6699 Surrounding a house

Peter wants to build a fence around his house. His house is located on a farm. The farm is divided vertically and horizontally into grids and the cost for building fences varies from grid to grid. The fence can only go vertically or horizontally. Perter hopes the total cost is minimized and does not care how large the area surrounded by the fence is. In addition, it is required that the area outside the fence, if any, cannot be cut into pieces, i.e., the outside area must be connected. Your task is to write a program for computing the minimum total cost of building a fence.

The grids of the farm are described as an $m \times n$ matrix M, and $M[i, j]$ is the cost of grid (i, j), in which $0 \leq i < m$ and $0 \leq j < n$. The house is always assumed located at $M[1, 1]$ for all the test cases, and $m, n \geq 3$. For example, in Figure 3, (a) and (b) show the same farm, which is a 6×7 matrix. The number in each grid is the cost, and the house is marked as the dark grid. The fence in (a), shown by the gray grids, is invalid since there are two disconnected areas outside the fence. Note that a grid is blocked once the fence goes through it. The fence in (b) is the optimal solution with cost 78. More invalid examples are given in Figure 4.

1	1	1	1	50	50	50
3	50	50	2	50	50	50
3	50	50	2	1	2	3
3	50	50	50	50	50	1
3	50	1	1	1	2	2
3	1	2	50	50	50	50

(a). An invalid solution

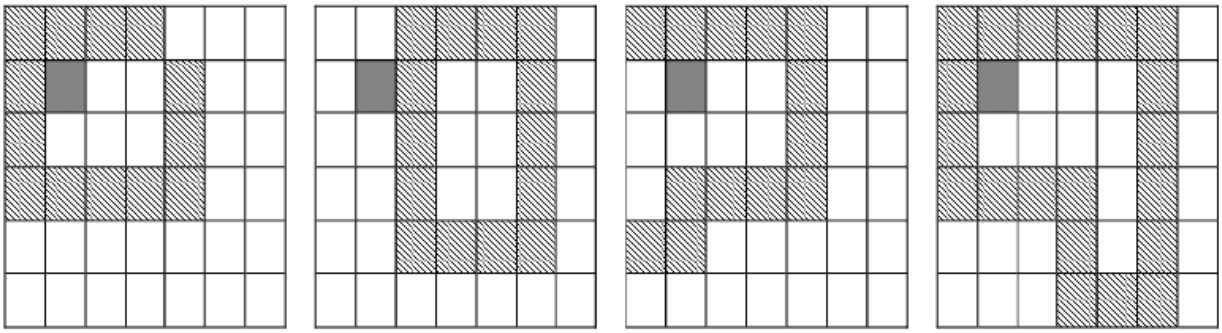
1	1	1	1	50	50	50
3	50	50	2	50	50	50
3	50	50	2	1	2	3
3	50	50	50	50	50	1
3	50	1	1	1	2	2
3	1	2	50	50	50	50

(b). An optimal solution

Figure 3: Valid and invalid examples.

Technical Specification

- The number of grids is bounded by 40000, i.e., $mn \leq 40000$.
- The cost $M[i, j]$ for each grid is a nonnegative integer at most 100000.
- The total cost of all grids is at most 2^{31}.
- $m \geq 3$ and $n \geq 3$.



(a). can only go vertically or horizontally.

(b). house not being surrounded.

(c). house not being surrounded.

(d). outside area broken

Figure 4: More invalid examples.

Input

There are at most 12 test cases. For each test case, the first line contains two integers m and n which are the numbers of rows and columns, respectively. The next m lines contains the costs of the grids in the following order:

$$\begin{array}{cccccc} M[0,0] & M[0,1] & M[0,2] & \dots & M[0,n-1] \\ M[1,0] & M[1,1] & M[1,2] & \dots & M[1,n-1] \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ M[m-1,0] & M[m-1,1] & M[m-1,2] & \dots & M[m-1,n-1] \end{array}$$

The input ends with a case that $m = 0$ and $n = 0$.

Output

For each test case, output the minimum cost in one line.

Sample Input

```
6 7
1 1 1 1 50 50 50
3 50 50 2 50 50 50
3 50 50 2 1 2 3
3 50 50 50 50 50 1
3 50 1 1 1 2 2
3 1 2 50 50 50 50
0 0
```

Sample Output

```
78
```