CS2180 Artificial Intelligence Lab (Jan-May 2023)

Department of Computer Science and Engineering
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Assignment 4: Adverserial Search (Given: 28 Feb 2023, Due: 19 Mar 2023)

General instructions

- Solutions are to be typed in the `.ipynb` file provided and uploaded in the lab course page in Moodle on the due date.
- Your code should be well commented and should be compatible with python3.
- For this assignment, you are allowed to import the libraries `random` and `copy` of python3. No other libraries may be imported.

1 Adverserial search

The Tic-Tac-Toe game using the minimax strategy. The game starts on a 3x3 grid with two players "X" and "O" who take turns and play. The rules are as follows: each player gets a turn with player "X" (resp. "O") writing an "X" (resp. "O") in an empty cell of the grid. The game starts with the move of the "O" player. The first player to mark three horizontal or vertical or diagonal cells wins.

(a) Use the minimax strategy to design an AI that plays the game optimally. The leaf nodes where "X" wins gets 1 and "O" wins gets -1 and neither wins gets a zero. A sample game play is given below.

```
Board locations are as follows
1|2|3
-+-+-
4|5|6
-+-+-
7|8|9


Enter position for O player 4
 | |
-+-+-
O| |
-+-+-
 | |
```

```
X| |
-+-+-
O| |
-+-+-
 | |


Enter position for O player 7
X| |
-+-+-
O| |
-+-+-
O| |


X|X|
-+-+-
O| |
-+-+-
O| |


Enter position for O player 3
X|X|O
-+-+-
O| |
-+-+-
O| |


X|X|O
-+-+-
O|X|
-+-+-
O| |


Enter position for O player 6
X|X|O
-+-+-
O|X|O
-+-+-
O| |


X|X|O
-+-+-
O|X|O
```

```
-+-+-
O|X|


Player X won
```

(b) Modify the previous answer to calculate in each game the following:

- the maximum depth of exploration of the game tree in a game, and
- number of leaves of the game tree whose scores were computed be the end of the game.

(c) Implement alpha-beta pruning minimax search to solve the Tic-Tac-Toe and repeat part (b).

Compare your results with vanilla minimax search and see on which all parameters part (b) is alpha-bet pruning search better. Also obtain by what factor is it better.