Day 1 Task 3: Quality of Living

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*C, where 1 is the best and R*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 1000.

Subtask 5 [20 points]
Assume R and C do not exceed 3000.

Implementation Details

- Implementation folder: /home/ioi2010-contestant/quality/
- 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.
- Compile and run (command line): runc grader.c or runc grader.cpp or runc grader.pas
- Compile and run (gedit plugin): Control-R, while editing any implementation file.
- Submit (command line): submit grader.c or submit grader.cpp or submit grader.pas
- Submit (gedit plugin): Control-J, while editing any implementation or grader file.