Data Structures & Algorithms

FG24GP

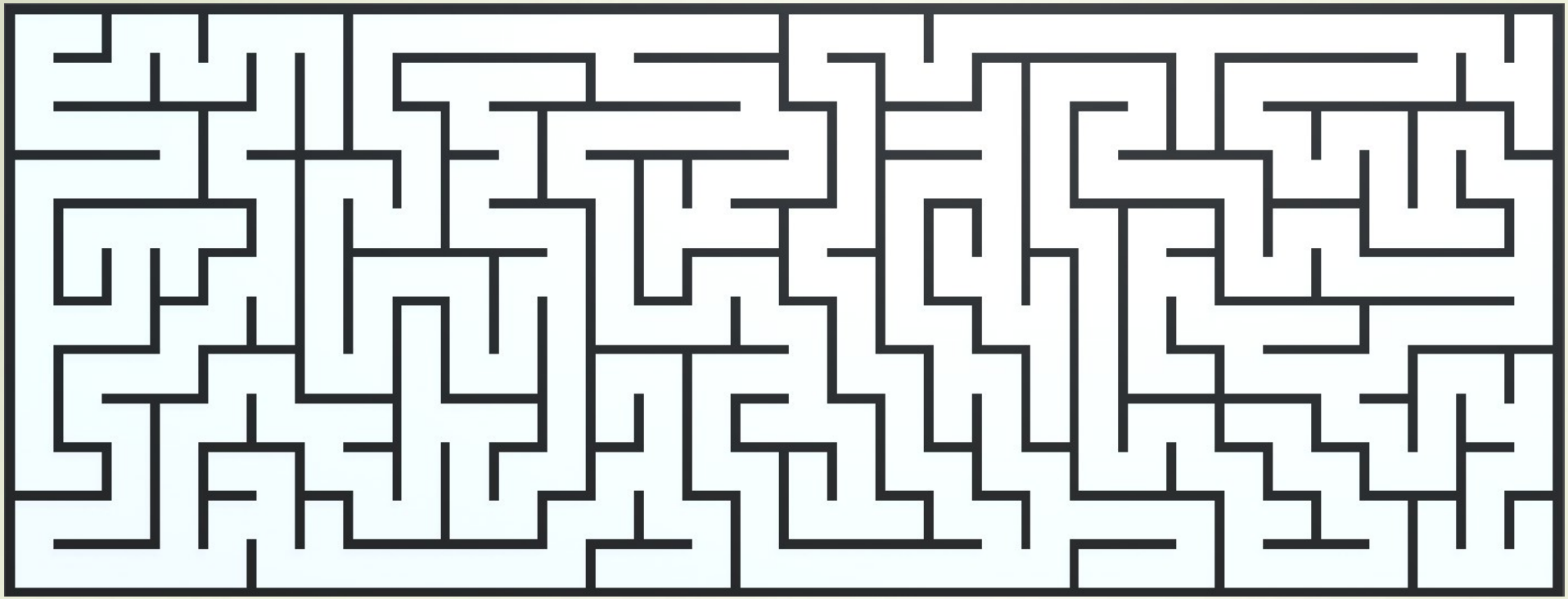
Today

- QuickSort - 2nd Attempt
- A few List, Queue & Stack Examples
- Maze Generation - The Backtracker Algorithm
- Tanks

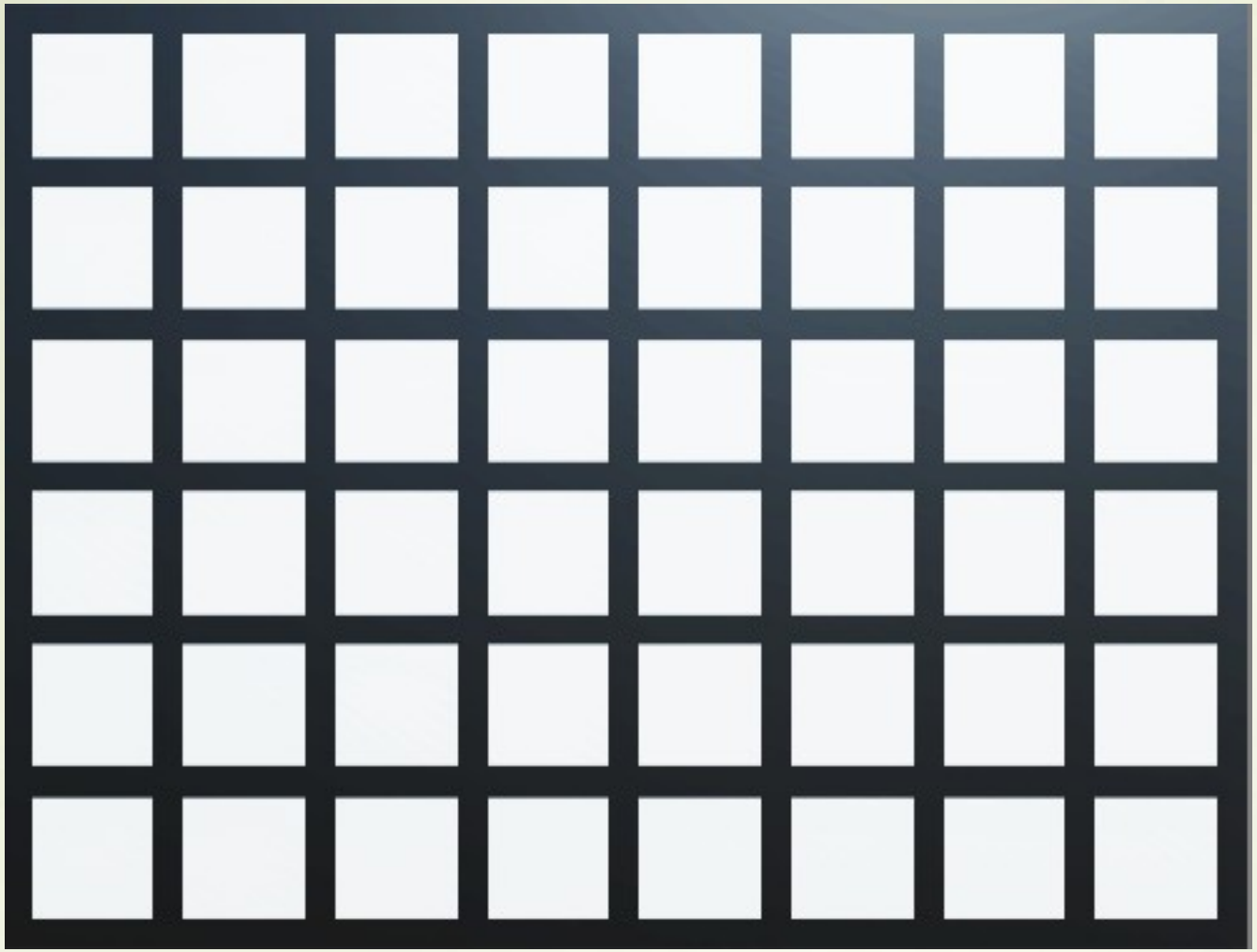
QuickSort

List, Queue & Stack Examples

Maze Generation

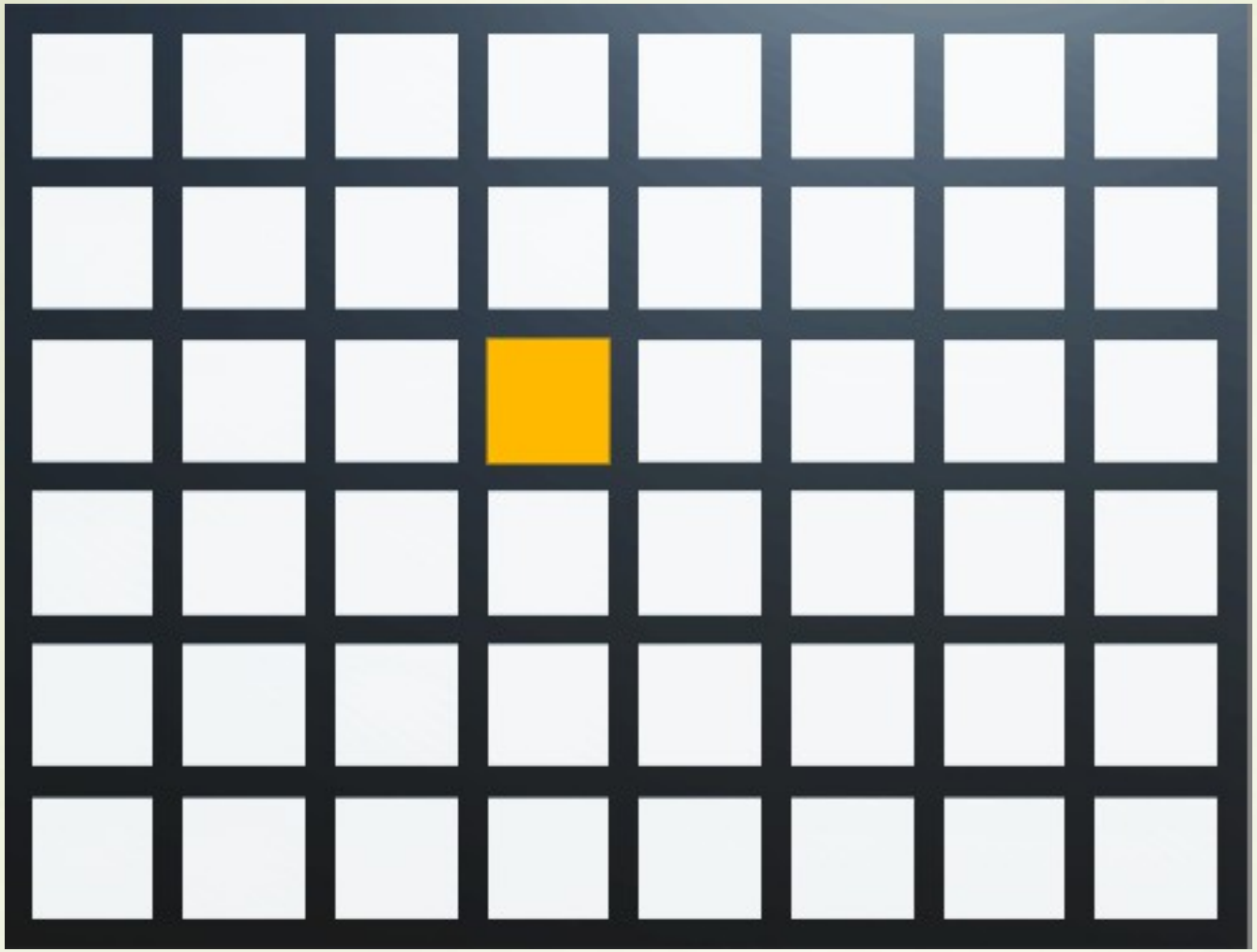


Maze Components



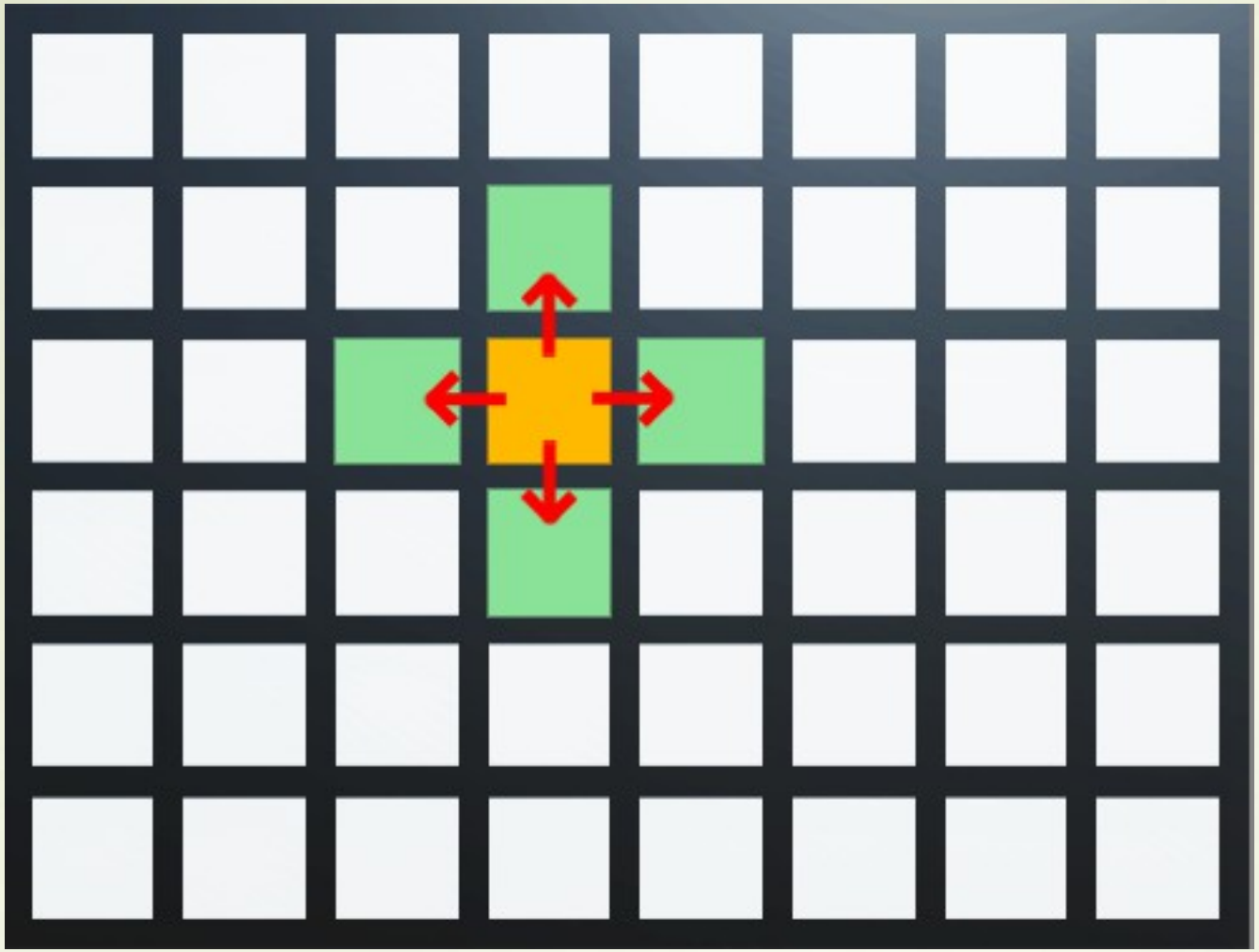
An initialized grid has all walls in place

Maze Components



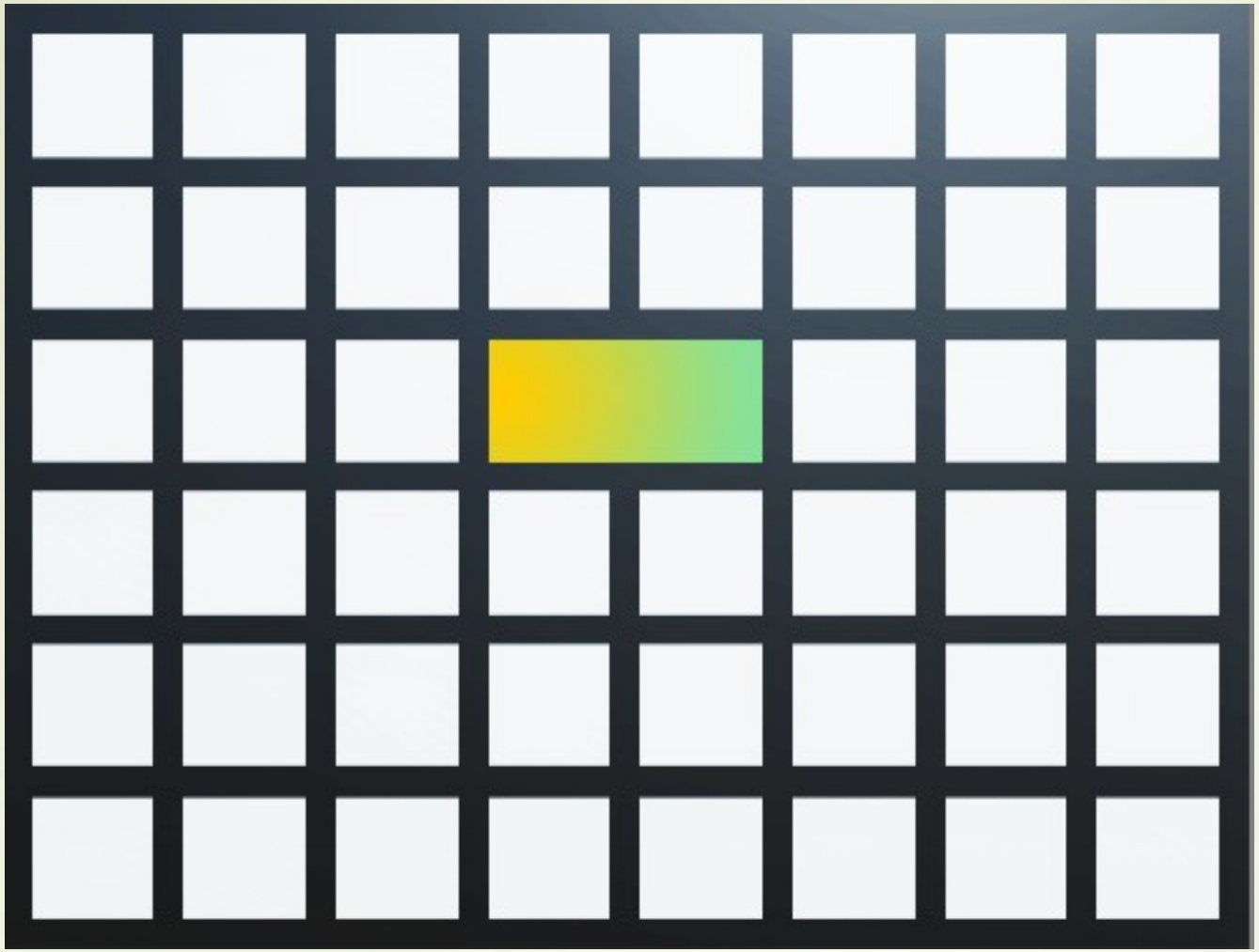
The grid is made up of tiles

Maze Components



Each Tile has up to 4 neighbors (North, East, West & South)

Maze Components



The Maze is constructed by repeatedly removing walls

The Randomized Depth-First Search
aka

The Backtracker Algorithm

The Recursive version of the Backtracker

1. Given a current tile as a parameter

2. Mark the current tile as visited

3. While the current tile has any unvisited neighbour tiles

- **A.** Choose one of the unvisited neighbours
- **B.** Remove the wall between the current tile and the chosen tile
- **C.** Invoke the routine recursively for the chosen tile

The Iterative (Stack) version of the Backtracker

1. Choose the initial tile, mark it as visited and push it to the stack

2. While the stack is not empty

- **A.** Pop a tile from the stack and make it a current tile
- **B.** If the current tile has any neighbours which have not been visited
  - **i.** Push the current tile to the stack
  - **ii.** Choose one of the unvisited neighbours
  - **iii.** Remove the wall between the current tile and the chosen tile
  - **iv.** Mark the chosen tile as visited and push it to the stack

Stretch Exercises

- Optimize the wall removal in **Maze_Backtracker.cs**
  (reduce or eliminate all linear searches)

- Rewrite the **Backtracking** algorithm using **Recursion**
  - *See the slide describing the Recursive version of the Backtracker algorithm*
  - *How large a maze can you generate before you get a Stack Overflow?*

- Try to create a Hex Grid where each Tile has 6 neighbors and run the Backtracking algorithm
  https://www.redblobgames.com/grids/hexagons/


WE MADE IT TO FRIDAY!
memegenerator.net

Tanks!