ECS 170 Winter 2017
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1. Our evaluation function works by accumulating all the possible positions of connecting four in a row (vertically, horizontally, and diagonally), and adding or subtracting its weight constant, depending on the whether or not that is the player's piece and how close it is to four in a row . On a 7x6 board there are 69 possible positions in which a player can connect four:

- 24 ways horizontally (4 positions per row * 6 rows)
- 21 ways vertically (3 positions per column * 7 columns)
- 24 ways diagonally (12 ways per diagonal direction * 2 diagonal directions)

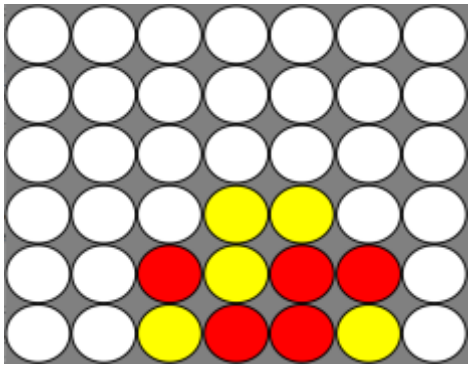
Any of the 69 given positions are only eligible to be a winning position if it contains either no tiles or only tiles of one color, otherwise that position is "blocked" and has zero evaluation value, i.e. there is no potential for that position to become a "line of 4". Furthermore, if a position is still eligible to win, it has a higher chance of winning the closer it is to four in a row.

Thus, our evaluation function is

$$f(n) = C_1*(R_1-Y_1) + C_2*(R_2-Y_2) + C_3*(R_3-Y_3) + C_4*(R_4-Y_4)$$

C_n = weighted constant for each n in a row -> 10^n
R_n = # of n in a row positions red player (MAX/first player) can still win
Y_n = # of n in a row positions yellow player (MIN/second player) can still win

It does not suffice to simply add up the number of 1,2,3,4 in a row of a particular player and multiply it by the weighted constants; it must be taken into account the opponent's position of winning. To elaborate, a player's move could not only put them in a better position to win, but also put their opponent in a worse position to win. Thus, our evaluation function is **reasonable** because it does not only calculate a player's position of winning, but also subtracts that from their opponent's position of winning ($R_n - Y_n$).



Taking this gameboard as an example:
$f(n) = C_1*(R_1-Y_1) + C_2*(R_2-Y_2) + C_3*(R_3-Y_3) + C_4*(R_4-Y_4)$
$f(n) = 10*(2-7) + 100*(2-4) + 1000*(0-1) + 10000*(0-0)$
$f(n) = -50 + -200 + -1000$
$f(n) = -1250$

Since $f(n) < 0$, yellow (MIN/Second player) is in a better position to win. A quick eye test can verify that yellow is in a better position to win because a lot of red's pieces are blocked by yellow's.