Heuristic Analysis

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Three heuristic are implemented in this project:

1. custom_score(): returns –inf if the current player loses the game, inf if the current player wins, and (# of player's legal moves - # of opponent's legal moves)^2 with the original move difference's sign if game is not ended.
2. custom_score2(): returns –inf if the current player loses the game, inf if the current player wins, and (# of player's legal moves + player's centrality) if game is not ended.
3. custom_score3(): returns –inf if the current player loses the game, inf if the current player wins, and the ratio of # of player's legal moves/# of opponent's legal moves if game is not ended.

The tournament results are summarized in the figure below.

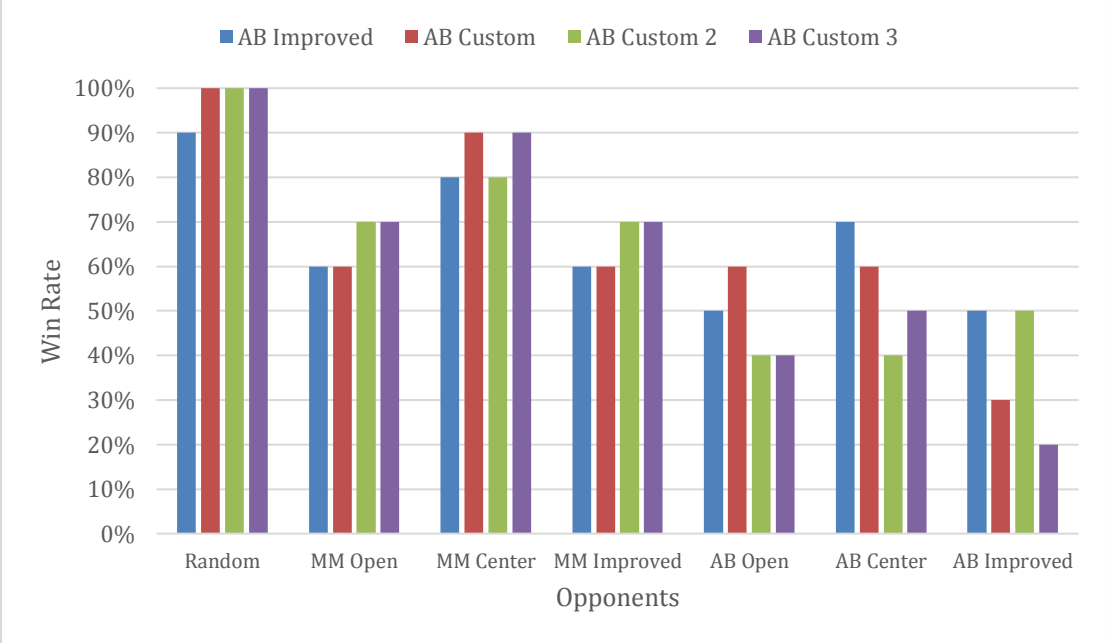

Figure 1. Summary of different agents and heuristics tournament result

The AB improved score agent has win rate of 65.7%, and the AB agent using custom scores 1, 2, and 3 has win rate of 65.7%, 64.3%, and 62.8%, respectively. AB agents using all four evaluation heuristics (improved and custom1-3) beat Random moves consistently. Our AB agents also beat the three MM agents, except for AB agent with custom2 heuristic versus MM agent with improved heuristic. When it comes to our AB agents v.s. computer AB agents, there isn't one heuristic that can consistently beat all three computer AB agents. In the games with AB agents, custom heuristic 1 is the most comparable to AB Improved heuristic, while the other two custom heuristics performed worse.

In terms of depth, the three heuristics are ranked 1>3>2. In terms of complexity, the three heuristics are ranked 2>3>1. Custom score 3 will go deeper since it's the relatively simplest in terms of computation, which will allow deeper search. Custom score 2 will go the shallowest since it computes both difference between

the two players and the center score, hence in the ID process it won't go very deep due to the time constraint. Custom score 1 is recommended since it performed reasonably well against opponents and better than the AB improved score benchmark. Custom score 1 is relatively easy (compared to custom score 2) and allows better trade-off between speed and complexity for better performance at deeper search.