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ECS 170 Project 2 Question 1

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Our evaluation function returns a score based on the current board state. We check every (x,y) position of the board, and per position, we check the consecutive 4 pieces in the horizon, vertical, left diagonal, and right diagonal directions. The total board state score is based off the sum of these consecutive scores based off the criteria:
If next consecutive piece is not ours, +0
If there are 1 blank(s) and 3 piece(s), +300 / -300
If there are 2 blank(s) and 2 piece(s), +100 / -100
If there are 3 blank(s) and 1 piece(s), +10 / -10
If the current state is game over, +25,000 / -25,000
If the current position we are checking belongs to the opponent, then the score is a sum of the negative values above.

Our evaluation function is reasonable because in Connect 4, the more consecutive pieces a player has, the more likely that player is to win the game. Our function mimics this idea by giving more weight to moves that would yield more consecutive pieces and decreases the weight accordingly as the number of consecutive pieces decreases. Ultimately, a weight of 0 would be assigned when an opponent piece is encountered because there is no chance of winning if a certain straight line is blocked. It is reasonable for our function to check all directions (vertical, horizontal, diagonals) because it needs to take into account all possible directions that it could win, so it could produce more accurate scores per move.

$totalScore = \sum(hScore + vScore + rdScore + ldScore)$
$hScore = sum(f(n)) \quad vScore = sum(f(n))$
$rdScore = sum(f(n)) \quad ldScore = sum(f(n))$
$f(n) = 0$ if mismatched consecutive pieces or a blank
$f(n) = 300\ |{-300}$ if 1 blank and 3 pieces; us | opponent
$f(n) = 100\ |{-100}$ if 2 blank and 2 pieces; us | opponent
$f(n) = 10\ \ |\ \ {-10}$ if 3 blank and 1 pieces; us | opponent

For board state (us: x, opponent: o)

	o_7					
	x_4	x_5	x_6			
	x_1	o_2	o_3			

Our State Score = 410

$$
\begin{aligned}
totalScore = & \\
& + (hScore = (0_1 - 100_2 - 10_3 + 300_4 + 100_5 + 10_6 - 10_7)) \\
& + (vScore = (0_1 - 0_2 - 0_3 + 0_4 + 10_5 + 10_6 - 10_7)) \\
& + (rdScore = (100_1 - 0_2 - 10_3 + 10_4 + 10_5 + 10_6 - 10_7)) \\
& + (ldScore = (0_1 - 0_2 - 0_3 + 0_4 + 0_5 + 10_6 - 0_7))
\end{aligned}
$$