

# Path



SEASON 8 – FINAL

Let's consider a table consisting of  $N$  rows and  $M$  columns. The rows and columns are numbered starting from 1. There is a number written in every cell of the table and we will call those numbers the **values** of the cells. Some of the cells are **blocked** and so the number **-1** is written in them. The values of all other cells are positive integers. Two cells are considered **adjacent** if they have a common border, i.e. cell  $(x,y)$  is adjacent to  $(x + 1, y)$ ,  $(x - 1, y)$ ,  $(x, y - 1)$  and  $(x, y + 1)$ , when the corresponding cells exist.

**Path** in the table is defined as a non-empty sequence of **different non-blocked cells**, such that they are consecutively adjacent. Unfortunately, we are afraid of long paths, so the length of every path shouldn't exceed **MAXL**.

A **subsequence** of a path is a sequence that can be derived from the given path by deleting zero or more elements without changing the order of the remaining elements. **The longest increasing subsequence** of a path is the longest sequence  $\{A_1, A_2, \dots, A_M\}$ , such that for every  $1 < i < M$  we have  $A_{i-1} < A_i < A_{i+1}$ . Similarly, **the longest decreasing subsequence** is the sequence  $\{A_1, A_2, \dots, A_M\}$ , such that for every  $1 < i < M$  we have  $A_{i-1} > A_i > A_{i+1}$ . We will denote the lengths of these two sequences for a path **P** as **LIS(P)** and **LDS(P)**.

The **value** of a path **P** is defined as **LIS(P).LDS(P)**.

Write a program **path**, that finds a path **P** such that its value is as large as possible.

## Input:

The first line of the input file **path.in** will contain the integers  $N$  and  $M$ . Each of the next  $N$  lines will contain  $M$  numbers – the values of the cells стойностите от поредния ред на таблицата, започвайки от реда с номер 1. На последния ред на входния файл ще бъде зададено цялото число **MAXL**.

## Output:

On the first line of the output file **path.out** the program should print the length  $K$  of the path found by you. On each of the following  $K$  lines print the coordinates - number of row and number of column - of the corresponding cell in the path.

## Scoring:

If the output does not fulfill the restrictions above, you will receive 0 points for the test. Otherwise, you will receive  $score \times \left(\frac{yours}{best}\right)^2$  points, where  $score$  is the number of points the test is worth,  $yours$  is the value of the path, obtained by you, and  $best$  is the maximum value of a path among all participants for the given test.

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## Constraints:

The values of the non-blocked cells are integers in the interval  $[1; 10^9]$

Portion of tests	Constraints on N, M and MAXL
10%	$N \leq 20, M \leq 20, MAXL \in [1; 100]$
40%	$N \leq 100, M \leq 100, MAXL \in [1; 40000]$
50%	$N \leq 1000, M \leq 1000, MAXL \in [1; 300000]$

**Time limit: 5 sec**

**Memory limit: 256 MB**

## Example test

Input (path.in)	Output (path.out)
3 3	4
1 3 -1	1 1
-1 2 1	1 2
-1 1 1	2 2
4	2 3

## Note:

The found path  $P$  contains the values  $\{1, 3, 2, 1\}$  in this order. This means that  $LIS(P) = 2$ ,  $LDS(P) = 3$  and its cost is equal to 6.