Heuristic Analysis

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CUSTOM_SCORE (CENTRAL ZONE)

In this heuristic I sought to apply a sort of centric weighted approach to the scoring. Rather than simply having a distance evaluation from the edge to the center I applied weights only within the central zone, which I have defined as the area 1.5 units less than width/2 and height/2 to 1 unit greater than the width/2 and height/2. This choice of factors was selected to allow for odd sized boards to still produce integer positions that qualified within this central zone.

In addition to this highly valued central zone, an additional weight may be applied that values the last useful corner position. Those that allow the piece to make a possible 6 moves while remaining close to the border. In cases where the size of the board causes these positions to overlap, the central zone weight is given priority.

Finally, in combination with these zone weights I applied a simple remaining move evaluation that was weighed towards the opponent to provide more conservative/defensive scores.

The overall effect was one that gives higher value to central moves and "corner" moves than surrounding positions, but never so much that a move that has more future moves is not valued higher.
This heuristic also includes end state checks before spending any computational time on scoring.
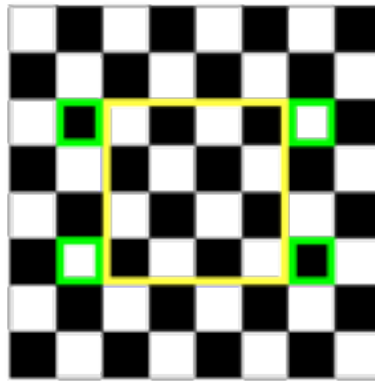
This resulted in a significant (~10%) increase over the AB_Improved heuristic. More tuning of this heuristic is needed to reach more competitive levels though.

Future considerations for this heuristic that I would like to attempt include adding a strategy for weighting moves to a quarter position heaviest, and then moving towards the center (when in a quarter position), and moving from the center to a quarter position unless they are no longer available.
This sort of in and out approach is one that I believe can maximize a players time spent in the center of the board, thus maximizing their chances of winning.

CUSTOM_SCORE_2 (AGGRESSIVE)

In this heuristic I applied a simple move comparison aggressively weighted towards the active player at a ratio of 2:1. Surprisingly this heuristic, even in it's simplicity, routinely performed at a higher than expected rate, generally outperforming AB_improved by a small margin. (1-2%)

CUSTOM_SCORE_3 (FUTURE + DEFENSIVE)

The final heuristic evaluates future conditions of the proposed move. By applying a check on the next possible moves of the proposed move this heuristic gives the most value to moves that have a high future potential by summing the possible positions together over the list of possible moves.
Additionally, the heuristic applies a defensive weight to the opponents future moves so that a conservative score is returned.
This heuristic performed extremely well, on average performing nearly the same or slightly better than the Central Zones heuristic.

Match #	Opponent	AB_Improved	AB_Custom	AB_Custom_2	AB_Custom_3
Won I Lost		Won I Lost	Won I Lost	Won I Lost	Won I Lost
1	AB_Improved	85 I 115	108 I 92	97 I 103	111 I 89
Win Rate:		42.5%	54.0%	48.5%	55.5%

SELECTED HEURISTIC
The heuristic custom_score (Central Zones) was chosen due to a number of factors.
First, it has the ability to quickly exit based on end game conditions such as active player winning, or opposing player winning. This saves cycles and leads to more trees being evaluated.

The complexity of the heuristic is another factor, the combination of a central weighting mechanism, along with a defensive, opponent weighted, remaining moves evaluation produce a scoring heuristic that encourages a play style that moves towards the center and corner zones, while always considering the total moves possible to the player.

Finally, the heuristic was chosen simply due to it's win rate vs AB_Improved. Winning by an average of ~10% more than AB_Improved. While custom_score_2 (Future + Defensive) has a comparable win percentage, it is my opinion that custom_score is a better overall heuristic that may still require some fine tuning to achieve it's best results.