IOI '10 P3 - Quality of Living

Time limit: 4.5s **Memory limit:** 256M

Cities in Alberta tend to be laid out as rectangular grids of blocks. Blocks are labeled with coordinates 0 to $R-1$ from north to south and 0 to $C-1$ from west to east.

The quality of living in each particular block has been ranked by a distinct number, called quality rank, between 1 and $R \cdot C$, where 1 is the best and $R \cdot C$ is the worst.

The city planning department wishes to identify a rectangular set of blocks with dimensions H from north to south and W from west to east, such that the median quality rank among all blocks in the rectangle is the best. H and W are *odd* numbers not exceeding R and C respectively. The *median quality rank* among an odd number of quality ranks is defined to be the quality rank m in the set such that the number of quality ranks better than m equals the number of quality ranks worse than m.

You are to implement a procedure **rectangle(R,C,H,W,Q)** where R and C represent the total size of the city, H and W represent the dimensions of the set of blocks, and Q is an array such that $Q[a][b]$ is the quality rank for the block labeled a from north to south and b from west to east.

Your implementation of **rectangle** must return a number: the best (numerically smallest) possible median quality rank of an H by W rectangle of blocks.

Each test run will only call **rectangle** once.

Example 1

```
R=5, C=5, H=3, W=3,
Q=  5 11 12 16 25
   17 18  2  7 10
    4 23 20  3  1
   24 21 19 14  9
    6 22  8 13 15
```

For this example, the best (numerically smallest) median quality rank of 9 is achieved by the middle-right rectangle of Q shown in bold. That is,

```
rectangle(R,C,H,W,Q)=9
```

Example 2

```
R=2, C=6, H=1, W=5,
Q=  6  1  2 11  7  5
    9  3  4 10 12  8
```

For this example the correct answer is 5.

Subtask 1 [20 points]

Assume R and C do not exceed 30.

Subtask 2 [20 points]

Assume R and C do not exceed 100.

Subtask 3 [20 points]

Assume R and C do not exceed 300.

Subtask 4 [20 points]

Assume R and C do not exceed $1\,000$.

Subtask 5 [20 points]

Assume R and C do not exceed $3\,000$.

Implementation Details

- Implementation folder: `/home/ioi2010-contestant/quality/` (prototype: quality.zip)
- To be implemented by contestant: `quality.c` or `quality.cpp` or `quality.pas`
- Contestant interface: `quality.h` or `quality.pas`
- Grader interface: *none*
- Sample grader: `grader.c` or `grader.cpp` or `grader.pas`
- Sample grader input: `grader.in.1` `grader.in.2` etc.
  Note: The first line of input contains: R, C, H, W The following lines contain the elements of Q, in row-major order.
- Expected output for sample grader input: `grader.expect.1` `grader.expect.2` etc.