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Compile and execution of the code:

1. The system needs to have python version 2.7 or up
2. Download all the connect4.py files into a folder.
3. Execute this python file using the following command

   Python connect4.py

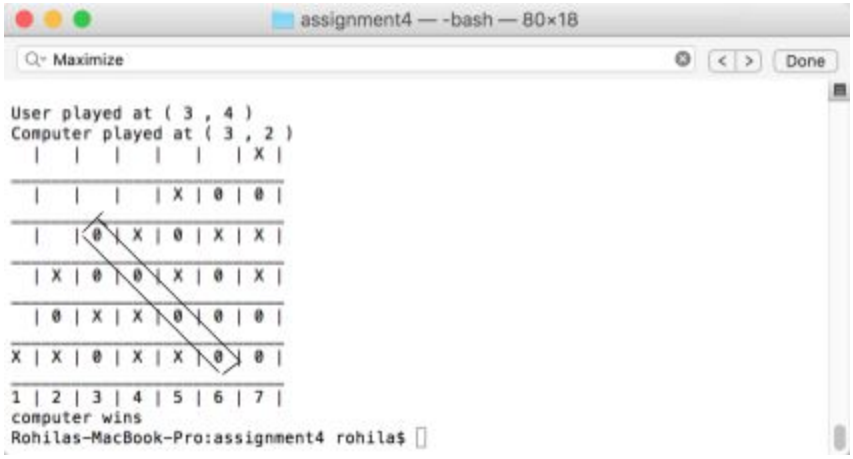
4. The AI plays as '0' and user plays as 'X'.
5. Once the file is executed, the current state of board is displayed .
6. Now, it prompts for user input and user has to give an input from 1 to 7, corresponding in which column user wants to play.
7. The user needs to give an input from 1 to 7 and press enter.
8. Now, the AI makes the move and again waits for user to make their move.
9. This process repeats until any player wins or game is draw.

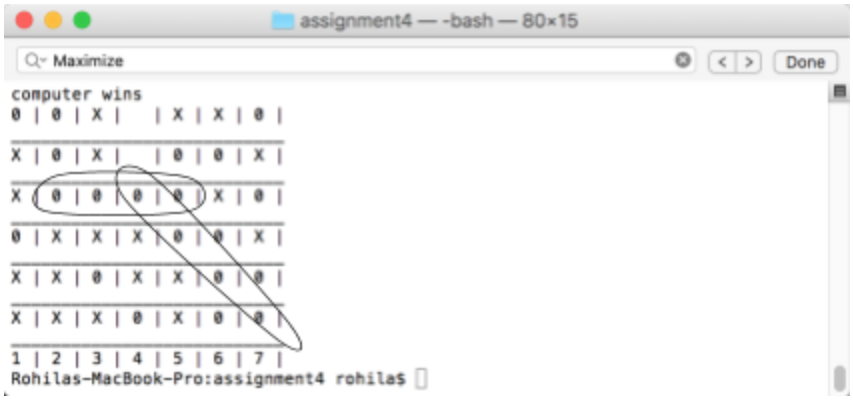
Design and heuristic of the AI

- The program is constructed using functions completely.
- It comprises of many functions like win() - to check whether anyone has won or not, gameover() - check whether game is over or not, maximise() - returns the best move of ai player, search() - searches the tree for best move and so on
- All the functions are explained clearly as comments in the python file.
- The heuristic i used for giving a value to state is as follows:
  alpha= number of 4 streaks*100000 + number of 3 streaks*100 + number of 2 streaks
  Where, number of 4 streaks is consecutive 4 symbols of same player in horizontal or vertical directions or diagonally and
  number of 3 streaks is consecutive 3 symbols of same player in horizontal or vertical directions or diagonally and number of 2 streaks is consecutive 2 symbols of same player in horizontal or vertical directions or diagonally.
- The state with highest alpha value is determined as best move for the AI player.
- Also, for every state the program checks the tree upto 4 levels below its level in the tree. That is 2-ply check meaning it explores states in tree for 2 moves of user and 2 moves of AI.
- If many number of moves results in states with similar heuristic value, then it chooses the last move.

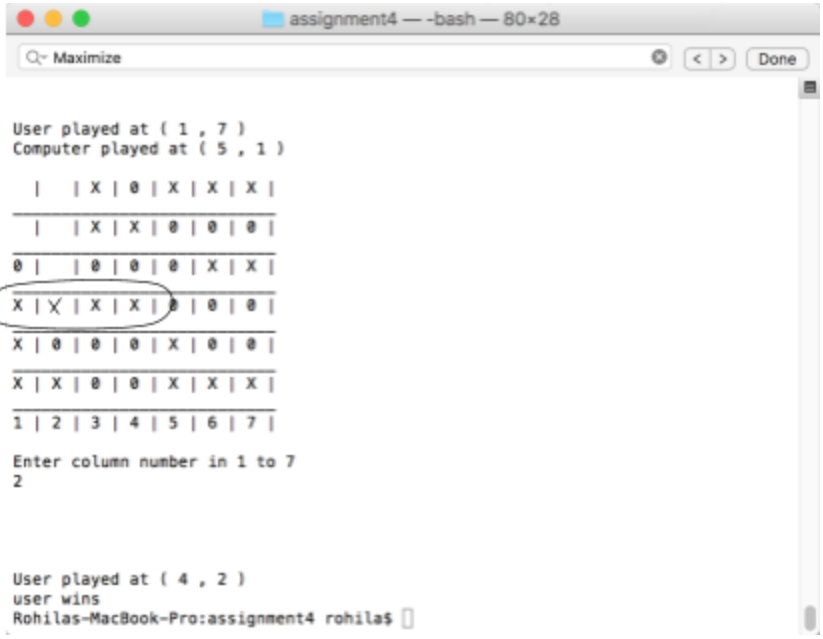
Outputs

AI wins





User Wins



The AI is very good, sometimes the user can win but AI gives a very tough game and wins most of the times i tried to win or draw the game. The Algorithm doesn't guarantee winning always as the depth of tree, i am checking is only upto 4 levels. We can increase the level of difficulty by increasing the depth search of tree. But it takes more time to for the algorithm to make the move.