



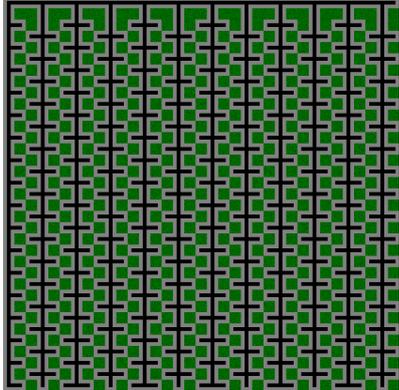
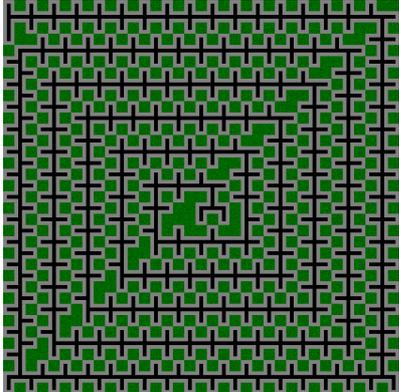
# Nowruz

## Abstract

- Input: an  $m \times n$  grid. Some random cells are blocked.
- Output: A tree such that its nodes are a subset of free cells of the grid. The tree should have many leaves (a solution is graded based on the number of leaves of the tree).

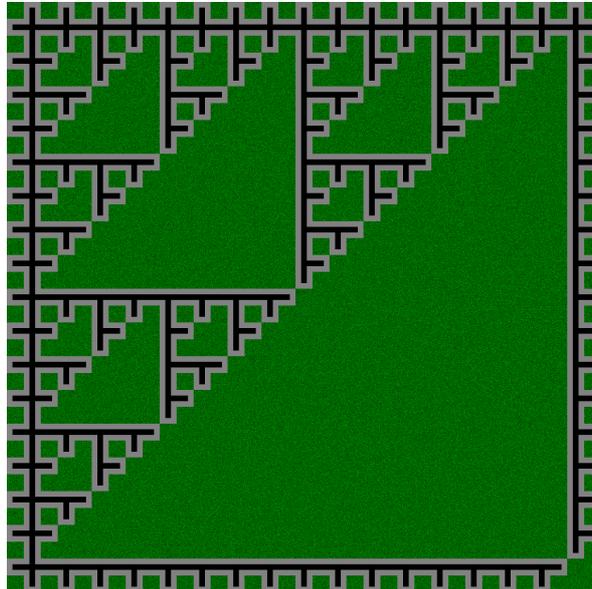
## Solutions for an empty grid

An easy approach is to build some patterns that have many leaves. Some examples for an empty  $35 \times 35$  grid are given below:

Maze	Description
	A hair comb with 386 leaves.
	A snail with 386 leaves.

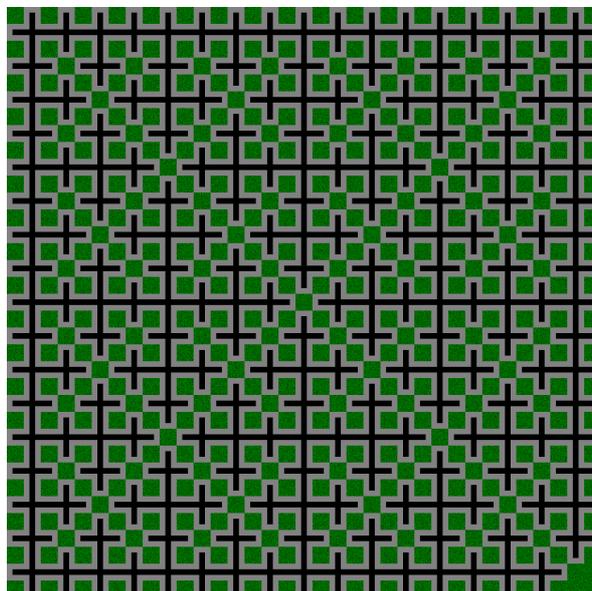
Unexpectedly, the following code generates a nice [Sierpinski fractal](#) with 148 leaves:

```
mark[1][1] = true
scan the whole grid, starting from (1,1):
    mark each cell that has exactly 1 marked neighbor
return mark
```



However, the optimal solution we have so far for this grid can be obtained by a simple change in the above code. It is a nice fractal with 408 leaves:

```
mark[1][1] = true
loop
    scan the whole grid:
        mark each cell that has exactly 1 marked neighbor
until mark values are not changed
return mark
```

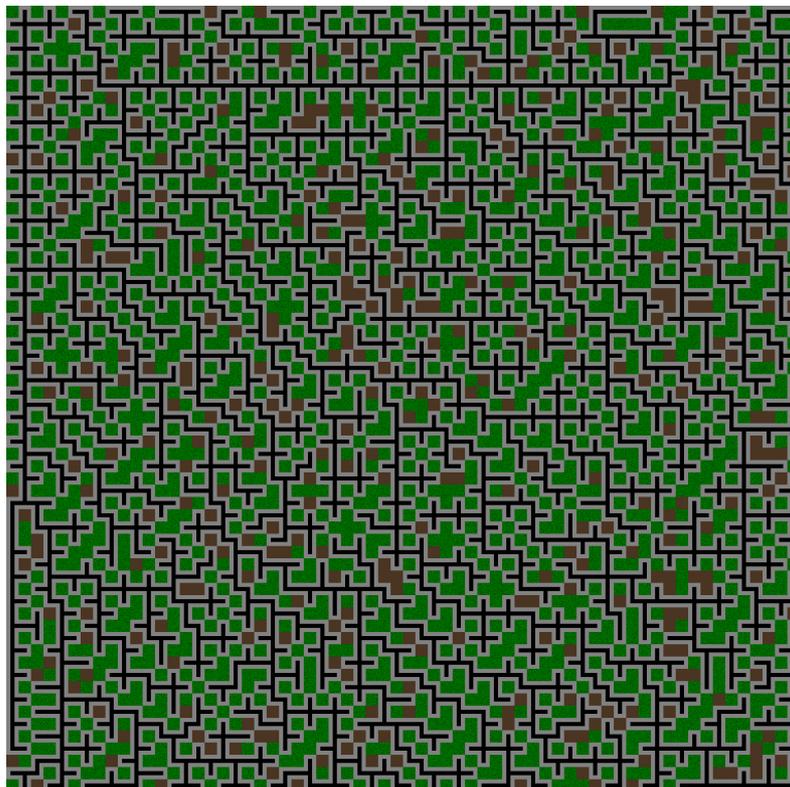


## Solutions for a grid with random blocks

The solution above can be adapted to work for grids with random blocks:

```
do the following search several times:
  unmark all cells
  select a random free cell and set its mark true
  loop:
    scan all cells in random order:
      mark each free cell that has exactly 1 marked neighbor
  until nothing changes
return the best answer
```

This solution can score 86 points with the actual test data of the contest.



Another idea is to pick a random free cell to initiate the tree and keep expanding it as long as possible. Expanding operation is as follows: pick a free cell that is adjacent to exactly one of the tree cells so far, add this cell and all of its adjacent cells that can be added and become leaves to the tree. If there are multiple such free cells, expand the tree with the one that adds the highest number of leaves. Note that in each operation, 1 to 5 cells will be added to the tree. This solution gets 99+ points.