

# AI4GAMES - Lab 1

Report for tasks 1, 2, 3 and 4

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## 1 FlatMC and MCTS with UCT

All the solutions were implemented in C++ and run on CodingGame

### 1.1 FlatMC

After implementing flatMC my bot managed to get to around 200th place in Silver League on CodingGame.

Simulation data:

- first round when all small boards available: 1500-1600 simulations
- first round when forced to play in one small board: 26000-32000 simulations
- regular round when all small boards available: 250 simulations
- regular round when forced to play in one small board: 2600-3200 simulations

### 1.2 MCTS with UCT

After implementing MCTS with UCT and random simulation, my bot managed to get around 380th place in Gold League.

Simulation data:

- first round when all small boards available: around 3100 simulations
- first round when forced to play in one small board: around 3400-3600 simulations
- regular round when forced to play in one small board: starting from around 350 and growing as the game progresses to around 1000-2000 simulations
- regular round when all small boards available: same as above

## 2 Enhancements

### 2.1 MAST

Simulation data:

- first round simulation decreased to around 1300
  - regular round simulations decreased to around 130 at the start
- Place in Gold League change: 460 :(

### 2.2 RAVE

Simulation data:

- first round simulation around 2300
  - regular round simulations decreased to around 250 at the start
- Place in Gold League: 460

## 2.3 MAST + RAVE

Simulation data:

- first round simulation around 1200
- regular round simulations decreased to around 120 at the start

Place in Gold League: 520 :(

## 3 Parameter Tuning

I will be running test on cg-brutaltester against my MCTS with UCT selection. First I will run tests to set up a base benchmark for all solutions and then try to find better parameters.

For all of these solution the biggest issue is that it significantly lowers the number of performed simulations, so I will first try to make them faster.

### 3.1 MAST

Base(100 games): Win ratio - 35.00%  
Speed up(100 games): Win ratio - 40.00%  
Decrease old stats(300games): Win ratio - 40.00 %  
Epsilon 0.4 (300games): Win ratio - 43.00%  
Logic change, p 0.3 (300 games): Win ratio - 44.00 %  
Decrease old stats 0.7 (300games): Win ratio - 36.00 %  
p 0.2, no decrease (300games): Win ratio - 42.00 %  
p 0.35, no decrease (300games): Win ratio - 45.00 %  
p 0.32, no decrease (300games): Win ratio - 42.00 %  
p 0.27, no decrease (300games): Win ratio - 42.00 %

### 3.2 RAVE

Base(100games): Win ratio - 36.00%  
Speed up(300 games): Win ratio - 41.00 %  
K 800 to 2000(300games): Win ratio - 35.00%  
K 500(300 games): Win ratio - 40.5%  
K 1000(300 games): Win ratio - 35.00%

### 3.3 RAVE + MAST

Base(100games): Win ratio - 34.00%  
Pragma speed up(300 games): 43.00%  
Small logic change in mast, epsilon 0.2 (300games): 30.0%  
Rave K=2000(300games): Win rate 40.0 %  
Rave K = 4000(300games): Win rate 33.0%  
All these win rates are much higher if played as player 1 - interesting.

## 4 Method Comparison

	UCT	MAST	RAVE	MAST+RAVE
UCT	x	67:33 — 45:55	58:42 — 38:62	64:36 — 35:65
MAST	55:45 — 33:67	x	60:40 — 30:70	64:36 — 29:71
RAVE	62:38 — 42:58	70:30 — 40:60	x	69:31 — 38:62
MAST+RAVE	65:35 — 36:64	71:29 — 36:64	62:38 — 31:69	x

First values in a cell are the results when fighting as player 1, second as player 2.

It seems like playing the first move is very beneficial to the player.