Printed Circuit

PROBLEM

A *printed circuit* is a board that consists of *nodes* and *wire segments* connecting pairs of nodes. We consider a special kind of printed circuits where the nodes are arranged in a rectangular grid, and the wire segments connect (vertically or horizontally) adjacent nodes only. A printed circuit is called *connected* if any two distinct nodes are connected with a series of wire segments. Given is a printed circuit where wire segments already connect several adjacent nodes. We have to add new wire segments in order to make the printed circuit connected. The cost of a new wire segment is 1 if it is vertical and 2 if it is horizontal in the grid.

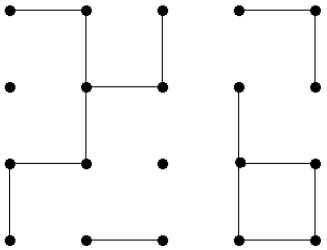

Figure 1

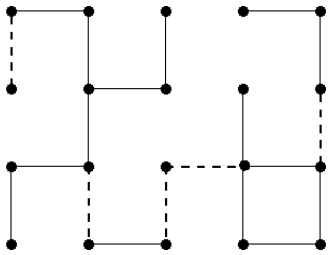

Figure 2

You are to write a program that computes a least cost completion of a given circuit. Your program should solve the following three subtasks:

A. Determine the number of new wire segments of a least cost completion.
B. Compute the value of the least cost.
C. Produce a list of wire segments of a least cost completion.

INPUT

The first line of the file `circuit.in` contains two integers, ***N*** and ***M***. ***N*** ***(1≤N≤100***) is the number of rows and ***M*** ***(1≤M≤100***) is the number of columns in the grid. The nodes of the circuit are identified by their coordinates; the node in the upper left corner is at ***(1,1)***, and the node in the lower right corner is at ***(N, M).*** Each of the next ***N*** lines contains ***M*** integers. The number in row ***i*** and column ***j*** of these lines describes the wire segments between the pair of nodes ***(i, j)*** and ***(i+1, j),*** and also between the pair of nodes ***(i, j)*** and ***(i, j+1)*** in the following way**.**

- 0 means that neither the pair of nodes ***(i, j)*** and ***(i+1, j)*** nor the pair of nodes ***(i, j)*** and ***(i, j+1)*** are connected by wire segments.
- 1 means that only the pair of nodes ***(i, j)*** and ***(i+1, j)*** is connected by a wire segment.
- 2 means that only the pair of nodes ***(i, j)*** and ***(i, j+1)*** is connected by a wire segment.
- 3 means that both the pair of nodes ***(i, j)*** and ***(i+1, j),*** and the pair of nodes ***(i, j)*** and ***(i, j+1)*** are connected by wire segments.

Note that not all 4 values are valid at certain positions (e.g. at position **(*N*, *M*)** only value 0 is valid).

OUTPUT

The first line of the file `circuit.out` should contain two integers, ***K*** and ***V***. The integer ***K*** is the number of new wire segments of a least cost completion; and the

integer ***V*** is the value of the least cost. The rest of the file must contain ***K*** lines; the list of wire segments of a least cost completion (in arbitrary order). Each line must contain three numbers describing exactly one new wire segment: ***i, j*** and ***d,*** where ***(i, j)*** are the coordinates of a node, and ***d*** is either 1 or 2. 1 means that the new wire segment connects the nodes ***(i, j)*** and ***(i+1, j)***, and 2 means that the new wire segment connects the nodes ***(i, j)*** and ***(i, j+1)***

EXAMPLE INPUT AND OUTPUT

The example input file corresponds to the circuit in Figure 1. The example output file is a possible least cost completion, and is depicted in Figure 2.

circuit.in	circuit.out
4 5 2 1 1 2 1 0 3 0 1 0 3 0 0 3 1 0 2 0 2 0	5 6 1 1 1 3 2 1 3 3 1 3 3 2 2 5 1

GRADING

If your answer is correct for subtask A then you obtain 1 point. You obtain 2 additional points if the answer is correct also for subtask B. If your answer is correct for all the three subtasks then you obtain 5 points. Note that it is not necessary in order to score points for subtask A (B) that the output file contains any output for subtask C.