Report for Game Othello

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Game： Othello

Game-rules：

To move: Place a chip with your color facing up on any empty square on the board such that there exists a straight (horizontal, vertical, and diagonal) line connecting that square to another square that is occupied by your piece with all the squares in that line occupied by the opponent's pieces. There must be at least one opponent's piece in between the piece you just placed and the one it forms a straight line with. All of the opponent's pieces in that line are flipped over to your color. If a player has no legal moves, the turn passes to the opposing player. If neither player can make a legal move, then check for the win condition.

To win: A game ends when neither player can make a legal move (e.g. when the board is full). At this point, whoever has more pieces wins.

Variants of our game:

We shrink the chessboard from 8×8 to 4×4 and 4×5. All other rules remain the same.

How we split work:

Game	Solver	Text GUI	Visual GUI
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Upper bound calculation:

The method to estimate upper bound is shown here.

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n=row * column
num_of_position=0
for i in range(1,n-3):
    num_of_position+=$C_{N-4}^{i} * 2^{i+4}$
    # The central 4 cells cannot be blank, and choose i cells for other pieces.
    # All pieces can be either black or white
pint(num_of_position)

For 4×4 chessboard, n=16, num_of_position= 8503040. For 4×5 chessboard, n=20, num_of_position= 688747520.

Analysis:

We calculate the number of the win/lose/tie positions of different chessboard, from 2×3 to 4×5. For each position, we analysis its remoteness and best move. Properties of the positions are written into a database after solving. Here shows the summery of station values. Other properties are shown in GUI.

Col×Row/ state	2×3/ 3×2	3×3（black not in corner）	3×3（black in corner）
win	0 (0.0 %)	13 (46.43 %)	21 (44.68 %)
lose	0 (0.0 %)	15 (53.57 %)	26 (55.32 %)
tie	2 (100.0 %)	0 (0.0 %)	0 (0.0 %)
total	2	28	47
Initial value	tie	win	lose

Col×Row/ state	3×4/ 4×3	4×4	4×5/ 5×4
win	152(39.79 %)	30156(48.03 %)	2585414(51.80 %)
lose	179(46.86 %)	27624(43.99%)	2042074(40.92 %)
tie	51(13.35 %)	5009(7.98 %)	363104(7.28 %)
total	382	62,789	4,990,592
Initial value	win	lose	win

Strategy:

For 4×4 Othello, you should go second, then choose the corner in your first step, and always choose the legal place that is most far away from where your enemy have just moved. If you go first, you can choose the legal place that is closest to your enemy's last move to make the game last long.

For bigger chessboard, corners are the most important places. Edges are the second important places. The general strategy is to occupy the corners and edges of the chessboard, and try not to give your enemy opportunities to get to these important places.

How to get our software:

https://github.com/ashawkey/CGT_player

How to install and play:

Download ZIP. Run cmdPlayer.py or guiPlayer.py directly, then follow the built-in help.

You need to solve the game and save the generated SQLite database first.

Note the game of Othello takes lot of time and space to solve for size larger than 5*4.

If you want to change the size of the chessboard, change the *Col* and *Row*, in class game_Othello of othello.py.

For more details, see the web set:

https://github.com/ashawkey/CGT_player/blob/master/README.md