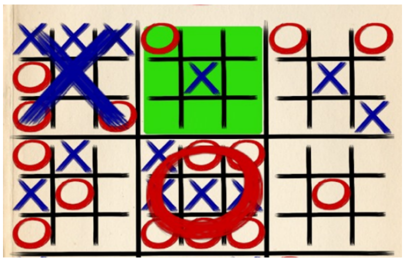
Tic-Tac-Toe Description

This task aims to teach you how to implement the minimax search in Tic-Tac-Toe game. You are required to complete the minimax search recursively.



Tic-Tac-Toe game

File Structure

tic_tac_toe.py

- Class `GameJudge` is defined to check the result (win or lose) of current state. **You don't need to edit codes in `GameJudge`!**
- The pipeline of minimax search is provided but you need to complete the core codes in `min_value()`, `max_value()` and `utility()`.

main_tic_tac_toe.py

- The main code to start a Tic-Tac-Toe game between you and the computer.

Run `main_tic_tac_toe.py` to test your algorithm in a game against the computer. You will always get a draw with the computer if your algorithm is correct.

Tips

You are required to implement the minimax search with a limited search depth of 3. For the consistency of details, you should follow such rules:

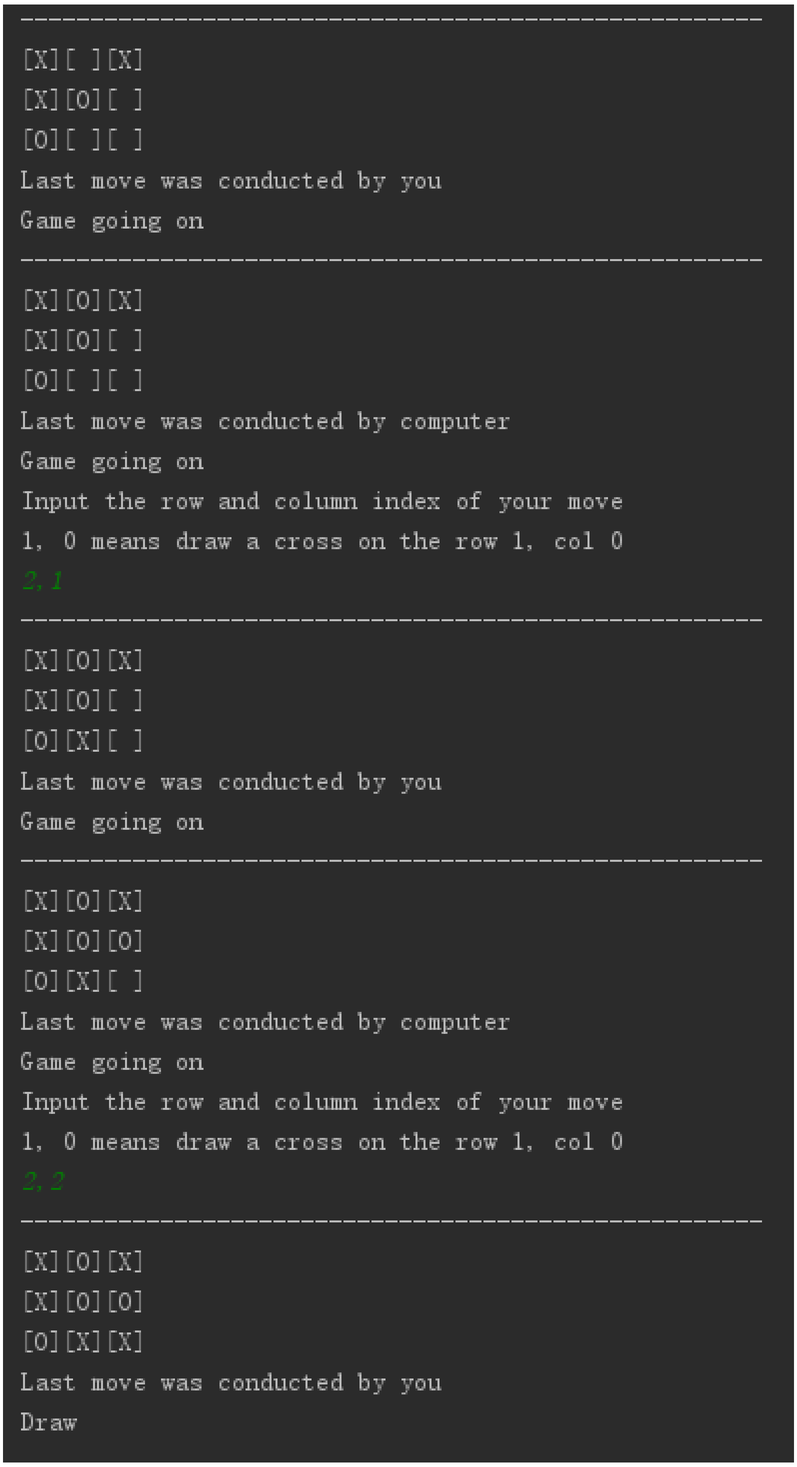
1. The computer plays circle chess (denoted with 1). The human plays cross chess (denoted with -1).
2. The computer is the MAX player and the human is the MIN player. In this zero-sum game, the computer attempts to maximize the utility and the human attempts to minimize the utility.
3. The search depth of your algorithm is limited in 3, meaning that two more steps will be considered by the algorithm after one of your decision.
4. The human player goes first.

Here is a simple pipeline of the minmax search for the computer player:

1. Get all possible solutions of current state.
2. Estimate the utility of all possible solutions using minmax search with a limited depth of 3.
3. Apply the solution at where gets the maximum utility.

Examples

The correct running of the program is like this:



```
----------------------------------------------------
[X][ ][X]
[X][O][ ]
[O][ ][ ]
Last move was conducted by you
Game going on
----------------------------------------------------
[X][O][X]
[X][O][ ]
[O][ ][ ]
Last move was conducted by computer
Game going on
Input the row and column index of your move
1，0 means draw a cross on the row 1，col 0
2,1
----------------------------------------------------
[X][O][X]
[X][O][ ]
[O][X][ ]
Last move was conducted by you
Game going on
----------------------------------------------------
[X][O][X]
[X][O][O]
[O][X][ ]
Last move was conducted by computer
Game going on
Input the row and column index of your move
1，0 means draw a cross on the row 1，col 0
2,2
----------------------------------------------------
[X][O][X]
[X][O][O]
[O][X][X]
Last move was conducted by you
Draw
```