X

Week 7 Programming Assignment: Here there be Dragons

Due on 2020-03-24, 23:59 IST

- Select your language (C/C++/Java/Python2/Python3)
- Paste your code into the submission window.
- There are some public test cases and some (hidden) private test cases.
- "Compile and run" will evaluate your submission against the public test cases.
- "Submit" will evaluate your submission against the hidden private test cases. There are 10 private testcases in all, each with equal weightage. You will get feedback about which private test cases pass or fail, though you cannot see the actual test cases.
- For each private testcase, you will get a status 'Evaluated', 'Not Evaluated' or 'Time Limit Exceeded'.
  - 'Evaluated' does not mean your answer is correct, just that the entire testcase completed and reported some answer.
  - 'Time Limit Exceeded' means your code took too long.
  - 'Not Evaluated' means this testcase was not run. This typically happens to all testcases after the first one that times out.
- Ignore warnings about "Presentation errors".

Here there be Dragons

(IOI Training Camp, 2012)

The kingdom is falling into ruin. People live in fear. Dragons pillage, kill, and just generally cause as much havoc as they possibly can. The king has just sent out a royal decree:

> *To any man out there who is able to bring me the heads of K dragons, I shall bequeath a lordship–to him, his sons and his grandsons, till the end of time.*

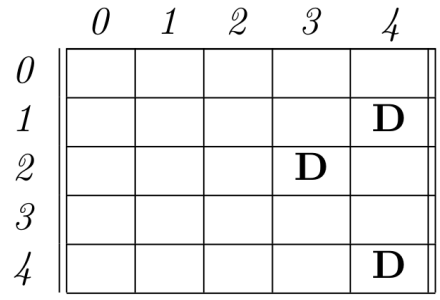
Having seen this royal decree, and knowing that you are capable of killing dragons thanks to your extensive medieval combat training, you set out on a quest to hunt down the evil creatures. Being a busy kind of guy, you would like to complete your quest quickly and kill K dragons through the shortest route.

The kingdom is arranged in a grid with R rows, numbered 0 to R-1, and C columns, numbered 0 to C-1 You start your quest at the top left corner of the grid, (0,0).

The total number of dragons in the kingdom is D, of which you have to kill K. Dragons are very territorial in nature, so each row of the grid contains at most one dragon. Also, since the kingdom is situated on a hill, you travel only downwards on the grid, though you may move left or right as you please.

You are told that no two dragons are on the same row of the grid. Also, no dragon is at position (0,0).

For example, suppose the grid has 5 rows and 5 columns with 3 dragons, of which you have to kill any 2. The three dragons are located at (1,4), (2,3) and (4,4), as shown below. In this case, your shortest route is to take 7 steps and kill the dragons in row 1 and row 2. Killing any other combination of 2 dragons takes 8 steps, so this is the minimum possible. Note that once you've killed K dragons, you don't incur any cost to return home. You just want to find how long it takes to do all the killing.



Solution hint

Number the dragons 1,2,…,D in ascending order of rows. Let mindist(i,j) denote the minimum distance travelled when the j^{th} dragon killed is dragon i. Recall the constraint that there is no dragon at (0,0). Use dynamic programming to compute mindist(i,j) for all values of i and j, then find the minimum among mindist(i,K) for all i ≥ K.

Input format

- Line 1 : Four space-separated integers, R, C, K and D.
- Lines 2 to D+1 : Each line has two-space separated integers r and c, the row and column of the corresponding dragon.

Output format

A single integer, the minimum total distance travelled to kill K dragons.

Test Data:

- In all testcases, K ≤ D ≤ R, and, for each dragon position (r,c), 0 ≤ r < R, and 0 ≤ c < C.
- In all testcases, 1 ≤ K,D ≤ 300.
- In 60% of the testcases, 1 ≤ R,C ≤ 300. In the remaining testcases, 1 ≤ R,C ≤ 100000.
- No two dragons will be on the same row.
- No dragon will be at position (0,0).

Sample Input:

```
5 5 2 3
1 4
4 4
2 3
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Sample Output:

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7
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Sample Test Cases

	Input	Output
Test Case 1	300 300 300 300 178 32 19 273 27 74 173 58 202 167 265 108 112 121 140 202 195 172 143 24 126 5 283 200 264 179 289 33 65 13 114 198 130 283	30342