Project Proposal

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Knight’s Tour Problem

The Knight's Tour problem is a mathematical puzzle that involves finding a sequence of moves for a knight on a chessboard such that the knight visits every square exactly once. The knight is a chess piece that moves in an L-shape, consisting of two squares in one direction (horizontally or vertically) and then one square in a perpendicular direction. The objective of the Knight's Tour problem is to determine if there exists a sequence of knight moves that covers all the squares on the chessboard without visiting any square more than once. If such a sequence exists, it is called a Knight's Tour.

The problem has intrigued mathematicians for centuries and has been studied as an example of a Hamiltonian path, which is a path that visits each vertex of a graph exactly once. The Knight's Tour is a specific instance of the Hamiltonian path problem on a chessboard. Finding a Knight's Tour for a given chessboard is not always possible. The existence of a Knight's Tour depends on the size of the chessboard and the starting position of the knight. For example, a Knight's Tour is possible on an 8x8 chessboard starting from some positions, but not from others.

Several algorithms have been developed to solve the Knight's Tour problem, including backtracking algorithms that systematically explore all possible moves until a solution is found or all possibilities are exhausted. The Knight's Tour problem has both recreational and practical applications. It is often used as a challenging puzzle and has been the subject of mathematical research. Additionally, the problem has connections to graph theory and optimization algorithms, making it relevant in various fields such as computer science and operations research.

What does the project show?

This project is a visualization of the Knight's Tour problem using Pygame. The Knight's Tour is a mathematical problem in which the task is to find a sequence of

moves for a knight on a chessboard such that the knight visits every square exactly once

The program allows the user to input the size of the chessboard (N) (will ask the user for the size as input at the start) and the starting position of the knight (edit the starting position from the source code). It then uses the Warnsdorff's algorithm and backtracking to find a solution to the Knight's Tour problem and visually animates the knight's movement on the chessboard using Pygame.

What data structures are used in this project?

The main data structure used in this project is a 2D list to represent the chessboard and keep track of visited squares. Additional lists, tuples are also used to make this project. The algorithm uses the concept of backtracking to explore all possible moves and find a valid tour. Heavy recursion also takes place to ensure the valid path

The program also uses Pygame to create the graphical user interface, handle user input, and display the chessboard and the knight's movement on the screen. Various Pygame functions are used to draw rectangles, display text, handle events, and update the display.

Overall, the project demonstrates the implementation of the Knight's Tour problem using the Warnsdorff's algorithm and provides a visual representation of the knight's movement on a chessboard.

What changes that you made from the proposal?

We changed our project from the proposal as advised by our Instructor Ms. Maria Samad. The project we chose was quite simple and had many loopholes. So we pitched this idea to Ms. Maria Samad, and she approved of it. We totally changed the project to the Knight’s tour problem and solved the Hamiltonian path problem.

The duties of the group members?

Hunain: Wrote the code and fixed bugs in the codes. Made the project report. Made the GitHub repository. Made the readme file.
Wasay: Wrote the code and did most of the error checking, Added comments for better understanding.
Hassan: Helped in writing the code and had the task of making the GUI of the project through Pygame.

Link to the GitHub repository: https://github.com/Hunainabbas/DSA_Project