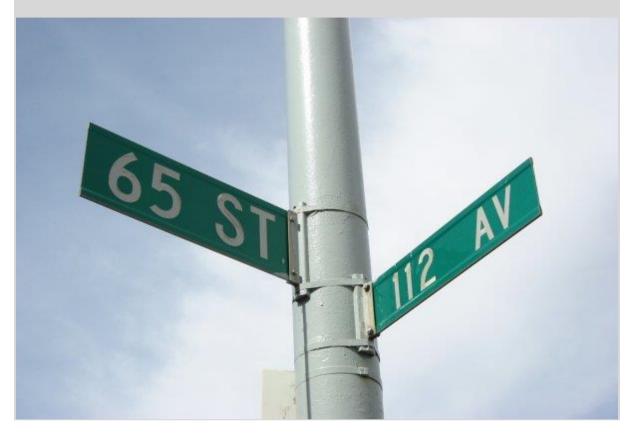
IOI 2010 Tasks

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 \mathbf{H} from north to south and \mathbf{W} from west to east, such that the median quality rank among all blocks in the rectangle is the best. \mathbf{H} and \mathbf{W} are *odd* numbers not exceeding \mathbf{R} and \mathbf{C} respectively. The *median quality rank* among an odd number of quality ranks is defined to be the quality rank \mathbf{m} in the set such that the number of quality ranks better than \mathbf{m} equals the number of quality ranks worse than \mathbf{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

- Use the RunC programming and test environment
- Implementation folder: /home/ioi2010contestant/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.
- Compile and run (command line): runc grader.corrunc grader.cpp or runc grader.pas
- Compile and run (gedit plugin): Control-R, while editing any implementation file.
- Submit (command line): submit grader.cor submit grader.cpp or submit grader.pas
- Submit (gedit plugin): Control-J, while editing any implementation or grader file.