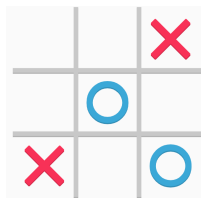


Reflex Agent

- 1) I played 100 games (as a younger kid) to realize that the best starting position is always a corner. (1 rule)
- 2) The opening move would always be a corner, so for simplicity of explanation I will always choose the bottom-left corner. The opponent has 8 distinct choices (3 are duplicates from the opposite side). The moves and their counters are the following. (8 rules)
 - a) Top-left: counter - top-right
 - b) Top-middle: counter - top-left
 - c) Top-right : counter - bottom-right
 - d) Middle-right : counter - bottom-right
 - e) Middle : counter - top-right
 - f) Middle-left : counter - bottom-right
 - g) Bottom-middle : counter - top-left
 - h) Bottom-right : counter - top-right
- 3) There are two different types of winning positions:
 - a) Two of your pieces are next to each other horizontally, vertically, or 45-degree diagonally with a blank space on a far side (3 rules, if checking for legal moves only)
 - b) Two of your pieces are horizontally, vertically, or 45-degree diagonally across from each other with a space in the middle (3 rules)
- 4) The two different types of losing positions are exactly the same as the winning positions, but instead of your pieces being the pieces analyzed, it is the opponents pieces. (6 total rules)
- 5) All of the opening moves/counters are guaranteed to either create forks on your following move to your counter given the proper choice (7 rules) or become an immediate winning scenario except for 2e - when the opponent chooses the middle space after the opening move. In the case of 2e, the only possibility of creating a fork occurs if the opponent then chooses a corner after the counter move, so that the board looks like the following image (or is flipped in any way). In this case, the fork is created by choosing the last corner on the following move. (1 rule)



- 6) The total number of rules to implement would be 29, some of them much more complex to implement than others (2e would take more effort than choosing the bottom-left corner every game).

Minimax Agent

To calculate the total number of possible game positions if the board always ended full, you would compute factorial(9), resulting in an astounding 362,880 possible games (states).

Tyler Prehl
CSC 468 - W2
3/1/22

This number is SIGNIFICANTLY reduced if rotations and reflections are considered the “same” game (to 26,830 - no I did not compute this myself). If we assumed 100 CPU cycles per state and we had access to a 3GHz processor, it would take 0.012096 seconds (3 billion cycles/second divided by 100 cycles/state to get 30 million states/second, which is then divided from 362,880 states) to create all possible game plans. Modern computing power is amazing!

Reflection

It took me about 4 hours at the age of 13 to understand the best winning possibilities of tic-tac-toe plus the 30 minutes I spent creating the exact rules to “create” the Reflex Agent above, so the Reflex Agent (likely) takes much longer to fully implement than the Minimax Agent. Moreover, because the Reflex Agent is built to go first and for certain solutions, it could absolutely lose if there is no immediate losing scenario when it starts as the second player, allowing for the opponent to create a fork (unless more rules were created). The Minimax Agent would never allow this to happen if it was built to understand the search tree from both the 1st person to play and 2nd person to play perspectives. Because Minimax understands the “strategy” of the game (it would know the best ways for achieving a win given any state), I believe it would succeed (to its best ability) in every scenario. The only possible downfall of the Minimax Agent is if it chooses safer moves that guarantee ties for fear of loss outcomes farther down in the search tree. If I was playing against another perfect robot, I would utilize the Minimax Agent since it assumes perfect play, but against a human, the Reflex Agent could prove to be better if the Minimax Agent makes safer choices to guarantee ties instead of losses.