Project Statement

The purpose of this project is to design, implement, and evaluate a grid-based pathfinding system that computes an optimal route from a defined start position to a goal position within a two-dimensional environment containing obstacles. The project aims to compare the performance, behavior , and efficiency of three fundamental AI search algorithms—**Breadth-First Search (BFS)**, **Uniform Cost Search (UCS)**, and **A***—when applied to maps of different sizes and structural complexities.

The system uses external text-based map files, where each map encodes traversable and blocked cells using numeric values. The start position is fixed at the top-left corner and the goal at the bottom-right corner. The implemented algorithms must correctly interpret the grid, avoid obstacles, expand valid neighboring states, and return a valid path if one exists. Additionally, the project measures key performance metrics such as runtime, nodes expanded, path length, and total movement cost.

Overall, this project demonstrates how informed and uninformed search strategies operate in constrained environments, highlights their differences in computational efficiency, and shows the importance of heuristics in accelerating goal-directed navigation. The implementation serves as a foundational exercise in artificial intelligence, algorithm design, and search optimization