**CS440/ECE448 Spring 2019**

**Homework 2: Planning, Games**

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Section Q

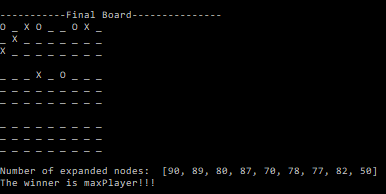
02/25/2019

**Section I:**

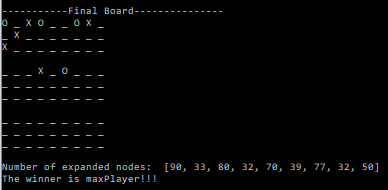
CSP

**Section II: Ultimate Tic-Tac-Toe**

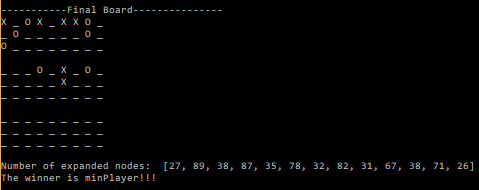
Game 1: Offensive(minimax) vs Defensive(minimax) – maxPlayer first



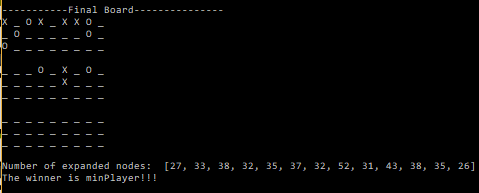
Game 2: Offensive(minimax) vs Defensive(alpha-beta) – maxPlayer first



Game 3: Offensive(alpha-beta) vs Defensive(minimax) – minPlayer first



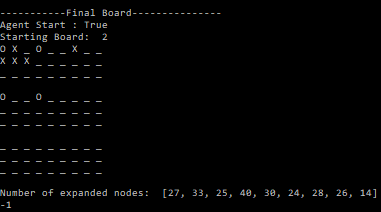
Game 4: Offensive(alpha-beta) vs Defensive(alpha-beta) – minPlayer first



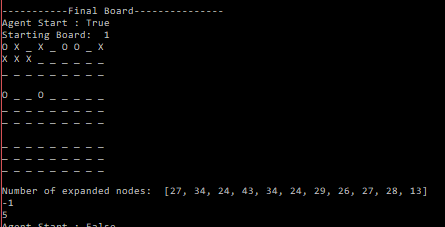
**Section III:** Ultimate Tic-Tac-Toe vs Designed Agent

Our new evaluation function assigned values to each of the local boards based on the number of empty spaces that would cause the next move to be in the current local board. For example, if the agent would must make its current move in the upper left-hand board (board 0), it would assign each potential move a higher score if it would force the predefined agent to make its next move in the current board. Basically, our designed agent knows that it has a higher chance of winning a local board if it can make more moves on the same board repeatedly. The remainder of the scoring heuristic was identical to the predefined agents.

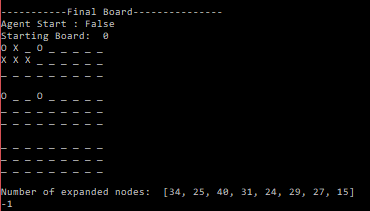
Sample Game 1: Designed Agent start, Initial board 2



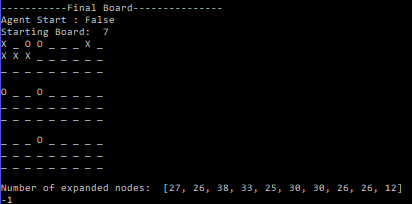
Sample Game 2: Designed Agent start, initial board 1



Sample Game 3: Predefined Agent Start, initial board 0

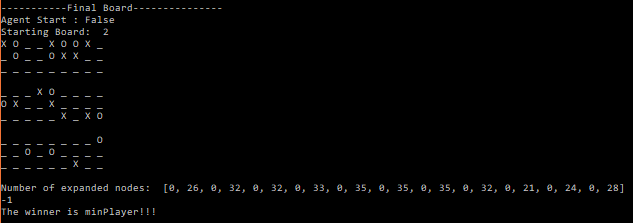


Sample Game 4: Predefined Agent Start, initial board 7

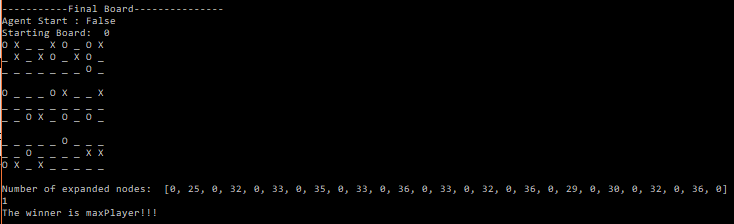


**Section IV:** Ultimate Tic-Tac-Toe vs Human

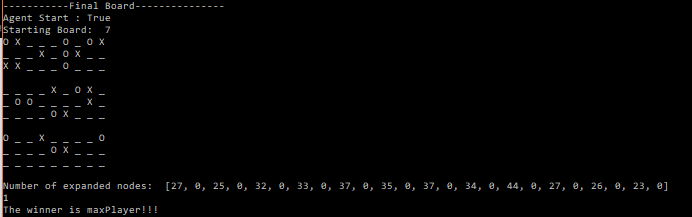
Game 1: Agent wins going second



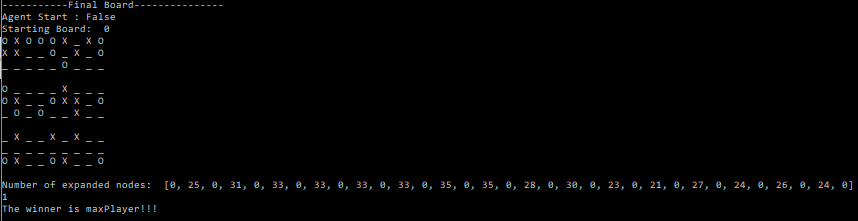
Game 2: Agent loses going second



Game 3: Agent loses going first



Game 4: Agent loses going second



In the ten games played against the designed agent, we were able to win eight of the ten games played. The agent’s win percentage was 20%.

**Statement of Contribution:**

Eric and Jason worked on the constraint satisfaction problem for pentomino tiling.

William and Eric implemented the ultimate tic-tac-toe minimax and alpha-beta algorithms for the predetermined AI and designed agents.

The report was written by all three group members.