Isolation game - AI heuristic analysis

This document compares three different heuristics in the Isolation game. Comparison is made using pre-made python script

`tournament.py`

which is bundled in the Isolation project sources. Comparison is made against result of agent with 'improved score' heuristic used as a benchmark which takes computer performance into account.

As the best heuristic was selected heuristic number 3 - Combined heuristic.

Heuristic 1 - Count number of blank spaces around legal moves

This heuristic takes into account number of blank spaces around each possible legal move in given move. The idea behind this heuristic is that the more blank spaces are around legal moves the more moves will be possible to play in the future and vice versa for opponent, where we are trying to minimize number of blank moves around him. The priority for minimizing blank spaces for opponent is slightly higher than maximizing blank spaces for player.

Opponent	ID_Improved	Student
Random	17 - 3	17 - 3
MM_Null	16 - 4	18 - 2
MM_Open	15 - 5	16 - 4
MM_Improved	13 - 7	12 - 8
AB_Null	16 - 4	15 - 5
AB_Open	14 - 6	13 - 7
AB_Improved	16 - 4	17 - 3

Results:

ID_Improved 76.43% Student 77.14%

Heuristic 2 - Check for corners and walls

This heuristic is an improved version of 'Improved score' which takes into account count of player and opponent legal moves. The improvement is made by checking if landing moves are near walls and corners for the opponent as this will further

limit possibility for moves in the future. The resulting effect of this heuristic is we are actively trying to chase opponent into board corners.

Opponent	ID_Improved	Student
Random	18 - 2	17 - 3
MM_Null	12 - 8	16 - 4
MM_Open	14 - 6	16 - 4
MM_Improved	15 - 5	12 - 7
AB_Null	17 - 3	17 - 3
AB_Open	12 - 8	17 - 3
AB_Improved	18 - 2	14 - 6

Results:

ID_Improved 75.71% Student 77.86%

Heuristic 3 - Combined heuristic

This heuristic is the combination of the previous two and thus is the most complex. In early stages of the game, we use the second heuristic as it's faster than the other one. In later stages of the game we try to count blank spaces around every move. Combination of these two metrics yields better results overall.

Opponent	ID_Improved	Student
Random	18 - 2	20 - 0
MM_Null	15 - 5	17 - 3
MM_Open	11 - 9	15 - 5
MM_Improved	14 - 6	15 - 5
AB_Null	17 - 3	15 - 5
AB_Open	20 - 0	16 - 4
AB_Improved	15 - 5	16 - 4

Results:

ID_Improved 78.57% Student 81.43%