# Maze Solver

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# Overview

# Introduction

## Problem Description

Given two points on a maze (start, end) we find the shortest path between them.

**Applications of Maze Solver :**

- Robotics
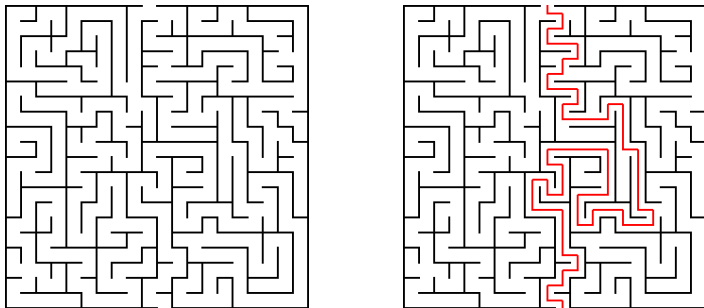- Path-Planning

# Maze Generation



Figure: Generated Maze (on left), Solved Maze (on right)

# Approach

1. Divide the graphs into subgraphs and stitch their solutions together.
2. Parallelize the search algorithm - BFS.
3. Apply mincut and perform search on two different graphs in parallel.

## Our Implementation

We opted to implement the **second approach** - parallelizing the search algorithm. The limitations of the other approaches are discussed in the coming slides.
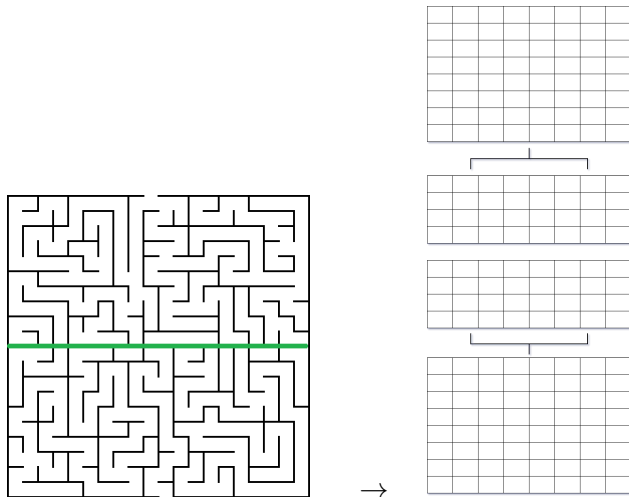
# Parallelizing Maze Solving



Figure: Generated Maze (on left), Solved Maze (on right)

# Drawbacks

- **Approach one and three**
  - Synchronizing solutions and re-running searches on them proved more time-consuming than in the 2nd approach.
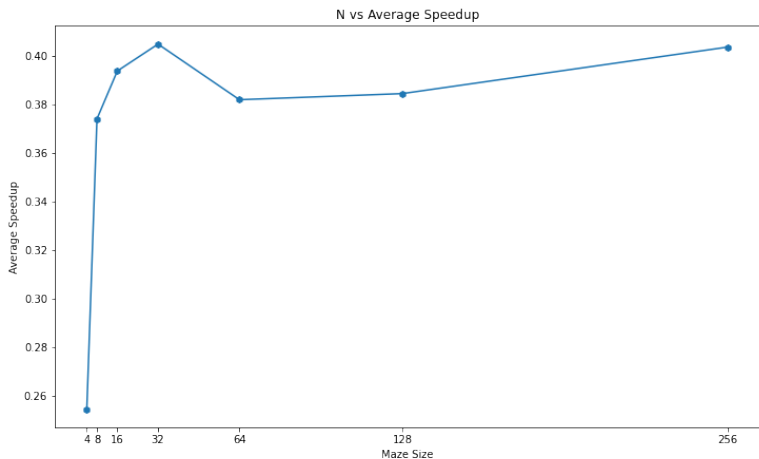- **Approach two**
  - In the Maze Graph, each traversal layer typically contains only 2 to 10 nodes.
  - Furthermore, the necessity for synchronization to update the queue introduced additional overhead.
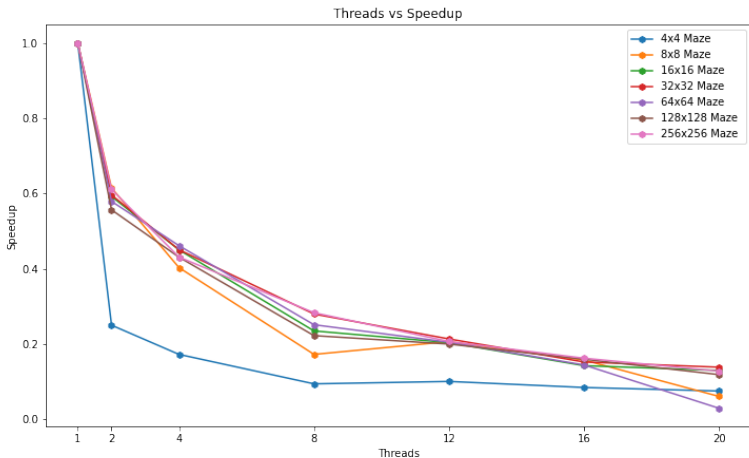
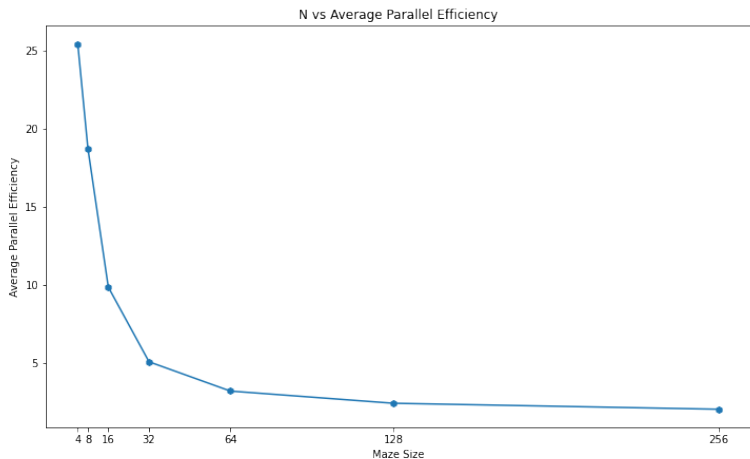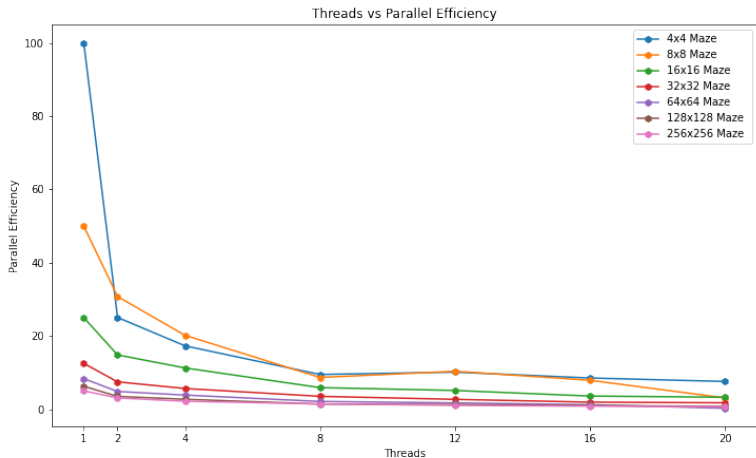Average computation time NxN dimensional Maze

N vs Average Speedup
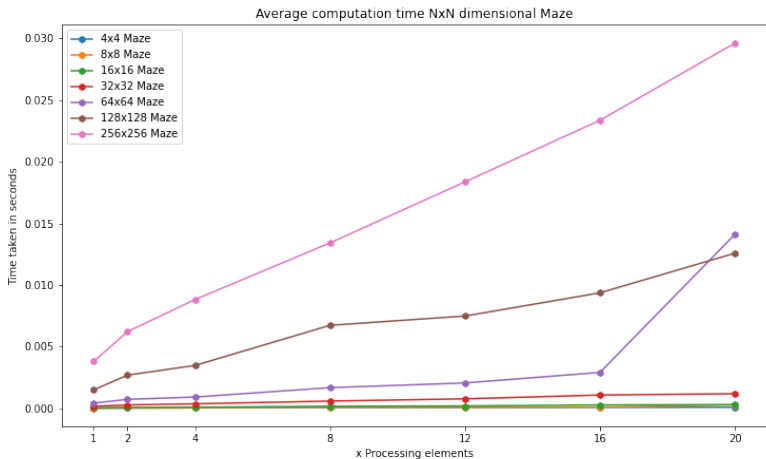
# Performance Metrics

# Performance Metrics



N vs Average Parallel Efficiency

# Performance Metrics

# References

📄 Samya Ahsan (2023)

Parallel Functional Programming Report: MazeSolver

📄 A. Botea et al

Near Optimal Hierarchical Path-Finding

*Journal of Game Development* Vol. 1, pp.7-28, 2004