Challenge V

Objective

In this challenge, the participant must take as many particles as possible from the start point to the end point 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.

The particles all move at the same time and cannot occupy the same cell. The challenge starts with a particle in the starting square and the participant will choose when the next particles will be added. The particles can only enter the board as long as no particle reaches the destination. Thus, the participant must balance as many particles as possible on the board without allowing any to pass through a live cell, nor allow two particles to occupy the same cell at the same instant of time. Finally, the participant must get all the particles, without exception, to the destination. Not necessarily following the order in which they entered the board. The destination is the only cell that can be occupied by multiple particles.

A particle can return to the starting square, but in the next turn a particle cannot enter the board, because the square is already occupied.

Pay attention to the turn order:

Particle enters the board -> particles start their move -> board updates -> particles finish their move -> turn ends.

It is not mandatory that a particle enters the board every turn, but whenever it does, it will be the first event of that turn.

After a particle finishes its movement at the destination, no other particle can enter the board. Two particles are allowed to move towards the destination, as long as they come from different cells.

Board

The board of 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 $a_{i,j}$. The first cell is identified by $a_{0,0}$ 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)

However, the initial (starting point) and final (target 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.

Particle Movement

The particle begins its trajectory on the initial cell, makes only one move per turn, always orthogonal (Right, Left, Down, Up). It cannot leave the board's limits, it cannot end its movement on a live cell, nor on a cell occupied by another particle. It also cannot remain stationary.

The particle begins its movement in the current state of the board and ends its movement in the next state. The particle can start the motion toward a living cell, but it cannot end the motion in a living cell. Similarly, the particle can move toward a cell occupied by another particle, but two particles cannot finish motion in the same cell.

Right - an increment in j at the particle's position. If the particle is in cell a3,4 and makes a rightward move it finishes 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 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.
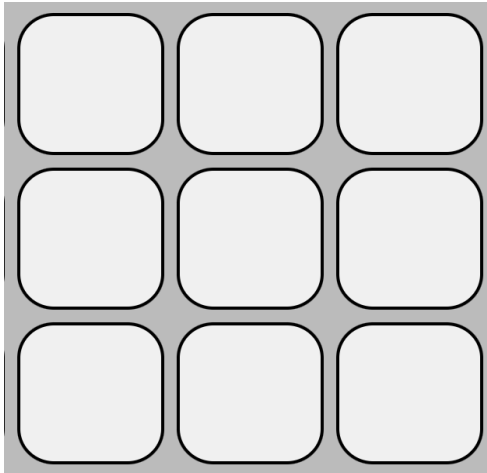
New particle input

Particles always start at the starting point. The candidate chooses the turn that each particle will enter the board. Obviously, no two particles can enter the board in the same turn, or they would be occupying the same square.

The starting particle will be on the board at turn 0, the next particles enter at the moment the participant prefers, always at the starting point. The particles cannot remain stationary, they all move at the same time, but they can move in different directions, the details will be explained in the output section.

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 that never take on the value of 0 or 1. 0 will represent dead cells = white and 1 will represent live cells = green. 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 output5.txt and should contain one line for each particle, starting with an integer representing the turn that particle entered the board and followed by all the moves of the particle separated by a space, at the end of the line there should be an end of line '\n' character.

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

In the file, the particles must be sorted in ascending order referring to the shift they entered the board. The first line will always start with 0.

example of answer:

```
0 R R R D D U D D
2 D D D R R R
3 R D R D R D
7 R R R D D D
```

In the example given, at instant 0 the first particle is at the origin, then it moves once to the right and again to the right, at that moment the second particle appears on the board. The first particle moves once to the right, the second particle moves once down, and then the third particle appears on the board. The particles follow their movements. In turn 7, first the fourth particle appears, then particle 1 and particle 2 move to the destination, one going down and one going right, particle 3 and particle 7 move to the right, and so turn 7 ends. From this turn on, no more particles can enter the board. The moves are simultaneous and counted from the moment a particle enters the board

The first move of a particle always occurs on the same turn it enters the board.

After one of the particles finishes its move at the destination, it no longer moves, no other particle can enter the board.

Output limitation. 50,000 moves for each particle.

Score

The maximum score for this challenge is 3500 points. The person who balances the most particles on the board and gets them all to the destination will receive 3500 points. The score of the other participants will be in reference to the highest number of particles following the rule:

a - highest number of particles taken to the destination
b - number of particles brought to the destination by the participant
n - score

$n = 3500 * b / a$

If the participant does not find a valid path to the destination, his score will be 0.

If no participant reaches the destination, all will receive a score of 0.

Cases in which the score will be 0:

- File with incorrect name or incorrect formatting
- Not respecting the board limits

- Passing through a live cell
- Two particles occupy the same cell at the same instant of time
- One particle enters the board after another has finished its move at the destination.