Heuristic 1

The first heuristic applied and the core of the other ones, is the one that is suggested during the "lectures": $\#my\_moves - \#enemy\_moves$. However, modification was applied to apply a tuning factor in order to increase the performance as was read and suggested in the forums. So the final equation used is as follows:

$$\#my\_moves - factor * \#enemy\_moves$$

Heuristic 2

In order to improve the first heuristic, a new condition was added. As was showed during the classes, the more wins happens when the center of the board is conquered, since more moves are available. In order to force that, during the first movements of the game the player will only try to reduce its distance to the center of the board, giving a high score to the positions that are close to the center. The number of movements that are selected for this transition period can be tuned by modifying the variable $nmovements$ .After this period, the same heuristic 1 is applied again.

Heuristic 3

This time, the idea that is developed here is to check if our player has common moves with our opponent and try to exploit this in order to narrow the possible moves to our enemy. In order to do that the intersections of the set of moves available for both players is calculated. Then with the length of this set and a factor the heuristic 1 is "weighted".

This technique is applied after the transition period of winning the center. So this third heuristic is an improved version of the second one.

Results

Based on a few experiments, the third heuristic seems to be better than the other two in average, even though sometimes does not get the best score. More work should be done in order to better tune the parameters in the three heuristics, since I am not very confident that the parameters that I used are the optimal ones.

Recommendation

Based on the results obtained during the experiments, it is possible to recommend the thir d heuristic. Not only for the results that are better, but also because the implementation cost it is not that important. Compared to the first heuristic, the simplest one, just an if statement is added and a few calculations that are not very demanding in computation cost (not interminable for loops nor anything similar).

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

Match #    Opponent    AB_Improved    AB_Custom    AB_Custom_2    AB_Custom_3
                       Won | Lost     Won | Lost   Won | Lost     Won | Lost
   1        Random      9  |  1        9  |  1       9  |  1        8  |  2
   2        MM_Open     9  |  1        5  |  5       7  |  3        8  |  2
   3        MM_Center   7  |  3        8  |  2       8  |  2        9  |  1
   4        MM_Improved 8  |  2        8  |  2       6  |  4        8  |  2
   5        AB_Open     4  |  6        6  |  4       5  |  5        5  |  5
   6        AB_Center   5  |  5        3  |  7       7  |  3        5  |  5
   7        AB_Improved 5  |  5        3  |  7       5  |  5        7  |  3
-----------------------------------------------------------------------------
           Win Rate:     67.1%          60.0%         67.1%          71.4%
```

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

Match #    Opponent    AB_Improved    AB_Custom    AB_Custom_2    AB_Custom_3
                       Won | Lost     Won | Lost   Won | Lost     Won | Lost
   1        Random      9  |  1       10  |  0       8  |  2        9  |  1
   2        MM_Open     8  |  2        7  |  3       6  |  4        7  |  3
   3        MM_Center   9  |  1       10  |  0      10  |  0        9  |  1
   4        MM_Improved 6  |  4        7  |  3       9  |  1        8  |  2
   5        AB_Open     6  |  4        4  |  6       5  |  5        4  |  6
   6        AB_Center   4  |  6        5  |  5       4  |  6        8  |  2
   7        AB_Improved 3  |  7        6  |  4       5  |  5        5  |  5
-----------------------------------------------------------------------------
           Win Rate:     64.3%          70.0%         67.1%          71.4%
```