Analysis of Isolation Heuristic Functions

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Choice of the heuristic that selects the next move among a set of possible alternatives is a critical factor in the success of a game playing agent. Often this function must balance the need to identify good moves quickly with that of a more exhaustive search, which will potentially identify options with a better overall change of success.

For this implementation of the game "Isolation," three heuristics were implemented. The descriptions of these three heuristics is as follows:

- **L1 Score Difference**: The difference between a player's own remaining moves and those of the opponent's is returned. This is necessarily not an absolute value to ensure that the moves favor the player in question; however, I have referred to the function with the "L1" connotation to note that it is a direct difference.
- **L2 Score Difference**: The difference between the square of a player's own remaining moves and the square of the opponent's. As before, the function is set up so the difference is positive for an option where the current player has more moves than the opponent.
- **L2 Difference and Location**: As before, the difference in squared value of remaining moves for player vs opponent is used. However, a second term is included which is the sum of the distance from the center of the board in both the horizontal and vertical axes. This will add an additional bonus for moves towards the edge of the board.

The results of seven matches, each consisting of 200 games, using one of the heuristic functions described above is shown in the table below:

	ID Improved			Student		
	Wins	**Losses**	**Percent**	**Wins**	**Losses**	**Percent**
L1 Score Difference	853	547	**60.9**	839	561	**59.9**
L2 Score Difference	807	593	**57.6**	888	512	**63.4**
L2 Difference and Location	834	566	**59.6**	932	468	**66.6**

Based on these results, the best heuristic was determined to be "L2 Difference and Location" because it has the highest win percentage and that percentage is greater than all of the ID Improved trials.

There are other heuristic functions that could be explored as well in the future, such as determining reachable space (i.e. a flood fill). The coefficients and associated exponents could be further tweaked, and the function could dynamically change based on the number of moves completed. Given more time and powerful hardware, it would be desirable to run more games to get a more stable percentage win, as well.