Lab 12 - OJ
Dynamic Programming (p3)

CS208 Algorithm Design and Analysis

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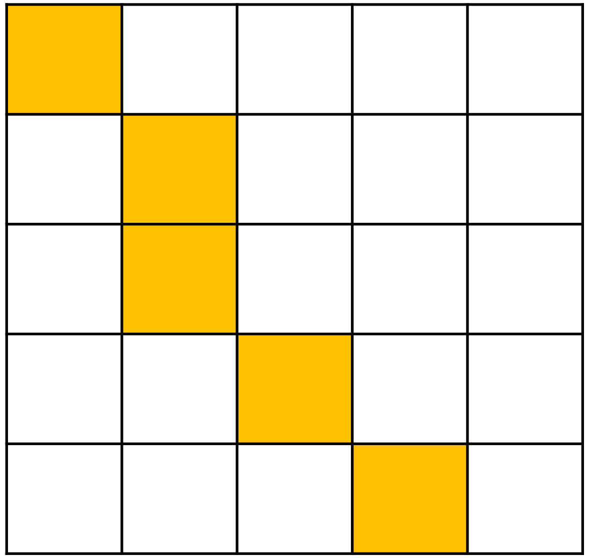
Q1: Seam Carving

Description

> We are given a color picture consisting of an $m \times n$ array $A[1...m, 1...n]$ of pixels, where each pixel specifies a triple of red, green, and blue (RGB) intensities. Suppose that we wish to compress this picture slightly. Specifically, we wish to remove one pixel from each of the m rows, so that the whole picture becomes one pixel narrower. To avoid disturbing visual effects, however, we require that the pixels removed in two adjacent rows be in the same or adjacent columns; the pixels removed form a “seam” from the top row to the bottom row where successive pixels in the seam are adjacent vertically or diagonally.



Q1: Seam Carving

Suppose now that along with each pixel $A[i, j]$, we have calculated a realvalued disruption measure $d[i, j]$, indicating how disruptive it would be to remove pixel $A[i, j]$. Intuitively, the lower a pixel's disruption measure, the more similar the pixel is to its neighbors. Suppose further that we define the disruption measure of a seam to be the sum of the disruption measures of its pixels. Find a seam with the lowest disruption measure and output the sum of the disruption measure.

1	2	3
2	1	3
3	1	2

Input Format

The first line contains four integers m, n.

Then m lines follow, each line contains n integers $d[i, j]$.

Output

One line outputs the lowest sum of disruption measure.

Q1: Seam Carving

Sample Input

```
3 3
1 2 3
2 1 3
3 1 2
```

1	2	3
2	1	3
3	1	2

Sample Output

```
3
```

Q2: Viterbi Algorithm

Description

Given a m length sequence, each position of the sequence has n states. Here we use an $n * m$ matrix E to demonstrate this sequence.

There are two more one state position: 0 and $m+1$. The position 0 can move to any states of position 1, and position m can move to position $m+1$. Their state values are s and t.

Anytime you are in the sequence, you are in one state of one position, and you can only move to one state of next position.

Denote the cost from one position to next position will be $v_i^2 - v_j^2 + v_i * v_j$. v_i is the state value of state i and v_j is the state value of state j.

Please calculate the minimum cost from 0 to $m+1$.

More context about Viterbi algorithm in speech recognition, see https://web.stanford.edu/~jurafsky/slp3/A.pdf

Q2: Viterbi Algorithm

$$W_{11}^{[1]} = 4^2 - 2^2 + 4 * 2 = 20$$

$$W_{12}^{[1]} = 4^2 - 3^2 + 4 * 3 = 19$$

$$W_{13}^{[1]} = 4^2 - 4^2 + 4 * 4 = 16$$

$$W_{11}^{[2]} = 2^2 - 2^2 + 2 * 2 = 4$$

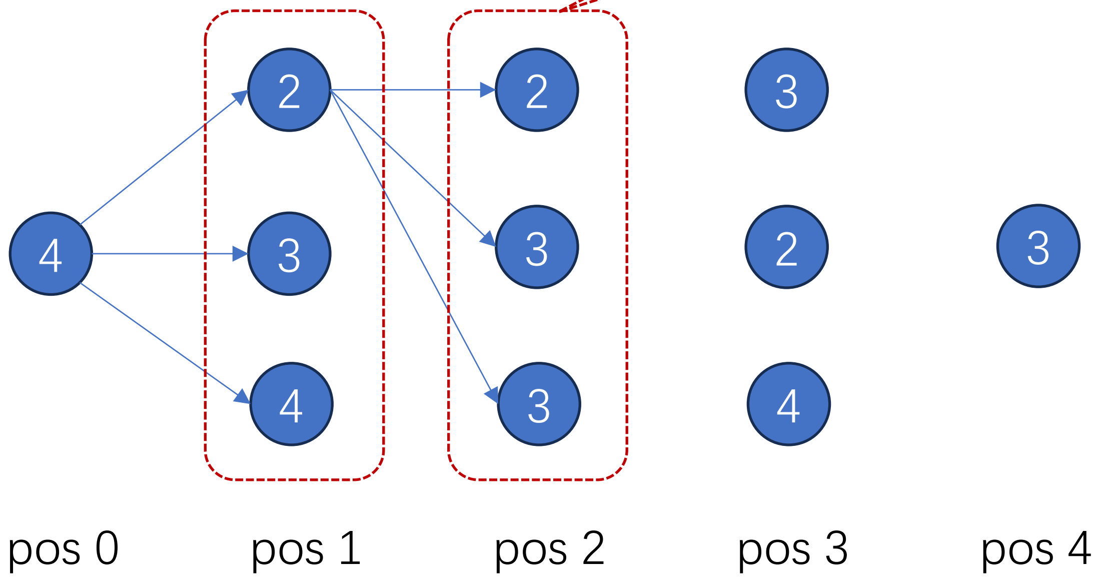
$$W_{12}^{[2]} = 3^2 - 3^2 + 3 * 3 = 9$$

$$W_{13}^{[2]} = 4^2 - 3^2 + 4 * 3 = 19$$

Sample Input:

3 3 4 3
2 2 3
3 3 2
4 3 4

n = 3
m = 3
s = 4
t = 3



Sample output:

29