Evaluation Functions

In order to create the heuristics, I've created three different evaluation functions.

Second Move Map

It counts the available moves in two turns, it counts each open position only once, even if it can't be reached in two turns.

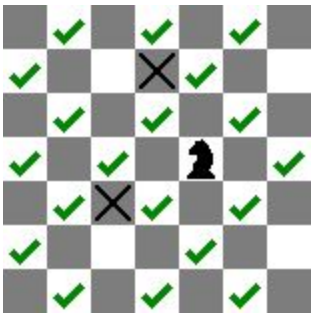

Image 1: Second Move Map available moves.

Second Move Path

It counts the available moves in two turns, if a position can be reached by two different paths, it is counted two times.

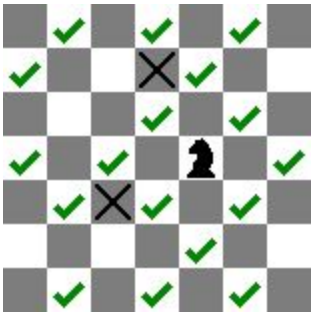

Image 2: Second Move Path available moves.

Second Move Map Weighted

Is the product between second move map score and open move score.

Heuristics

In order to create different heuristics, I've combined the evaluation functions described above in the same way the Improved score function does, subtracting the value of the function for the opponent to mine. The results of the performance against different agents can be found in the table below, where Custom is second move map, Custom_2 is second move graph and Custom_3 is second move map weighted:

```
                        *************************
                             Playing Matches
                        *************************

 Match #    Opponent    AB_Improved   AB_Custom   AB_Custom_2  AB_Custom_3
                         Won | Lost   Won | Lost   Won | Lost   Won | Lost
     1       Random      10  |   0     9  |   1     7  |   3    10  |   0
     2       MM_Open      6  |   4     6  |   4     6  |   4     8  |   2
     3      MM_Center     9  |   1     7  |   3     7  |   3    10  |   0
     4     MM_Improved    5  |   5     6  |   4     5  |   5     5  |   5
     5       AB_Open      4  |   6     5  |   5     5  |   5     6  |   4
     6      AB_Center     6  |   4     4  |   6     5  |   5     5  |   5
     7     AB_Improved    5  |   5     5  |   5     3  |   7     6  |   4
    --------------------------------------------------------------------------
               Win Rate:      64.3%        60.0%        54.3%        71.4%
```

We can see that *second move map weighted* perform slightly better than the improved heuristic, I think that this is because the agent is looking one step further when applying the evaluation function, also, *second move map weighted* is better than *second move map* because it corrects how many moves the agent will have available in the future by the ones that it has just on the next turn, making more likely that the agent will pick up moves that lead to broader trees, which in the end leads to better chances of winning.