day to do this: setting up the required libraries may take some time.