Faculty of Engineering & Technology

Electrical & Computer Engineering Department

ENCS3340

Project Report

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Introduction :

The objective of this project was to implement a 2-player game called Magnetic Cave. Magnetic Cave is an adversarial game where two players compete to build a bridge of five magnetic bricks within a cave represented by an 8x8 chessboard. The game follows specific rules, and the players take turns placing their bricks on the board. The first player to align five bricks in a row, column, or diagonal wins the game. If no player achieves a winning configuration and the board becomes full, the game ends in a tie. The implementation of the game involved developing a program that utilizes the minimax algorithm to play the game automatically. The program allows for manual entry of moves by both players or a combination of manual and automatic moves.

Game Rules

The rules of the Magnetic Cave game are as follows:

• The game is played on an 8x8 chessboard initially empty.

• Two players, represented by ■ and □, take turns placing their bricks on the board.

• Player ■ starts the game, followed by player □, and the turns alternate.

• A player can only place a brick on an empty cell of the cave if it is stacked directly on the left or right wall or to the left or right of another brick.

• The game continues until one player aligns five consecutive bricks in a row, column, or diagonal, resulting in a win for that player.

• If the board becomes full and no player achieves a winning configuration, the game ends in a tie.

Problem Formulation:

Initial state: board is empty

Successor function: list of pairs (move, state) specifying legal based on game rules moves and their resulting states.

A terminal test: decide if the game has finished.

A utility function: produces a numerical value for (only) the terminal states. in this game we have three cases win or loss or draw.

Description of our program:

The code you is a complete implementation of a game called "Magnetic Cave." a two-player game played on an 8x8 board, where the players take turns placing their respective symbols ('■' and '□') on the board.

Here's a brief overview of the code structure and functionality:

The class MagneticCaveGame represents the game itself.

The game board is stored as a 2D array of characters (char[][] board).

The board is initialized with empty cells ('-') in the initializeBoard method.

The game can be played in manual or automatic mode for both players.

The playGame method handles the game loop, alternating turns between the players and making moves.

The makeManualMove method prompts the player for input and validates and makes the move.

The makeAutomaticMove method uses a minimax algorithm to make automatic moves for the computer player.

The minimax method recursively evaluates possible moves and uses alpha-beta pruning to improve performance.

The evaluateBoard method calculates a score for a given board state based on possible bridges for each player.

The countPossibleBridges method checks rows, columns, and diagonals for possible bridges.

“We certify that this submission is the original work of members of the group and meets the Faculty's Expectations of Originality”, mohammad shrateh – 1201369 and mohammad dallash – 1200937 , Date 20/6/2023