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AIND Project 2: Advanced Game Playing
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Heuristic Analysis

Three heuristic functions were created and examined against the *ID_Improved* agent.

Fig. 1. Tournament Results Table

Player	Random	MM_Null	MM_Open	MM_Impr	AB_Null	AB_Open	AB_Impr	AVERAGE
ID IMPROVED	97.00%	87.00%	54.00%	46.00%	79.00%	60.00%	52.00%	**67.86%**
HEURISTIC 1	94.00%	82.00%	59.00%	53.00%	75.00%	62.00%	62.00%	**69.57%**
HEURISTIC 2	93.00%	88.00%	68.00%	59.00%	79.00%	72.00%	64.00%	**74.71%**
HEURISTIC 3	98.00%	93.00%	78.00%	73.00%	93.00%	72.00%	73.00%	**82.86%**

Heuristic One:

This heuristic function outputs a score equal to the difference in the number of moves available to the player and two times the number of moves available to the opponent. By simply adding weight to the opponent's moves, we force our agent to be more selective about its moves, performing more aggressively as a result.

The agent performed slightly better than *ID_Improved* using this heuristic. See Fig. 1.

Heuristic Two:

This heuristic function outputs a score equal to the difference in the number of moves available to the player and the weighted number of moves available to the opponent. In this case, there's additional weight applied, which decreases as the game progresses. The reason for trying this heuristic approach is based on the premise that the agent can afford to be more selective at the beginning of the match, but not so much towards the end where there are less possible moves available.

The agent performed better than *ID_Improved* using this heuristic. See Fig. 1.

Heuristic Three:

This heuristic function outputs a score equal to the difference in the number of moves available to the two players in the two subsequent rounds. Just like before, decreasing weight is applied to the opponent's moves. The reason for trying this heuristic is based on the assumption that a reasonable advantage can be obtained if the agent can weight its options a bit deeper. This approach gives the agent some valuable insight into future states of the game.

The agent performed considerably better than *ID_Improved* using this heuristic. See Fig. 1.

Conclusion:

We conclude that the third heuristic function should be used by the agent, based on the following observations:

1. Performance data shows that *Heuristic Three* outperforms *ID_Improved*, as well as the other two heuristics.

2. It's consistently better than *ID_Improved*, *Heuristic One* and *Heuristic Two* against *all* opponent types.

3. It's a simple function that doesn't add a significant computational burden.

Fig. 2. Average Wins for Agents