Reykjavík University Fall 2017
SC-T-732-GAPL
General Game Playing

Monte Carlo Tree Search
Project 4 - Heuristics

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We implemented QRAVE and Tree-Only-MAST heuristics for MCTS and compared their performance in various games with that of normal MCTS, in addition to a random gamer in one case. The games chosen were the following:

- Single player: Queens
- Two-player: nim2, breakthrough
- Four-player: 4pttc

In all games we gave the players a 30 second metagame phase and a 10 second playtime. We used $C = 50$, where C is the exploration/exploitation factor as all scores are on the scale of 0-100. For QRAVE we used $k = 500$ where k is the number of iterations the for which the algorithm will place more emphasis on the QRAVE scores. For MAST we used $\tau = 10$ where τ controls greediness in the rollout.

We used a prover state machine for all testing, running each game for every heuristic 10 times and averaged or summed up the results (see the charts for each case).

The average number of moves for each game were:

- Queens: 10 (queens is always 10 moves)
- Nim2: 13
- Breakthrough: 50.9
- 4pttc: 20.3

From our relatively small sample space, QRAVE was completely dominant in every game. This could be explained by the games selected and we can not conclude that this is an indication that this will always be the case, since some games favor specific heuristics. MAST did outperform the original MTCS gamer in Queens, but performed worse in 4pttc.

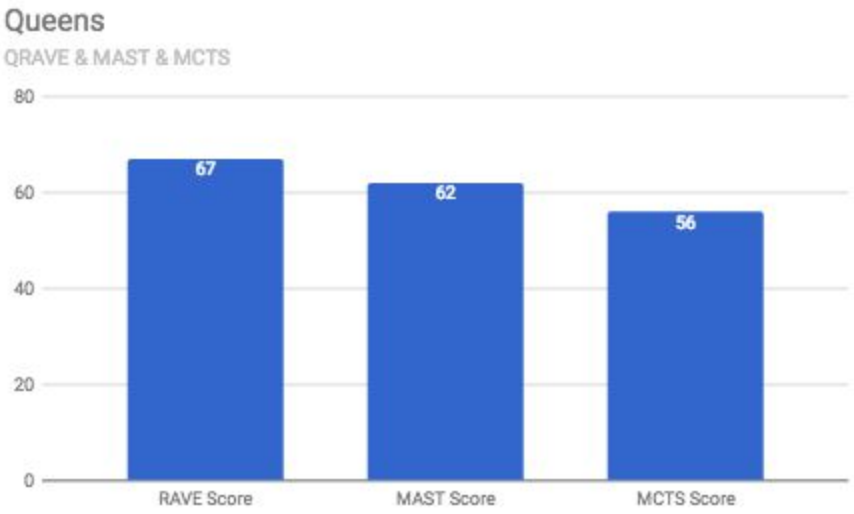

Figure 1: Average score for all three players after 10 games each

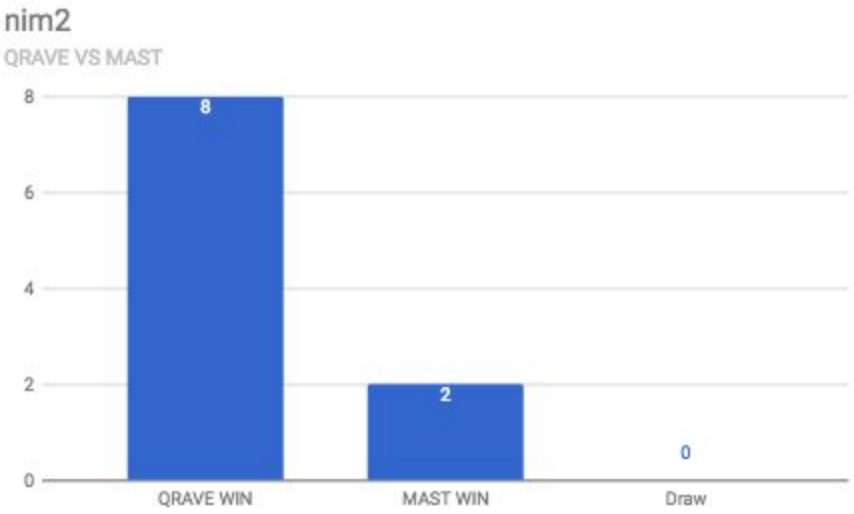

Figure 2: Number of wins for each player after 10 games.

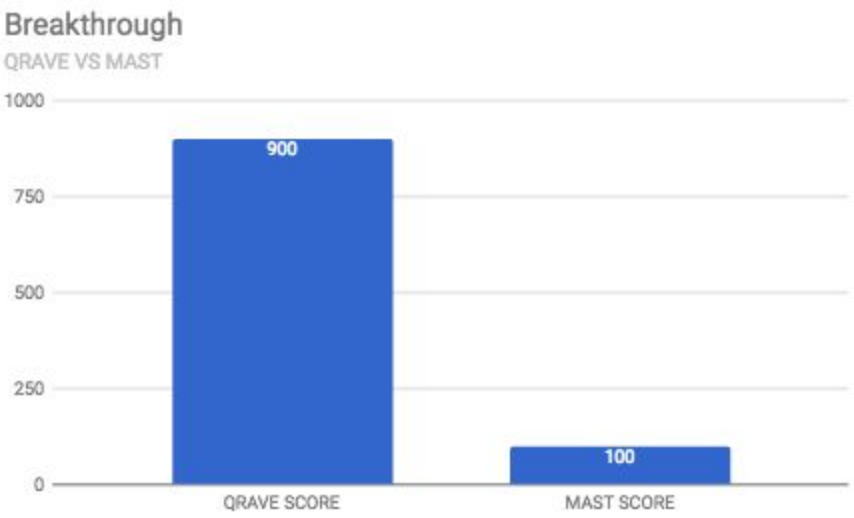

Figure 3: Summed up score for both players after 10 games.

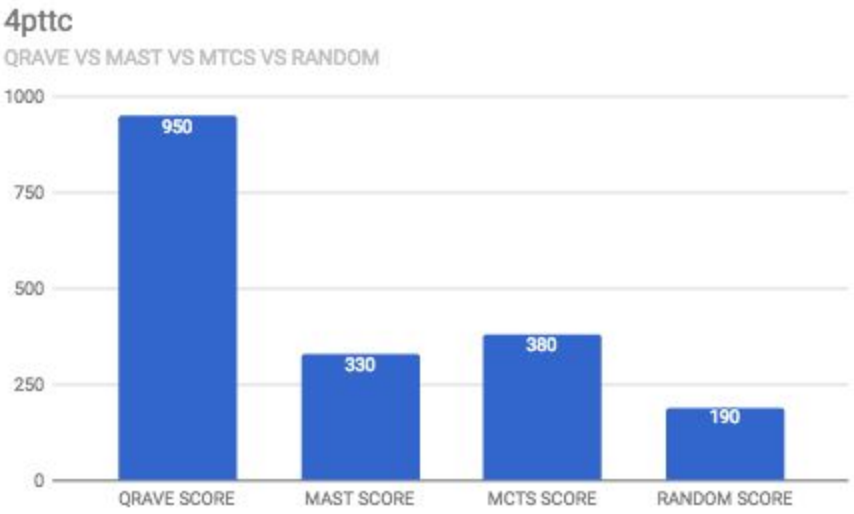

Figure 4: Summed up score for all players after 10 games.