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Analysis of Heuristic Scoring Functions For Isolation Game

As part of the Isolation Game Project, I implemented the following heuristic scoring functions:

1. Adversarial: number_of_my_moves – 0.7x number_of_opponent_moves
2. Adversarial Optimized: number_of_my_moves – 0.7x number_of_opponent_moves but alternative implementation
3. Cooperative: number_of_my_moves + 0.5x number_of_opponent_moves. This heuristic tries to cooperate wit the opponent (Doesn't really make sense)
4. Center: number_of_my_moves + try to stay close to the center of the board
5. Margins: number_of_my_moves + try to stay close to the margins of the board
6. Student: number_of_my_moves – 0.7x number_of_opponent_moves + stay close to center

Performance:

Heuristic \ wins against	Random	MM Null	MM Open	MM Improved	AB Null	AB Open	AB Improved	Percentage of wins
adversarial	38	33	28	22	34	24	19	70.71
adv optimized	38	28	22	28	37	26	18	70.36
cooperative	39	28	26	18	20	14	18	58.21
center	37	21	26	17	27	25	22	62.50
margins	38	32	22	22	27	22	21	65.71
ID_improved	32	36	25	25	30	26	23	70.36
Student	38	31	27	26	27	25	23	70.36

Conclusions:

- As expected, "cooperative" does not make sense in adversarial search.
- Trying to bias the heuristic to staying close to the center or close to the margins does not help
- I was not able to provide a more efficient implementation of the Improved heuristic (a better way to implement it in python)
- using a weight different then 1 for number_of_opponent moves can provide small improvements over ID_improved.
- I have observed significant variation in results between executions of the tournament script (for ex 5% for ID_improved). This makes me think it should be possible to improve the underlying alpha-beta algorithm (common to all heuristics) to better handle some specific situations.
- Student, Margins and ID improved are the only heuristics to defeat each opponent in the evaluation.

I chose Student as the final implementation because it is comparable to ID_Improve in performance and defeated every direct opponent during the tournament. Adversarial had a slightly better performance in the tournament, but won less then 50% of the matches against AB Improved.