Challenge IV

Objective

In this challenge, the participant must get the particle from the start point to the end point in the fewest number of moves without ever passing a live cell = green. With each move the board changes, the participant must calculate the next state of the board and avoid all living cells. However, a piece of the board has been lost, and the value of these cells is unknown. The player must first determine the value of the cells, and then find the path.

Board

The board for this challenge is a rectangle formed by R * C cells. The cells are arranged in a grid of R rows (horizontal) and C columns (vertical). The rows are numbered 0 to (R - 1) from top to bottom and the columns 0 to (C - 1) from left to right. Each cell is given an ID based on its row and its column ai,j. The first cell is identified by a0,0 and is located in the upper left corner of the board. The first index corresponds to the rows and the second to the columns.

In this board each cell has a state = color, defined based on its value:

1 = alive (green)
0 = dead (white)
x = undetermined (participant needs to find the value)

However, the initial (starting point) and final (destination point) cells are exceptions to this rule. They never assume a value of 0 or 1, can be represented by the color yellow, and are immutable. As long as the particle is in a cell orthogonally adjacent to one of these points it can always access it.

Indeterminate Cells

Inside the board there is a square of 10 * 10 cells with some indeterminate cells. The first cell of this square is a2300,2300 and the last one is a2309,2309. The participant must extract this piece of the board and solve the puzzle to find the value of the indeterminate cells, which can be 0 or 1.

Important: the puzzle must be solved isolated from the main board and then added to it. The puzzle rules refer to the square completely isolated from the rest of the board and should not consider the cells that do not belong to it.

To solve the puzzle the participant must apply the following rules:

in the square there cannot be a 2x2 area with a single state. For example, the following configurations are invalid:
0 0
0 0

or

1 1
1 1

In addition, all cells in the square with the same state must be orthogonally connected to form a single area. This rule applies to live (green) cells = 1 and dead (white) cells = 0. A valid and an invalid arrangement will be shown below:

valid arrangement

0 0 0 0 0
0 1 0 1 0
0 1 0 1 0
0 1 0 1 0
1 1 1 1 1

invalid provision

0 0 0 1 1
0 1 0 0 1
0 1 0 1 0
1 1 0 1 0
1 1 1 1 1

Note that this last arrangement violates the rules 3 times. The cells a3.0; a3.1; a4.0 and a4.1 form a 2x2 entirely living area = 1. The cells a0.3; a0.4 and a1.4 are isolated from the other living cells, a diagonal connection is not valid. And finally, cells a2,4 and a3,4 are isolated from the other dead cells = 0, again a diagonal connection is not valid. If this provided board fragment were the area to be inserted into the main board, for solving the puzzle the value of the cells not belonging to this area is not computed, i.e. the value of the cells outside the given area does not matter at all.

Particle Motion

The particle begins its trajectory in the initial cell, and makes only one move per turn, always in the orthogonal direction (Right, Left, Down, Up). It cannot leave the board's limits and cannot finish its movement on a live cell.

The particle begins its move in the current state of the board, and ends its move in the next state. The particle can start movement toward a live cell, but cannot end its movement on a live cell.

Right - an increment in j in the particle's position. If the particle is in cell a3,4 and makes a rightward move it ends its move in cell a3,5

Left - an increment by j in the particle's position. If the particle is in cell a3,4 and moves left it finishes its move in cell a3,3

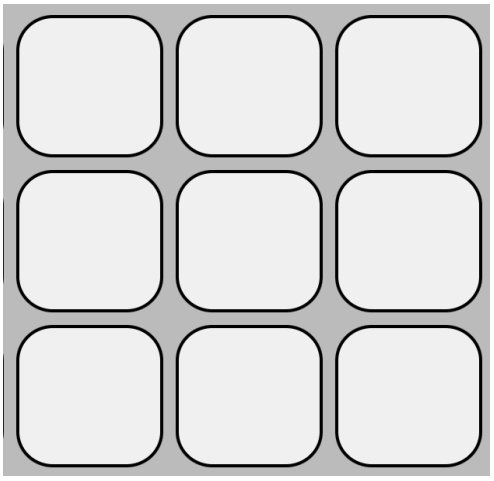
Down - an increment by i in the particle's position. If the particle is in cell a3,4 and moves right it finishes its move in cell a4,4
Up - an i-decrement in the particle's position. If the particle is in cell a3,4 and makes a move up it finishes its move in cell a2,4

Rule of propagation

White cells become green if they have a number of adjacent green cells greater than 1 and less than 5. Otherwise they remain white.

Green cells remain green if they have a number of green adjacent cells greater than 3 and less than 6. Otherwise, they become white.

Two cells are considered adjacent if they have a border, either on the side, above, below or diagonally. In the example below, the white cell in the center therefore has 8 adjacent white cells.



Input

For this challenge, the participant will receive the initial layout of the board in a text file. 3 represents the starting point and 4 represents the destination point. Immutable cells which never take on the value of 0 or 1.
0 represents dead cells = white, 1 represents live cells = green and x represents indeterminate cells. Each line in the file represents a row of the board and the values in that row represent the cells. The values are separated by a space and an '\n' character represents the end of the line.

Output

The participant must formulate a text file with their response to the challenge. The file should be named as output4.txt and should contain only one line with all the movements of the particle separated by a space.

R - to the right
L - to the left
U - up
D - down

response example

R R R D D D D R D U D R R

Output limitation. 50,000 moves

Score

The maximum score for this challenge is 2500 points. The maximum score will be awarded to whoever finds the shortest path to the destination, the path with the fewest moves. The score of the other participants will be in reference to the score of the shortest path following the rule

a - shortest path found
b - path found by the participant
n - score

$n = 1000 * a / b$

In case a participant doesn't reach the final point, he can still have a score, as long as he hasn't broken the rule of passing by a live cell. In the case of failing to reach the destination the participant's grade will be in reference to the grade of the candidate who reached the destination with the greatest number of steps:

d1 - orthogonal distance between the destination point and the final position of the particle following the path provided by the participant
d2 - orthogonal distance from the starting point to the destination point
nr - reference score of the candidate who reached the destination with the worst performance
n - score
$n = nr * (1 - d1 / d2)$

If no participant reaches the destination, the candidate who gets closest to the destination will receive 2500 points. In this case, the number of moves is irrelevant.

In such cases, the score will be 0:

- File with incorrect name or incorrect formatting

- Not respecting the limits of the board
- Passing a live cell