Heuristic Analysis

There are three heuristics used within the game agent. Each uses the mini-max algorithm with iterative deepening and alpha-beta (AB) pruning. These heuristics are being analysed against the performance of the AB_Improved test agent which uses alpha-beta pruning. The heuristic is the sum of the total moves available for the player minus the moves for the opponent. Each heuristic is weighed against a series of opponents and heuristics (these can be found in sample_players.py).

The game agent heuristics can be found in game_agent.py. There are the following functions: custom_score, custom_score2, custom_score3. I have called these Aggression, Increased Weighting and Symmetrical respectively.

Aggression was my first attempt at beating AB_Improved. I wanted to see what would happen if I increased the aggression of the player at the beginning of the game and lowered it at the end. This is based on the understanding that the beginning of the game is the most crucial to winning so the idea was to act aggressive at the start but consider riskier options at the end. To do this I took the original heuristic for AB_Improved (my moves - opposition moves) and amplified it by drastically lowering the score for positions that what lead to higher opposition moves. This is a three tiered approach that lowers the aggression at three stages: when there are 70% remaining spaces, when there are 40% remaining spaces and when there 15% remaining spaces. In my tests this produced a win rate of +2.34%.

Increased Weighting took a similar approach to Aggression but instead of getting more aggressive at the beginning of the game it took a flat approach of doubling the effect of higher opposition moves (lowering the score). In my tests this produced around the same win rate as AB_Improved.

Finally, Symmetrical would mirror any opponent position if it could, otherwise it would use the Increased Weighting heuristic. The idea was to keep away from the opponent and thus limit potential moves that could block our piece into a corner. This produced a marginally improved win rate of +2.3% over AB_Improved.

I ran this tournament 40 times and took the mean of the results (these results can be found in the results.txt along with tournament.xlsx). They are as follows:

	AB_Improved	Cusom 1	Custom 2	Custom 3
Win Rate	60.06%	62.34%	60.81%	62.3%