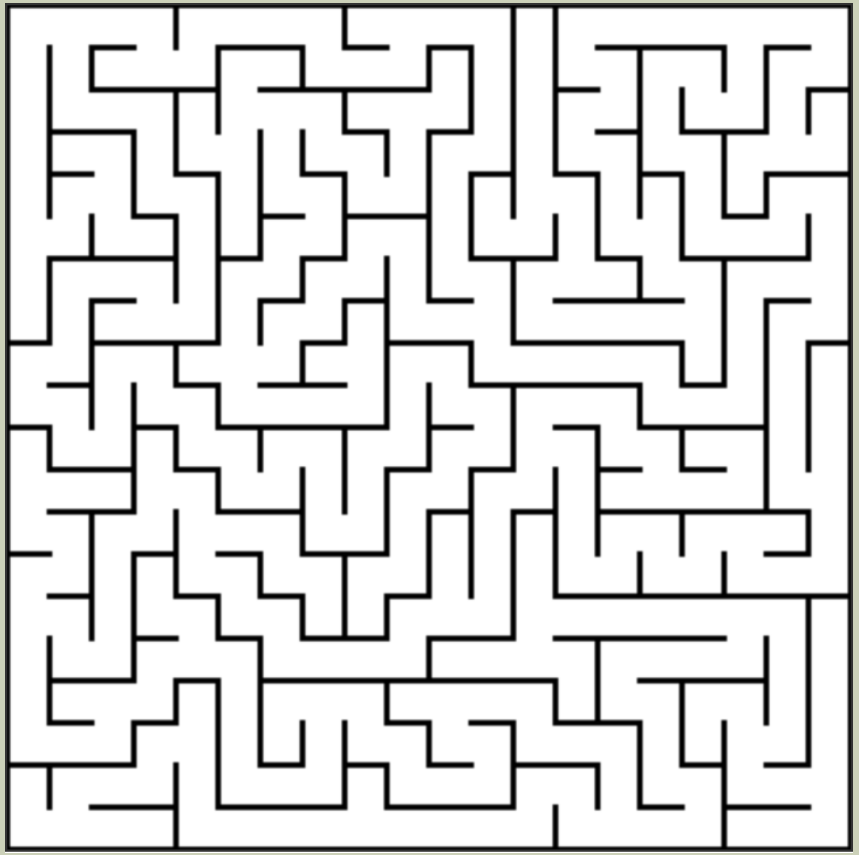
MAZE GENERATION

By Robert Kaufman

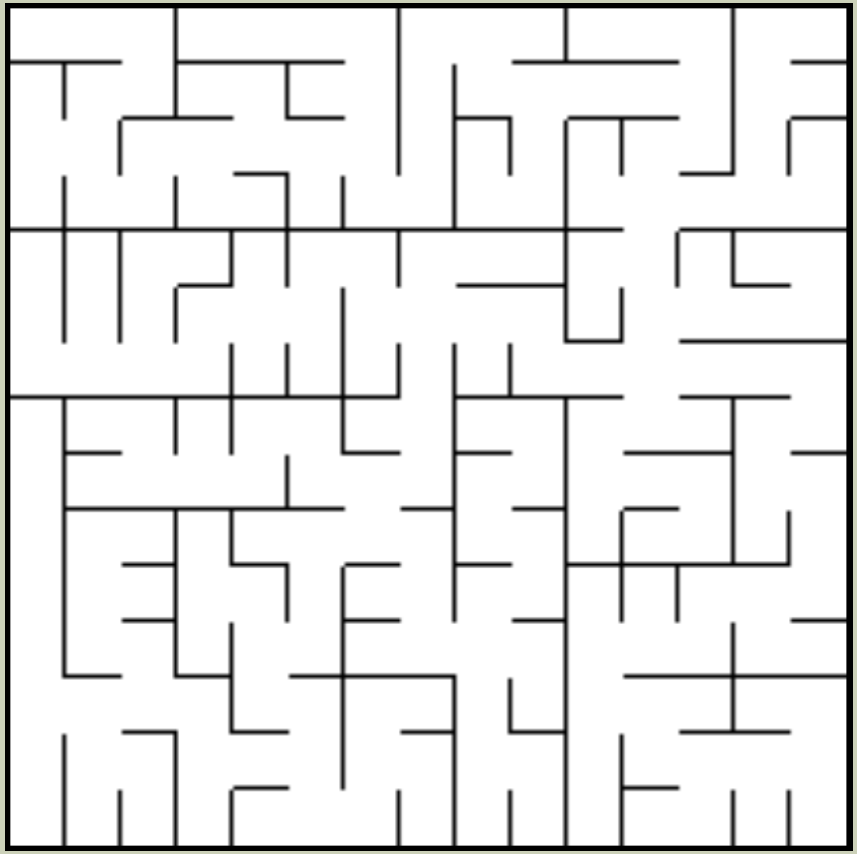
BACKGROUND

- A maze is a simple puzzle in which a set of walls divide an area
- The goal is to get from one point to another



RECURSIVE DIVISION

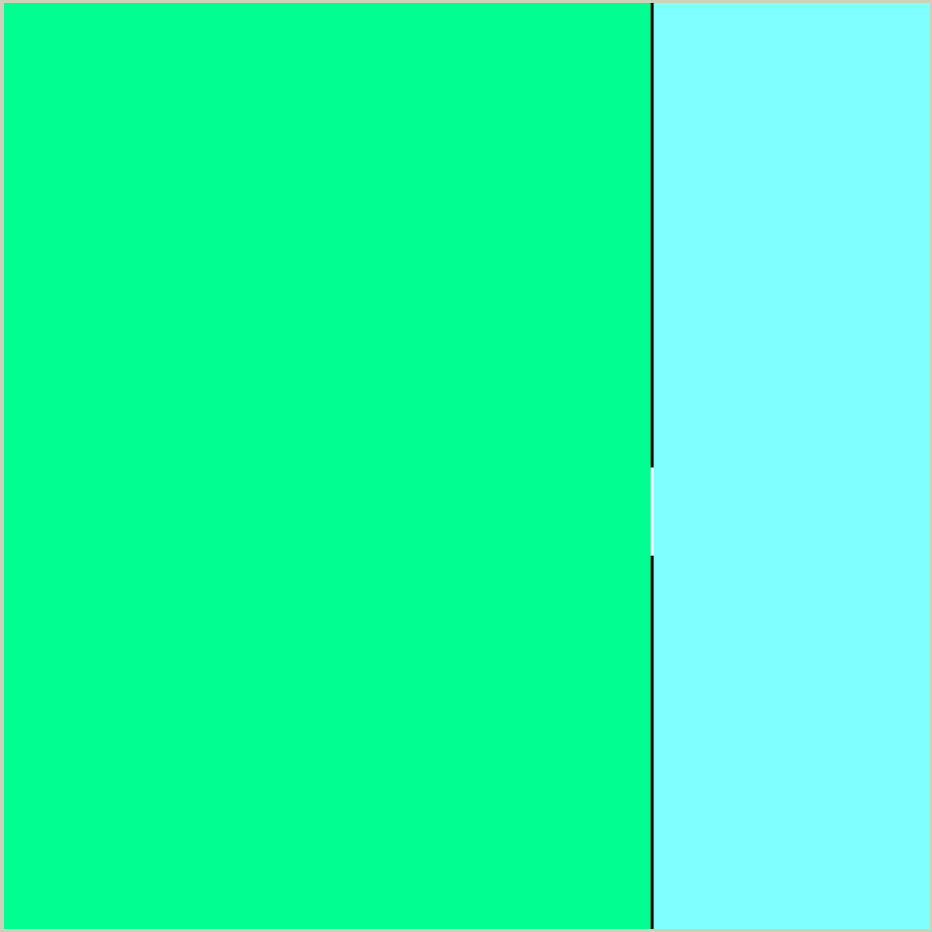
- Pattern:
  - Lots of intersections between paths
  - Long straight lines of walls
- Algorithm:
  - Randomly places a wall dividing the maze in two and picks a random opening
  - Then does that same division with the two new sections



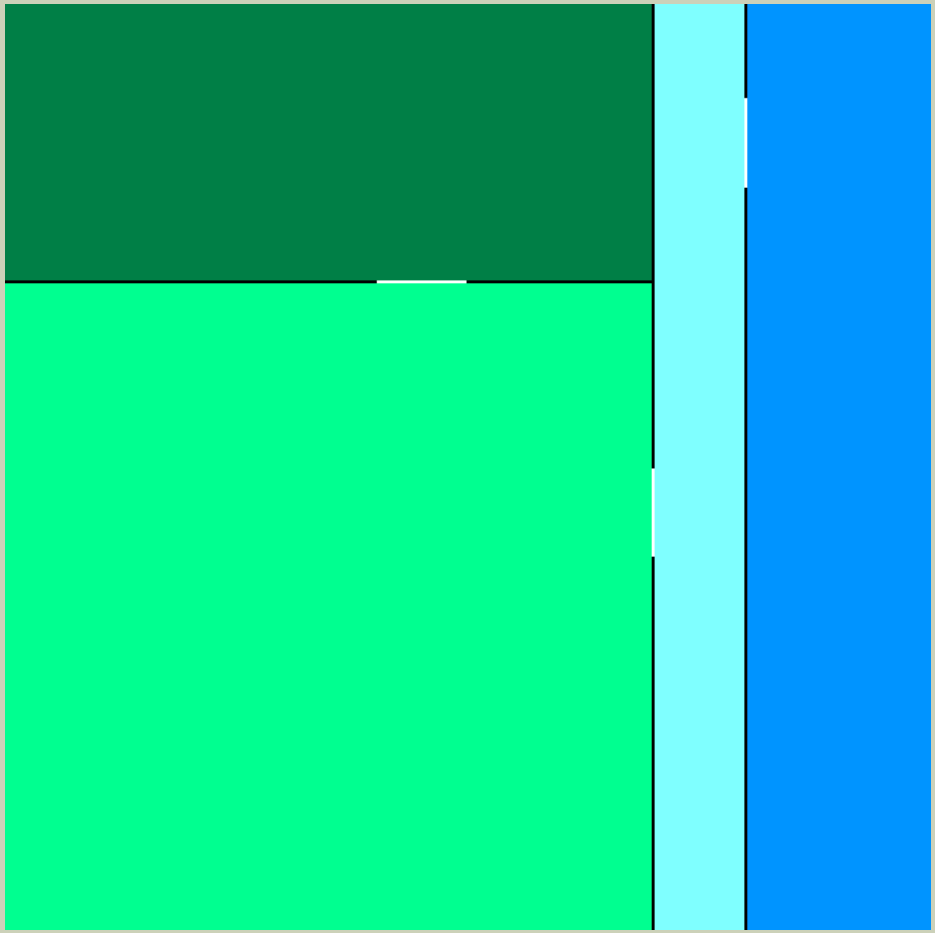
RECURSIVE DIVISION EXAMPLE

RECURSIVE DIVISION EXAMPLE

RECURSIVE DIVISION EXAMPLE

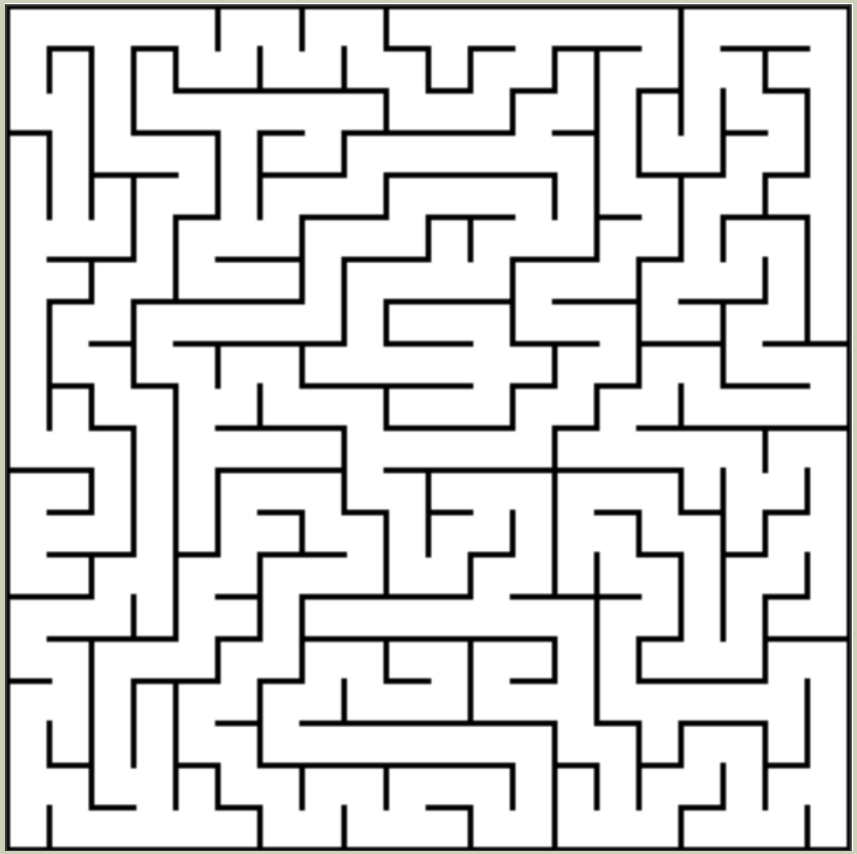


RECURSIVE DIVISION EXAMPLE

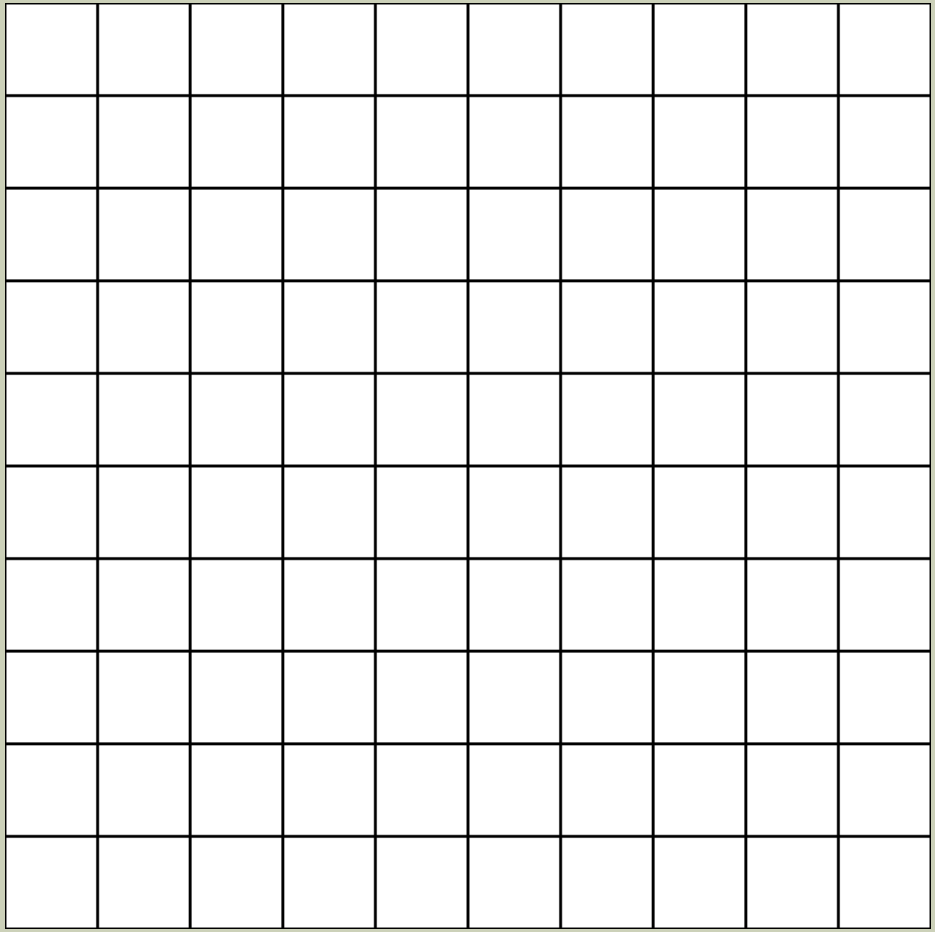


RECURSIVE BACK-TRACKER

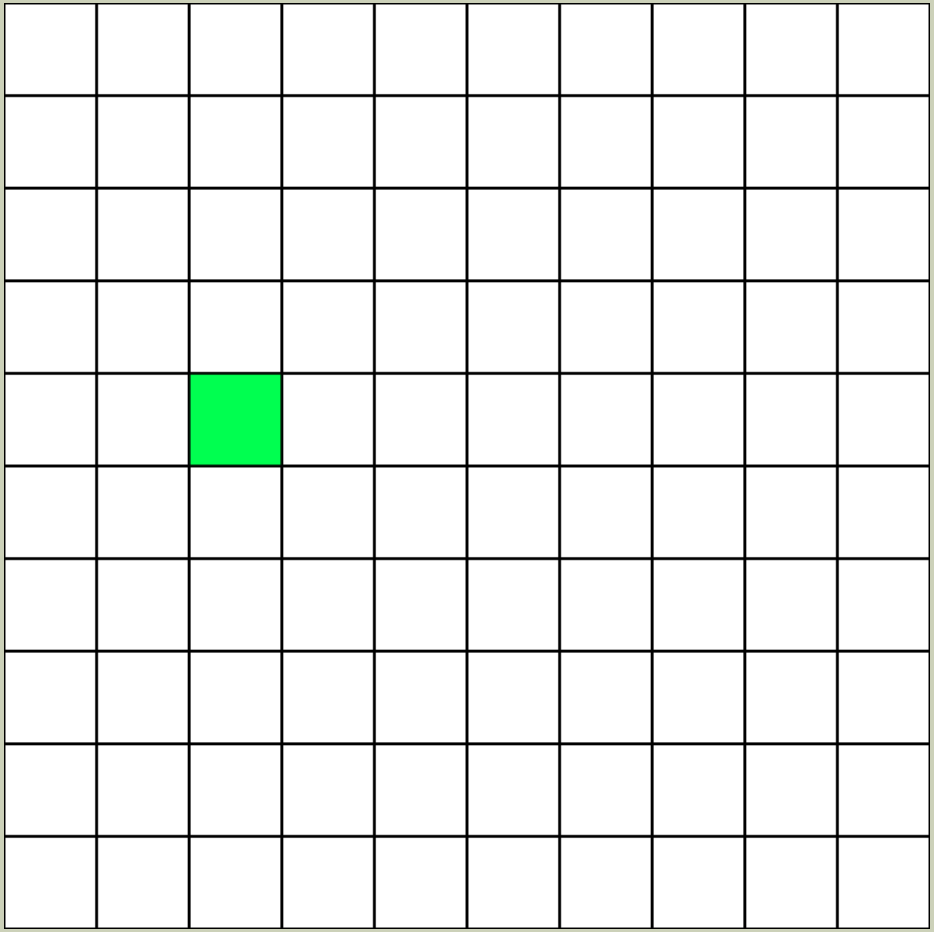
- Pattern:
  - Pleasing, random appearance
  - Relatively long sections before a branch
- Algorithm:
  - Works by randomly selecting a path until there are no more valid moves (there are no unvisited adjacent cells).
  - Next moves back until another move is possible.
  - Continues until the whole maze has been visited.



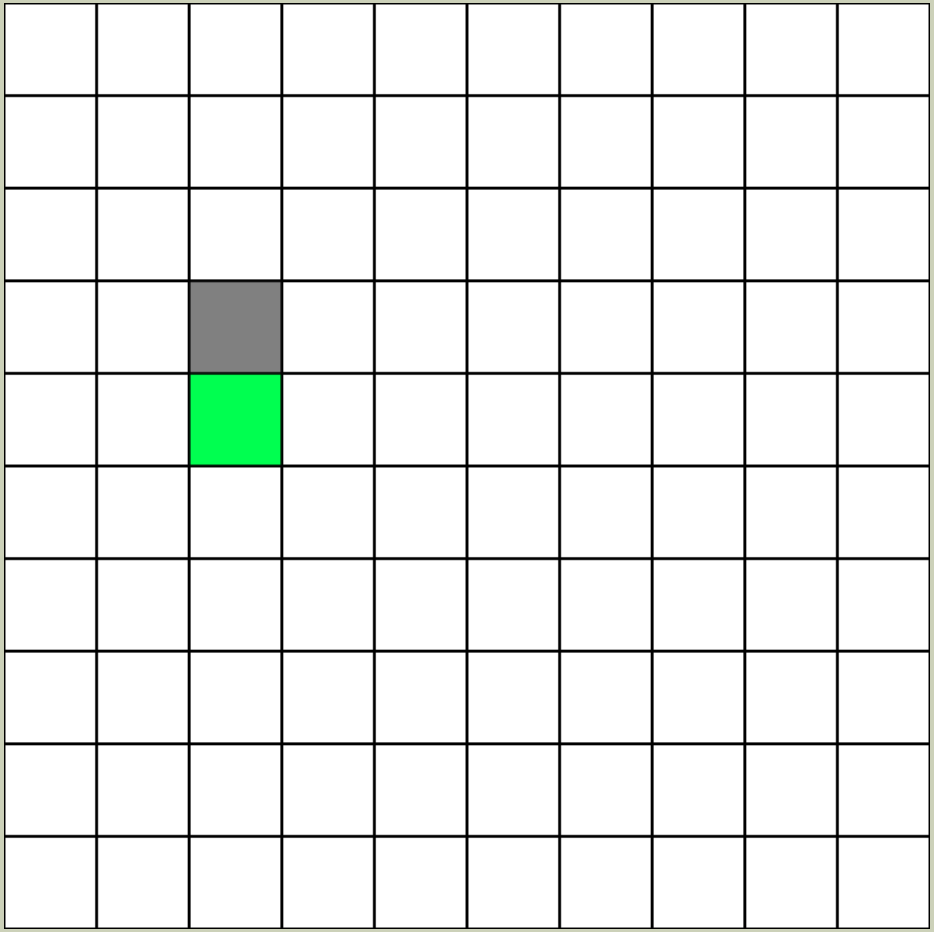
RECURSIVE BACK-TRACKER EXAMPLE



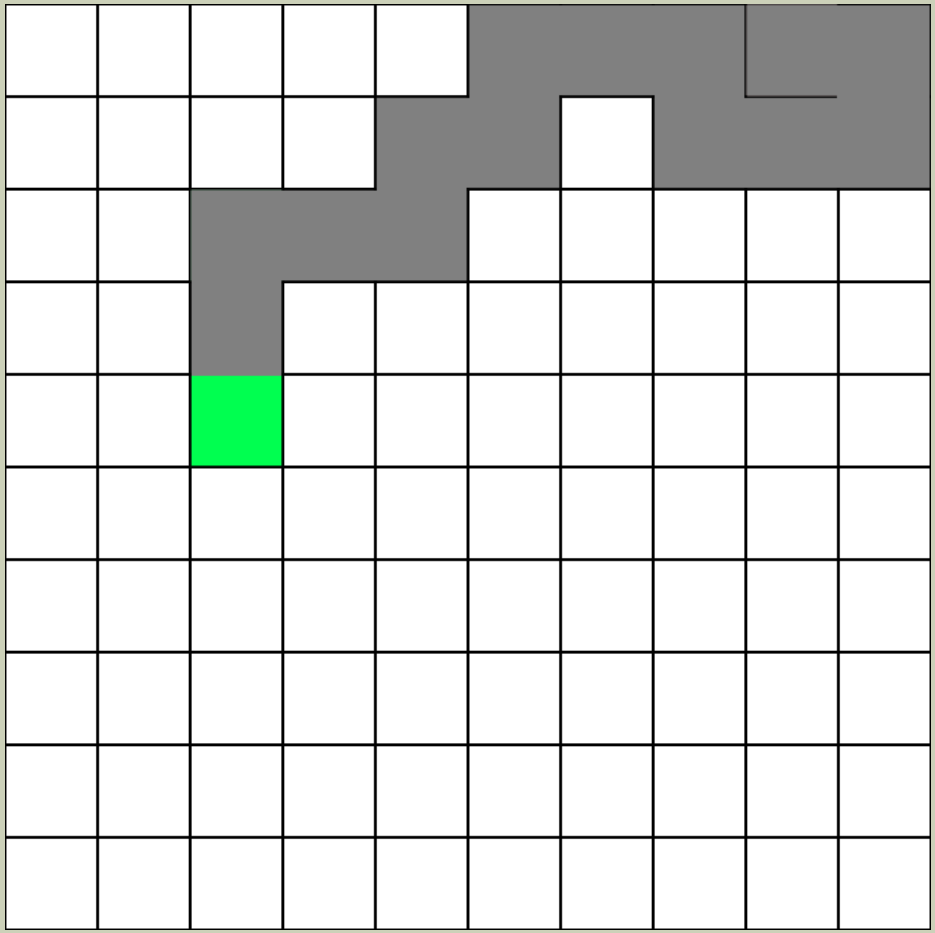
RECURSIVE BACK-TRACKER EXAMPLE



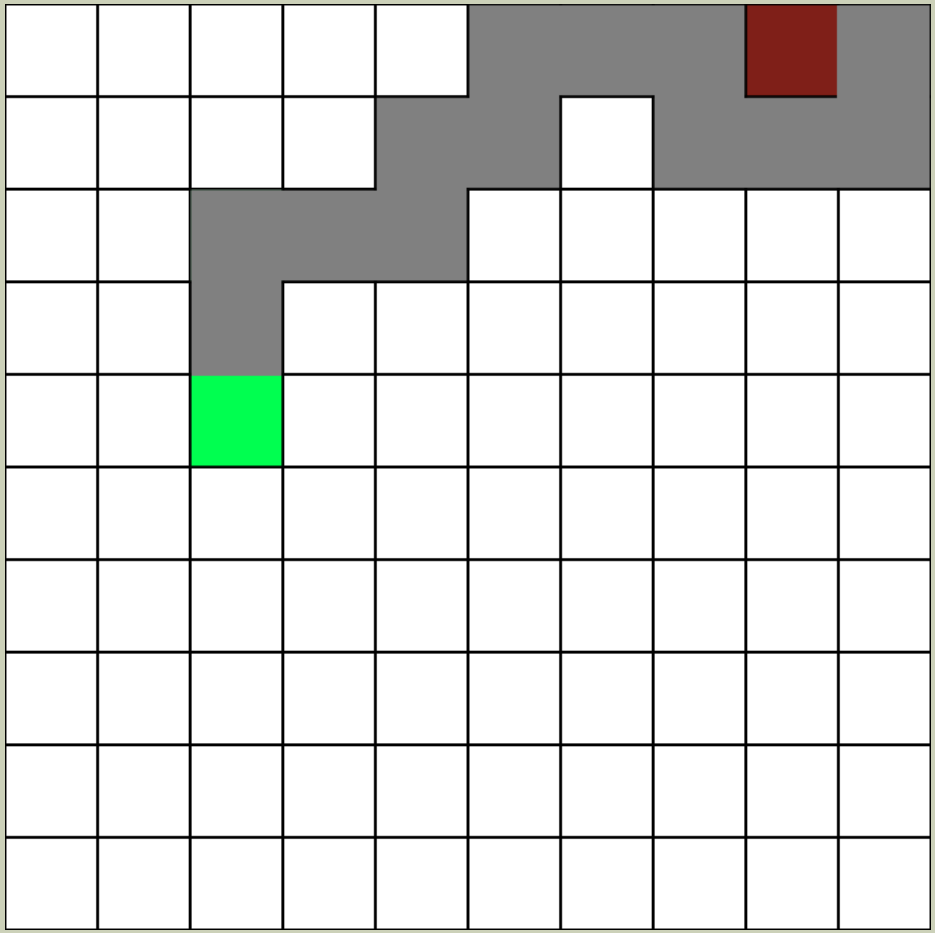
RECURSIVE BACK-TRACKER EXAMPLE



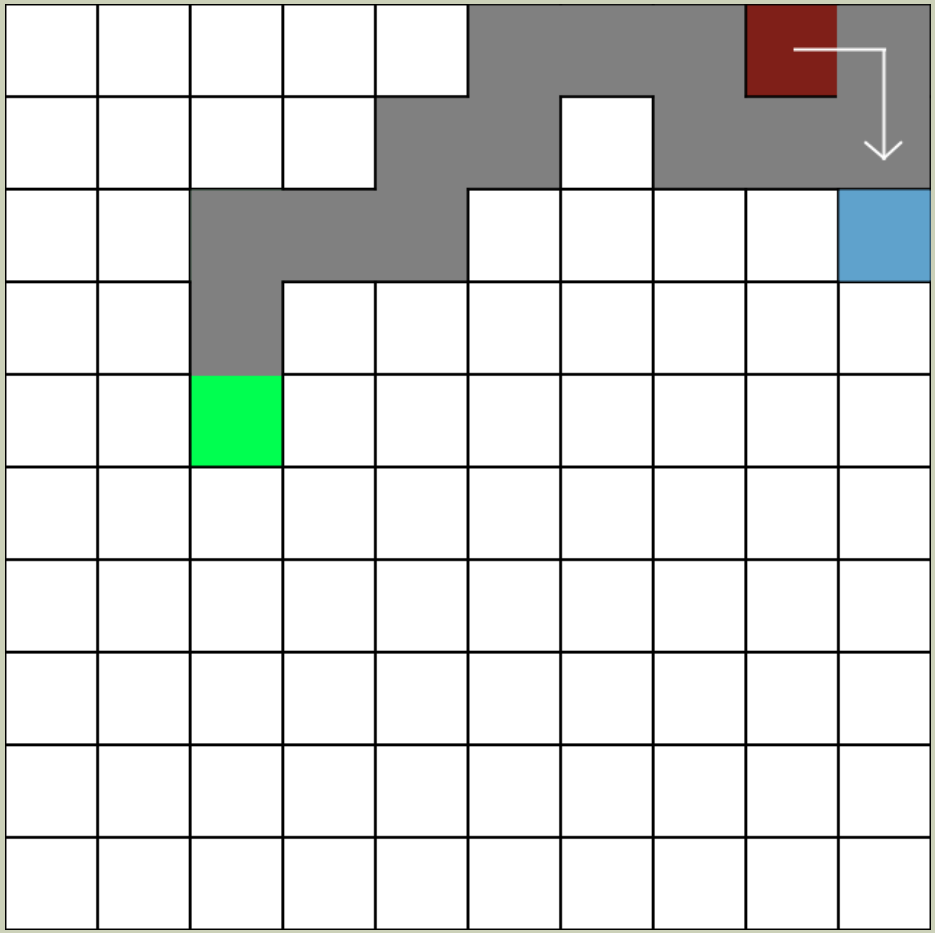
RECURSIVE BACK-TRACKER EXAMPLE



RECURSIVE BACK-TRACKER EXAMPLE

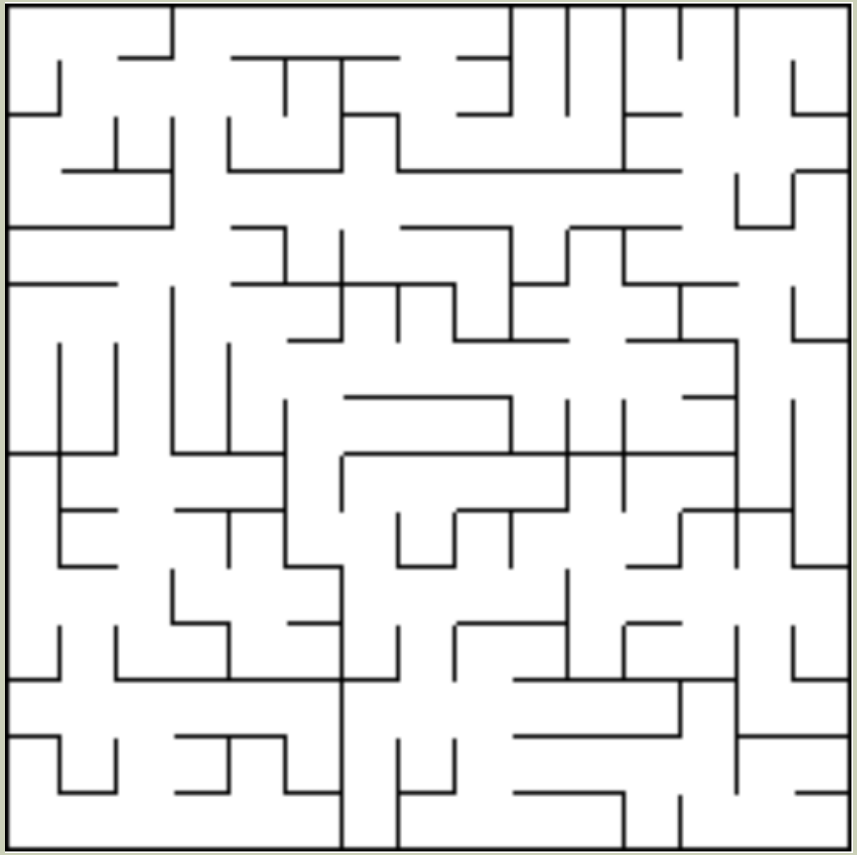


RECURSIVE BACK-TRACKER EXAMPLE

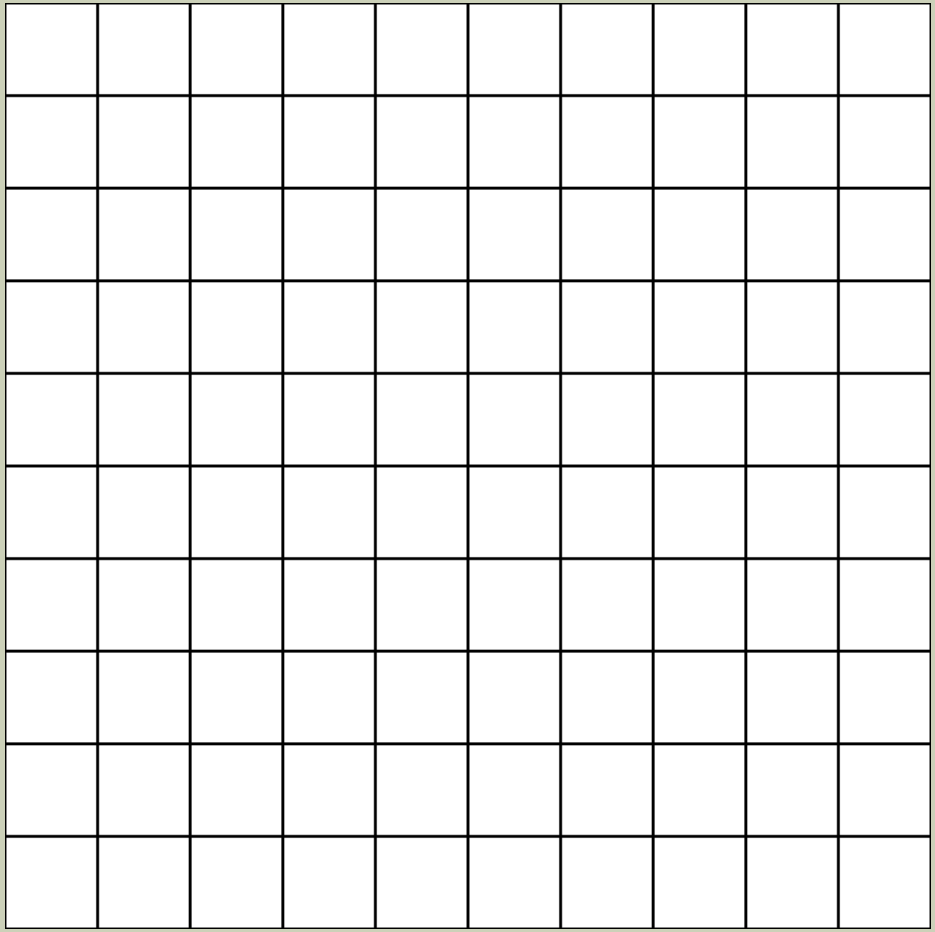


PRIM'S ALGORITHM

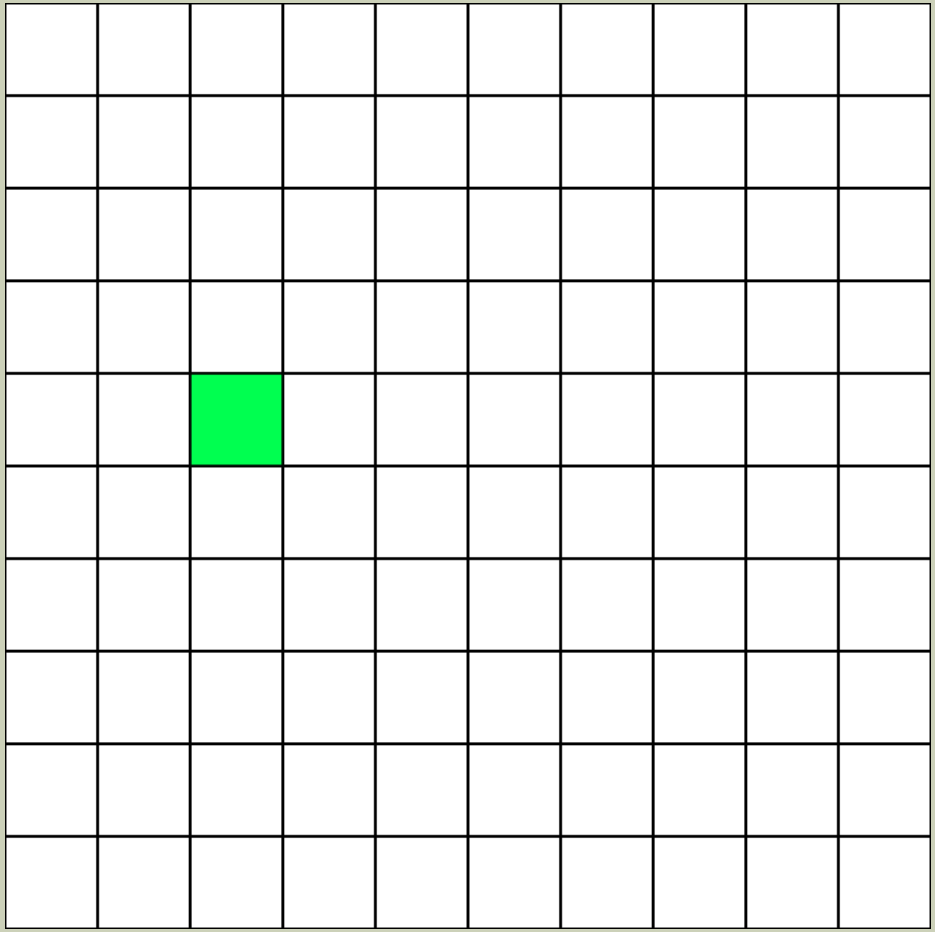
- Pattern:
  - Looks like a mix between previous two
  - Many intersections between paths
  - But shorter and more random wall segments
- Algorithm:
  - Picks a random starting point
  - Continuously picks a random cell from the unvisited neighbors of the current visited cells



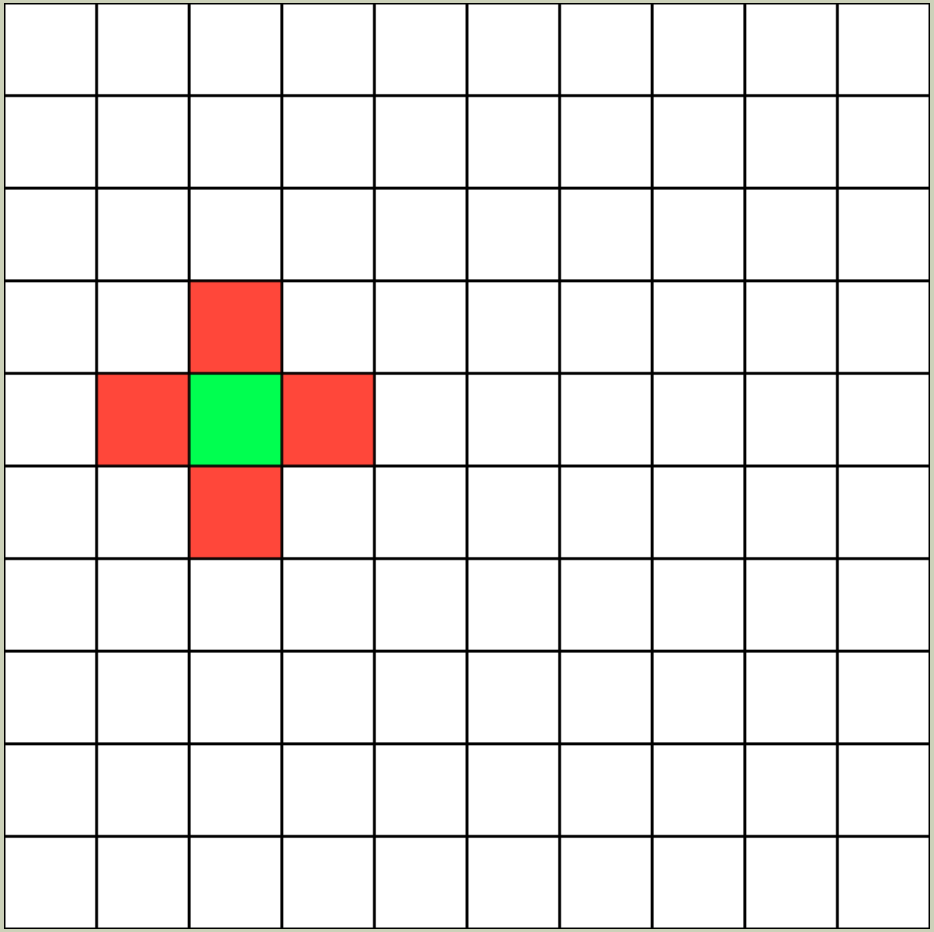
PRIM'S ALGORITHM EXAMPLE



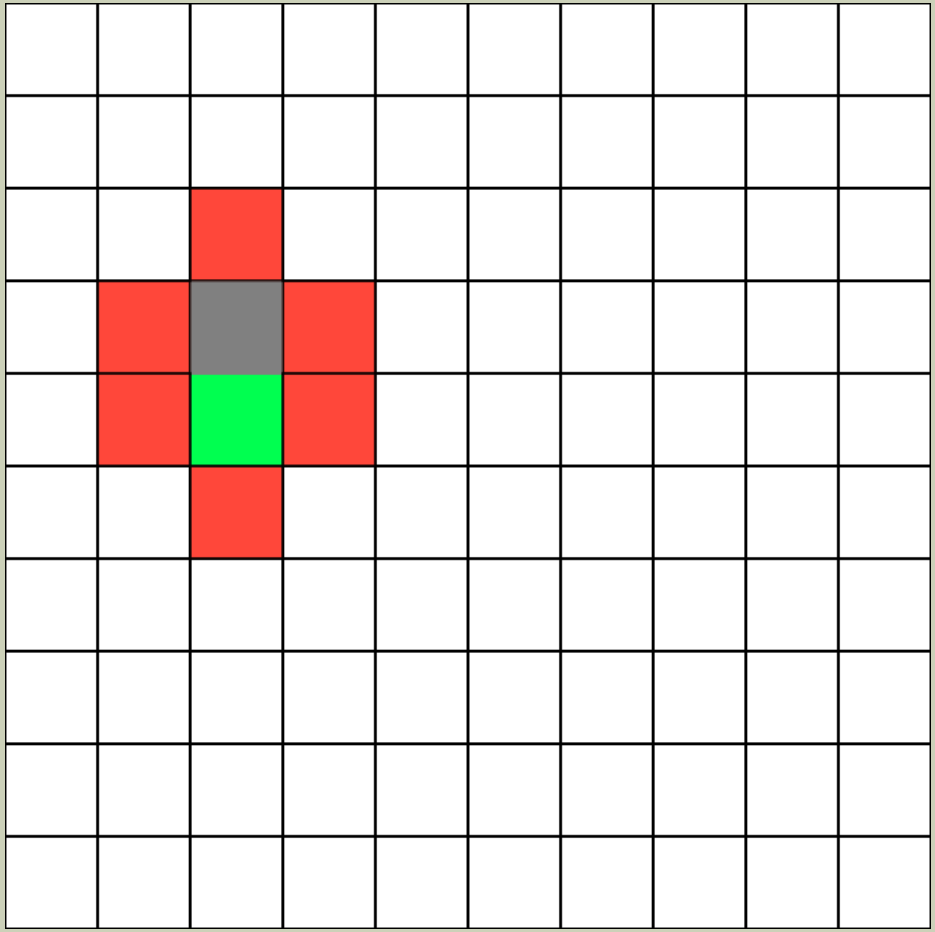
PRIM'S ALGORITHM EXAMPLE



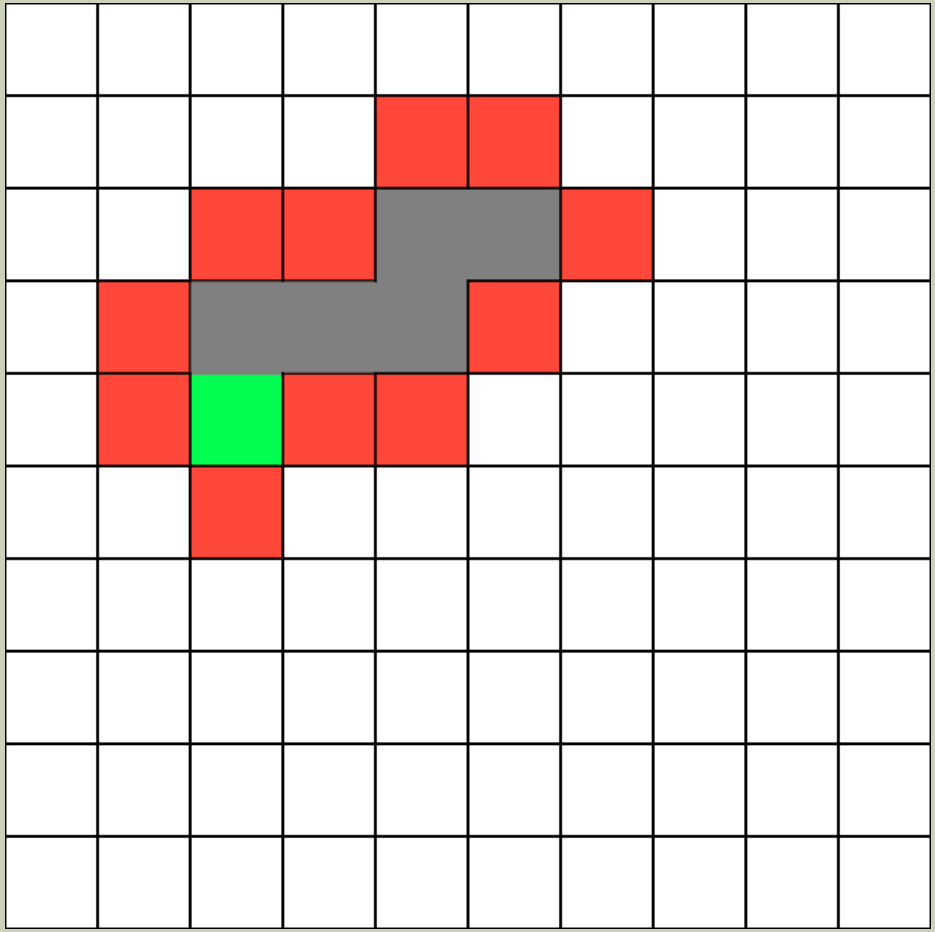
PRIM'S ALGORITHM EXAMPLE



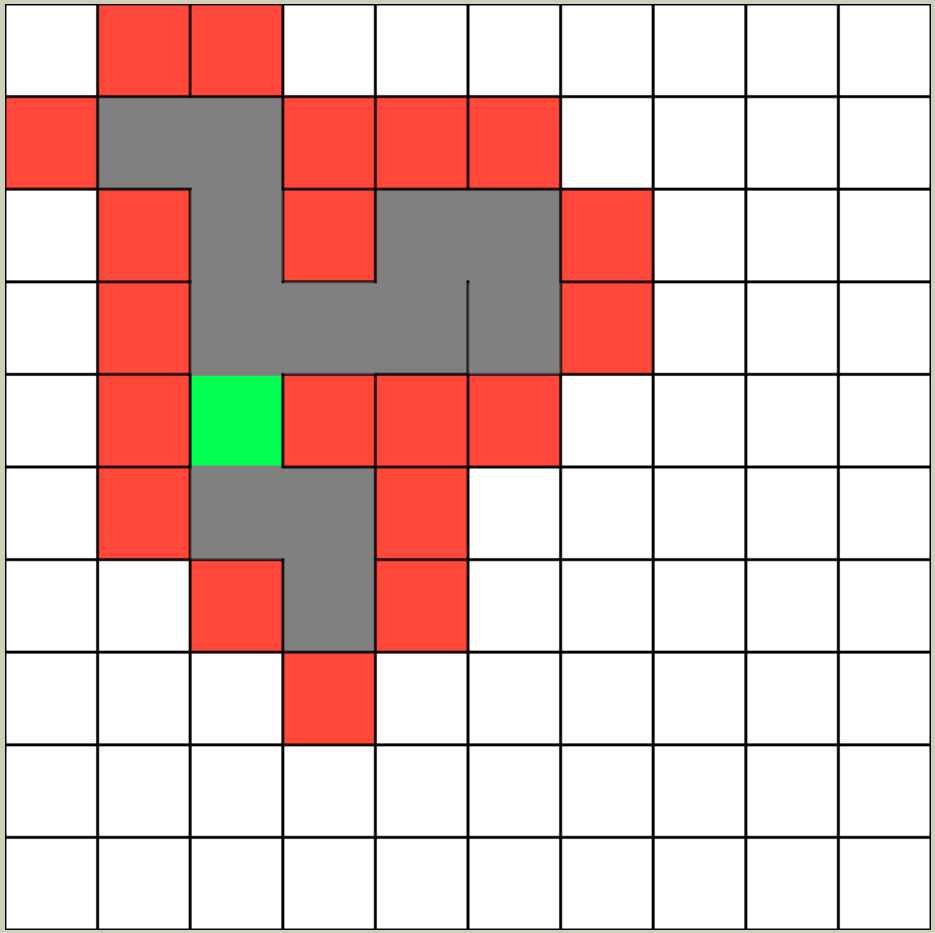
PRIM'S ALGORITHM EXAMPLE



PRIM'S ALGORITHM EXAMPLE

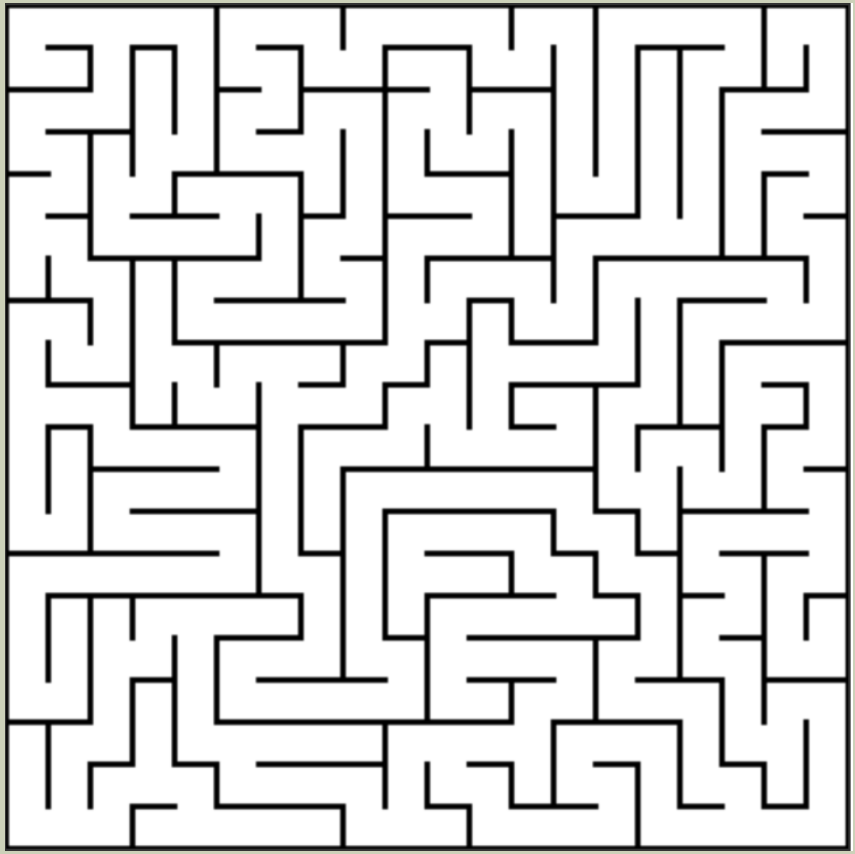


PRIM'S ALGORITHM EXAMPLE



GROWING TREE

- Pattern:
  - It depends on the parameters
  - Can look like Prim's, Recursive Back-tracker, both and more
- Algorithm:
  - Pick a random cell and store it in a list
  - Randomly pick more cells until no longer possible
  - Once a dead-end is hit, use some condition to pick the next cell to iterate from, ex:
    - Most recent added cell: performs like a back-tracker
    - Random cell: looks similar to Prim's algorithm



REFERENCES

- Maze Algorithms:
  - https://en.wikipedia.org/wiki/Maze generation algorithm
  - http://weblog.jamisbuck.org/2011/2/7/maze-generation-algorithm-recap
- Images:
  - Recursive Division Completed Example
    - http://weblog.jamisbuck.org/2011/1/12/maze-generation-recursive-division-algorithm
  - Prim's Algorithm Completed Example
    - http://weblog.jamisbuck.org/2011/1/10/maze-generation-prim-s-algorithm
  - Other Images: Robert Kaufman