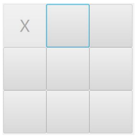
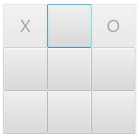
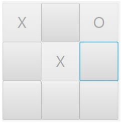
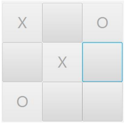
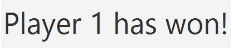
MCO2 - Technical Report

1. Define the goal of the TIC-TAC-TOE agent
    - a. The goal of the TIC-TAC-TOE agent is to be the first one to land three of its own corresponding mark(X/O) vertically, horizontally or diagonally to win.
2. Formulate the problem
    - a. The agent can place its own mark in any block in the 3x3 square, as long as the specific block isn't taken by the agent's own and opponent's moves.
    - b. The players, user and the TIC-TAC-TOE agent, will take turns in putting their corresponding marks. Following that, the player who has the 'X' mark will get to take the first move.
    - c. The first one to land their own mark, either vertically, horizontally or diagonally, wins. However, when either of the players failed to put their marks in a row but there are no other moves that could be done, the game would end in a draw.
    - d. The game ends when one of the players has been able to land 3 of their corresponding marks in a row, or there are no moves to be done.
3. Determine the specific states and configurations that the agent operates on
    - a. Level 0
        - i. The agent gets all valid and possible moves then chooses and performs random valid moves on each round.
    - b. Level 1
        - i. The agent first checks number of moves opponent needs to complete any single winning move
        - ii. Then, the agent checks the number of moves AI needs to complete any single winning move
        - iii. Following that, the agent do the move which has the lower number of moves to complete any single winning move
        - iv. Lastly, as a backup, if moveToStop and moveToWin are both equal to -1, which means that no player has done a move yet, get the middle position (1, 1).
    - c. Level 2
        - i. The agent follows the Minimax algorithm, to get the best possible move, to get the best possible outcome.
4. Determine the specific actions, and the states (configurations) on which the actions are applicable (include illustrations for transition table)

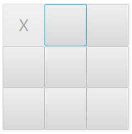
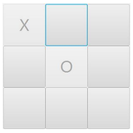
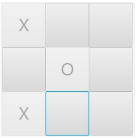
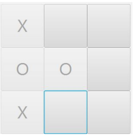
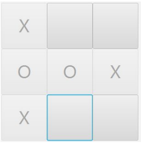
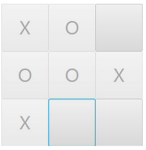
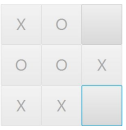
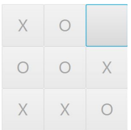
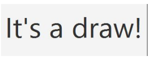
Player : X <-> **AI** : O

- a. Level 0

STATE	ACTION	ILLUSTRATION: Player 1	ILLUSTRATION: AI

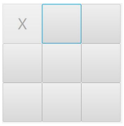
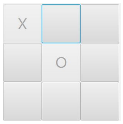
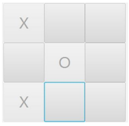
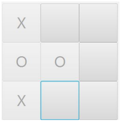
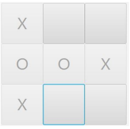
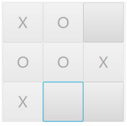
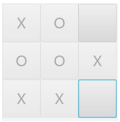
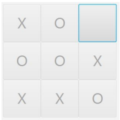
AI Turn	Picks random valid move		
			
		 Player 1 has won!	

b. Level 1

STATE	ACTION	ILLUSTRATION: STATE	ILLUSTRATION: EFFECT
1st Round: Player 1 chooses (1, 1)	Picks the block closest to obtain goal state.		
2nd Round: Player 1 only has 1 move left to win.	Player 1 has less moves to win so it blocks the winning move. (*moveToStop*)		
3rd Round : *moveToStop* and *moveToWin* are equal	Picks the move to win (moveToWin)		
4th Round: Player 1 only has 1 move left to win	Picks the move to stop Player 1 from winning. (*moveToStop*)		
		 It's a draw!	

c. Level

STATE	ACTION	ILLUSTRATION: STATE	ILLUSTRATION: EFFECT

1st Round: Player 1 chooses (1, 1)	Picks the best block at the current circumstances.		
2nd Round: Player 1 only has 1 move left to win.	Picks the block(2,1) to prevent losing.		
3rd Round : *moveToStop* and *moveToWin* are equal	Picks the block(1,2) to minimize loss.		
4th Round: Player 1 only has 1 move left to win	Picks block (3,3) to prevent losing.		
[redacted]		It's a draw!	

5. Specify how the goal state can be determined and detected by the agent
    a. The goal state can be determined by the agent, when the agent has recognized that it can do a winning move.
6. Describe the three levels of rational behavior
    a. Level 0
        i. In this level, the agent just takes in all the possible movements, then it picks on one of the possible moves randomly and performs it.
        ii. No smart algorithm is used.
    b. Level 1
        i. The agent follows an algorithm.
        ii. The agent always calculates the number of moves for each player to complete a winning move.
            1. The agent picks depending on the number of moves left for each player to complete a winning move
            2. If the player has less moves to complete a winning move, then the AI would stop the player's winning move by blocking it
            3. If the AI has equal or less moves to complete a winning move, then the AI would do that complete winning move in order to win.
    c. Level 2
        i. The agent follows the Minimax algorithm.
        ii. The goal of the algorithm is to minimize the worst case scenario every move by minimizing the Player's and maximizing the AI's chance of winning.