3620 - Manhattan Wiring

Asia - Yokohama - 2006/2007

There is a rectangular area containing $n \times m$ cells. Two cells are marked with ``2", and another two with ``3". Some cells are occupied by obstacles. You should connect the two ``2"s and also the two ``3"s with non-intersecting lines. Lines can run only vertically or horizontally connecting centers of cells without obstacles.

Lines cannot run on a cell with an obstacle. Only one line can run on a cell at most once. Hence, a line cannot intersect with the other line, nor with itself. Under these constraints, the total length of the two lines should be minimized. The length of a line is defined as the number of cell borders it passes. In particular, a line connecting cells sharing their border has length 1.

Fig. 6(a) shows an example setting. Fig. 6(b) shows two lines satisfying the constraints above with minimum total length 18.

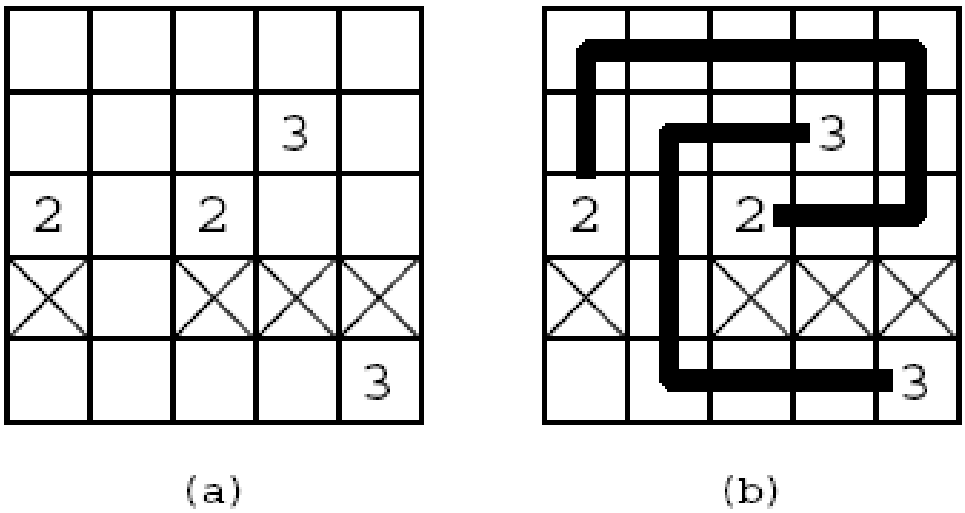

Figure 6: An example setting and its solution

Input

The input consists of multiple datasets, each in the following format.

n m
row_1
$\vdots$
row_n

n is the number of rows which satisfies $2 \leq n \leq 9$. m is the number of columns which satisfies $2 \leq m \leq 9$.

Each row_i is a sequence of m digits separated by a space. The digits mean the following.

`0`:
: Empty

`1`:
: Occupied by an obstacle

`2`:
: Marked with ``2''

`3`:
: Marked with ``3''

The end of the input is indicated with a line containing two zeros separated by a space.

Output

For each dataset, one line containing the minimum total length of the two lines should be output. If there is no pair of lines satisfying the requirement, answer ``0'' instead. No other characters should be contained in the output.

Sample Input

```
5 5
0 0 0 0 0
0 0 0 3 0
2 0 2 0 0
1 0 1 1 1
0 0 0 0 3
2 3
2 2 0
0 3 3
6 5
2 0 0 0 0
0 3 0 0 0
0 0 0 0 0
1 1 1 0 0
0 0 0 0 0
0 0 2 3 0
5 9
0 0 0 0 0 0 0 0 0
0 0 0 0 3 0 0 0 0
0 2 0 0 0 0 0 2 0
0 0 0 0 3 0 0 0 0
0 0 0 0 0 0 0 0 0
9 9
3 0 0 0 0 0 0 0 2
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2 0 0 0 0 0 0 0 3
9 9
0 0 0 1 0 0 0 0 0
0 2 0 1 0 0 0 0 3
0 0 0 1 0 0 0 0 2
0 0 0 1 0 0 0 0 3
0 0 0 1 1 1 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
```

```
0 0 0 0 0 0 0 0 0
9 9
0 0 0 0 0 0 0 0 0
0 3 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 2 3 2
0 0
```

Sample Output

```
18
2
17
12
0
52
43
```

Yokohama 2006-2007