

# ADA-2024: Homework-3

Deadline: 20th February, 2024. Full Marks: 25

**Problem:** You have mined a large slab of marble from a quarry. For simplicity, suppose the marble slab is a rectangle measuring  $n$  centimeters in height and  $m$  centimeters in width. You want to cut the slab into smaller rectangles of integral pieces (i.e. every small rectangle piece should be  $a$  cm by  $b$  cm dimension for positive integers  $a$  and  $b$ ) of various sizes. 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  $P[x, y]$  by an  $x$  cm by  $y$  cm marble rectangle in  $O(1)$ -time, for any positive integers  $x$  and  $y$ .

These prices depend on the 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 how to subdivide  $m$  cm by  $n$  cm marble slab into integral pieces to maximize your profit.