



Analyzing the best strategies and developing AIs for the 7 Wonders game

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Introduction

-Brief explanation of the game and the rules

- 3 to 7 players, 3 ages and 6 turns per age
- Types of cards implemented (Military, Resources, Civil and Scientific) and rewards
- Trading cards and resources, sacrificing cards, wonder card and chain cards
- Rotation of cards after each turn

-Objectives of the TER

- Develop strategies (Resource, Civil, Military and Scientific)
- Develop 2 AIs (Guaranteed AI & Ambitious AI) that uses efficiently strategies developed to win the game
- Comparing the 2 AIs
- Analyzing results to know which strategy works best for which age

Tasks Done

1. Guaranteed AI

- Uses strategies developed by composition (multiple strategies for same or different age)
- How the AI chooses the card to be played
- When the AI changes strategy
 - i. Maximum state reached
 - ii. Sacrifice action

How Guaranteed AI play a card

Play chain card

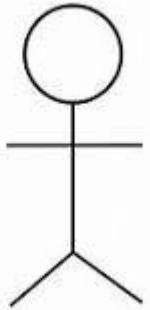


How Guaranteed AI play a card

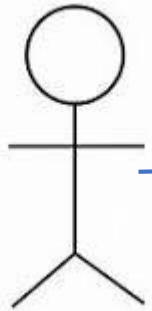
No chain cards in hand

X

Play chain card



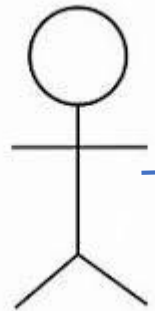
How Guaranteed AI play a card



Play chain card

Play wonder card

How Guaranteed AI play a card



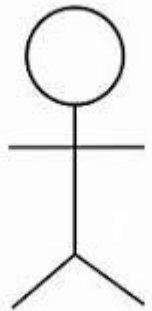
No wonder cards in hand



Play chain card

Play wonder card

How Guaranteed AI play a card

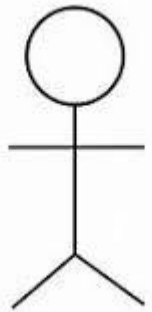


Play chain card

Play wonder card

Play a strategy card

How Guaranteed AI play a card



No strategy cards in hand

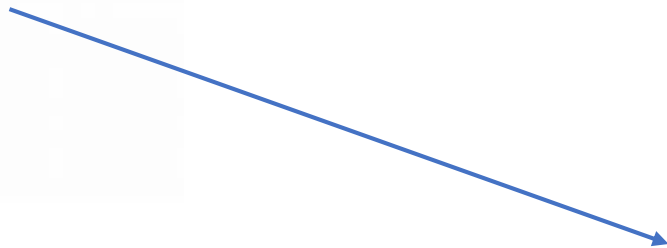
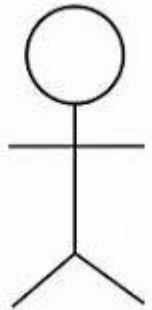
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Play chain card

Play wonder card

Play a strategy card

How Guaranteed AI play a card



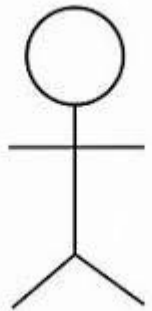
Play chain card

Play wonder card

Play a strategy card

Play free card

How Guaranteed AI play a card



No free cards in hand

X

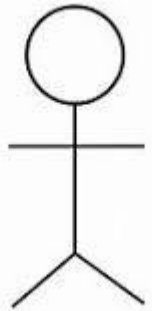
Play chain card

Play wonder card

Play a strategy card

Play free card

How Guaranteed AI play a card



Play chain card

Play wonder card

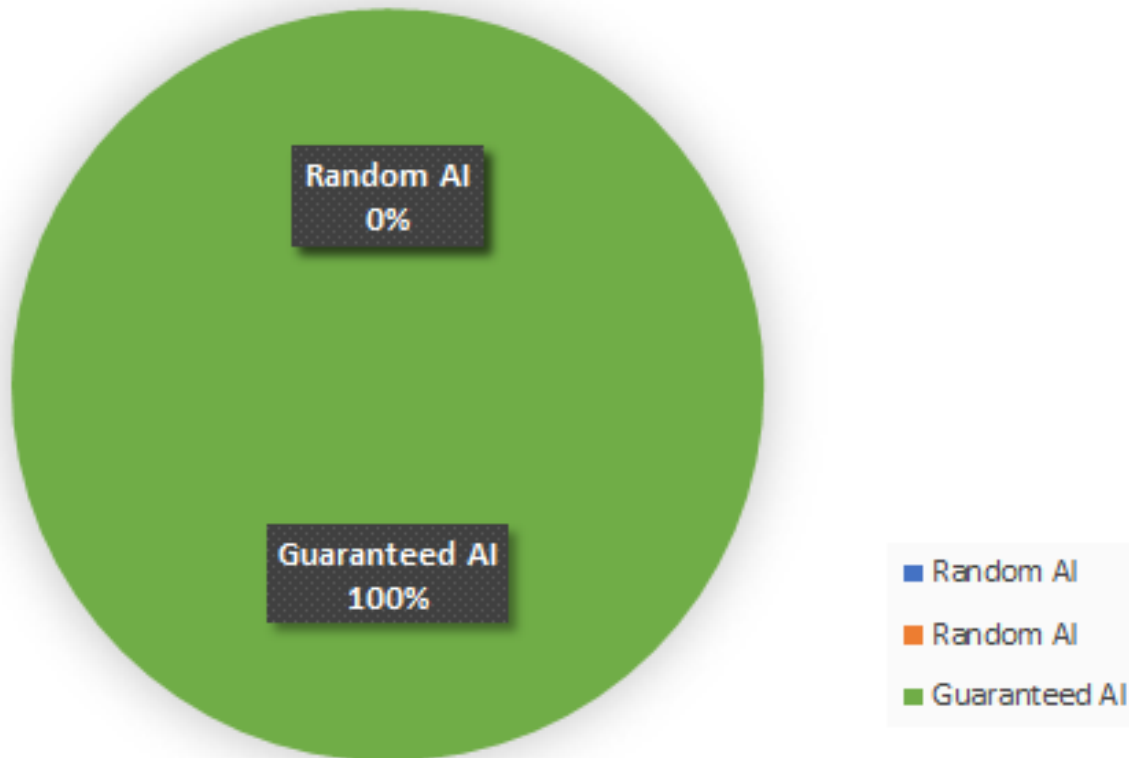
Play a strategy card

Play free card

Sacrifice a card

Performance of Guaranteed AI

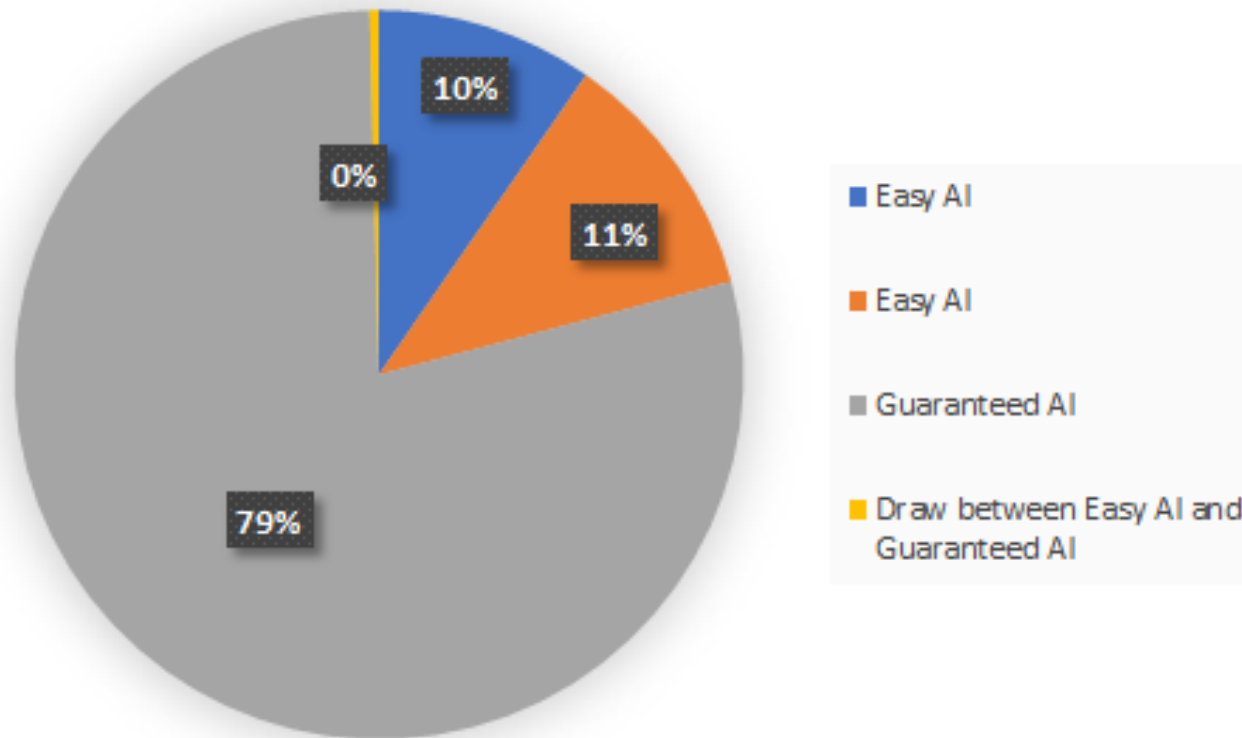
i. Against Random AI



- Guaranteed AI wins all 1000 games against Random AI
- Random AI plays a card randomly

Performance of Guaranteed AI

ii. Against Easy AI

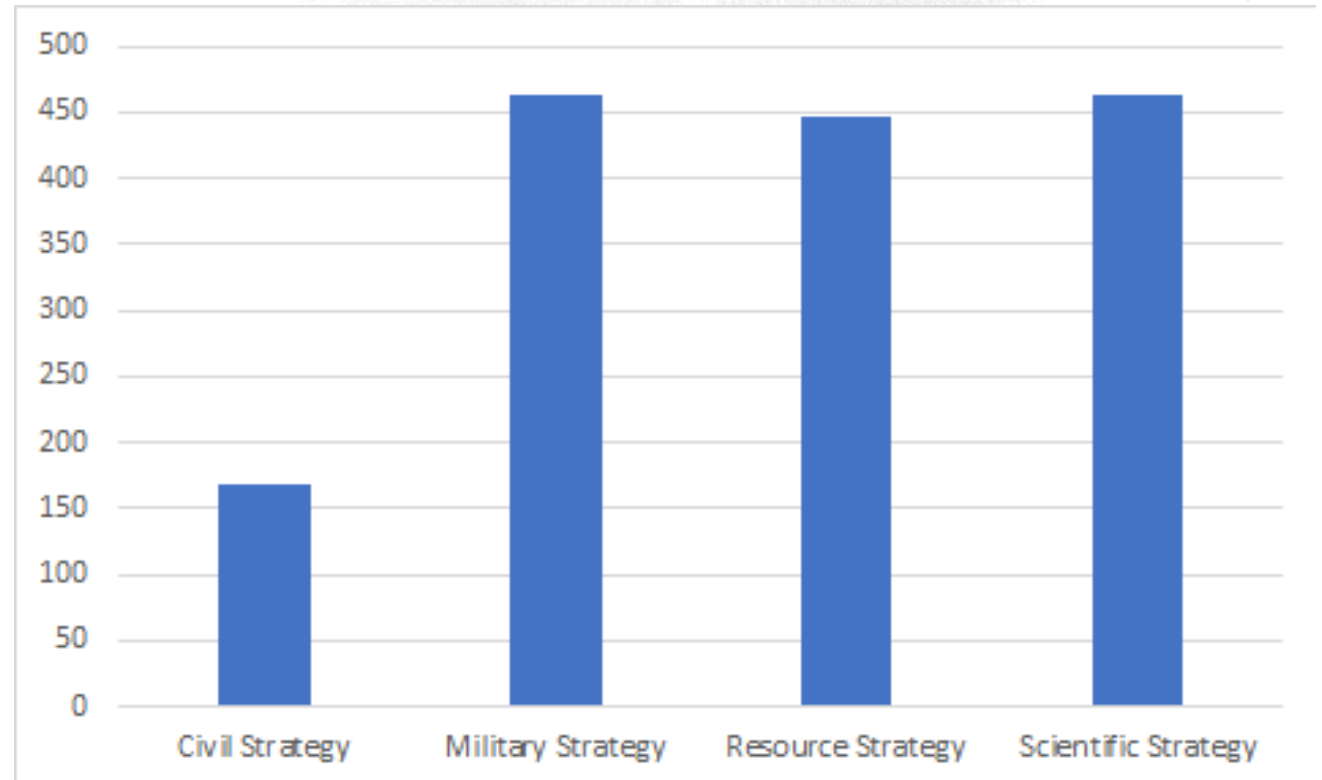


- The Guaranteed AI wins 790 games, the 1st Easy AI wins 100 games and the 2nd Easy AI wins 110 games.
- Clearly demonstrate that Guaranteed AI is far better and efficient than the Easy AI

Performance of Guaranteed AI

iii. Against Guaranteed AI

- Comparison between different strategies to use for the first age that wins the most games
- Out of 1000 games, we observed starting with :
 - Starting with Civil strategy won 168 games
 - Starting with Military strategy won 463 games
 - Starting with Resource strategy won 446 games
 - Starting with Scientific strategy won 463 games



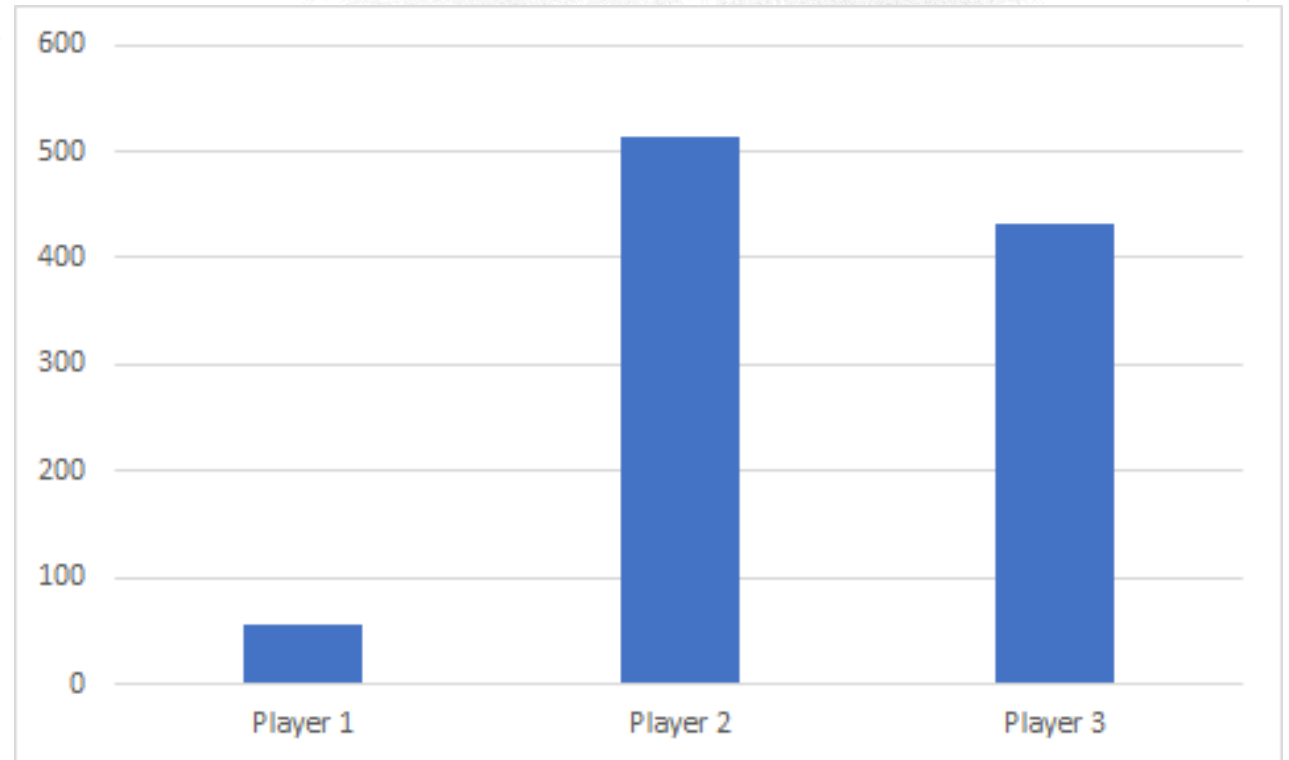
Performance of Guaranteed AI

iii. Against Guaranteed AI

- Used the previous method for each age and tested against some set of strategies to be used for all three ages

Note:

- Player 1 uses RCM, MCS and MCS
- Player 2 uses MSC, RSM and SCM
- Player 3 uses RSM, SCM and SMC



Performance of Guaranteed AI

iii. Against Guaranteed AI

- We observed that P1 won 15% more than P2
P1 = RSM, MSC, MSC
P2 = RSM, SCM, SMC
- Player 1 was better than Player 2 as having the Military strategy followed by Scientific strategy was really an advantage to winning more games.

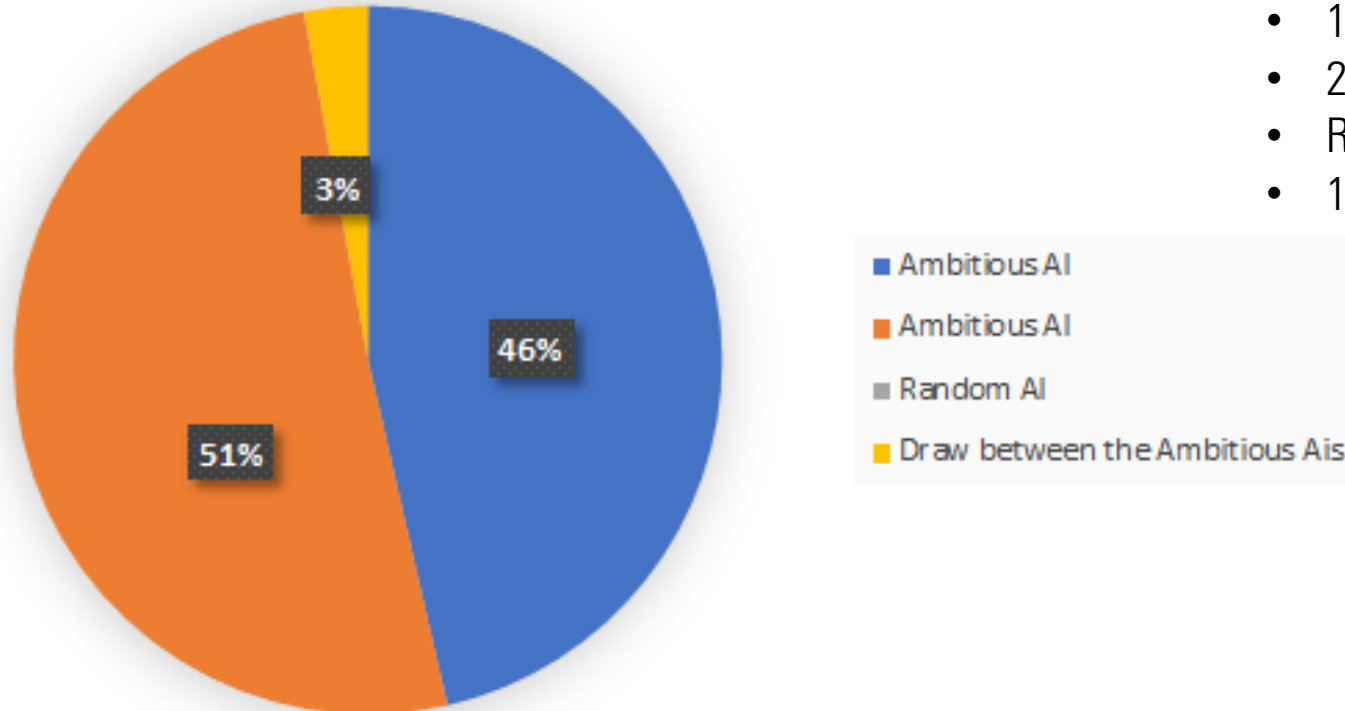
Tasks Done

2. Ambitious AI

- Derived from Guaranteed AI
- List of priorities of the AI is updated according to cards played and how the game evolves
 - ❖ Example: if AI played green cards (Scientific cards) for 6 turns, therefore Scientific strategy will become one of its priorities.
 - ❖ Evaluation of list of strategies set to each 3 turns.
 - ❖ Can adapt better to changes in the game as compared to Guaranteed AI

Performance of Ambitious AI

i. Against Random AI

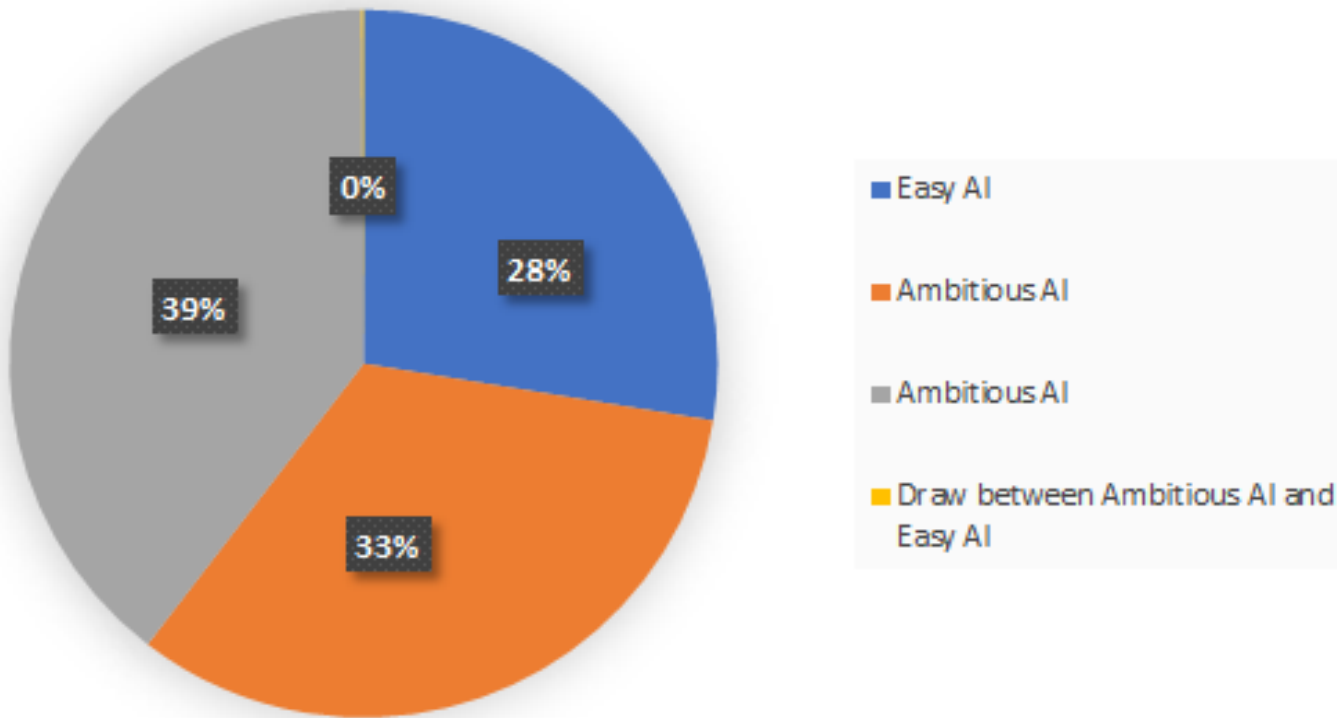


Ambitious AIs wins against the Random AI

- 1st Ambitious AI wins 510 games
- 2nd Ambitious AI wins 460 games
- Random AI does not win any games
- 1st Ambitious AI ties with 2nd Ambitious AI in 30 games.

Performance of Ambitious AI

ii. Against Easy AI

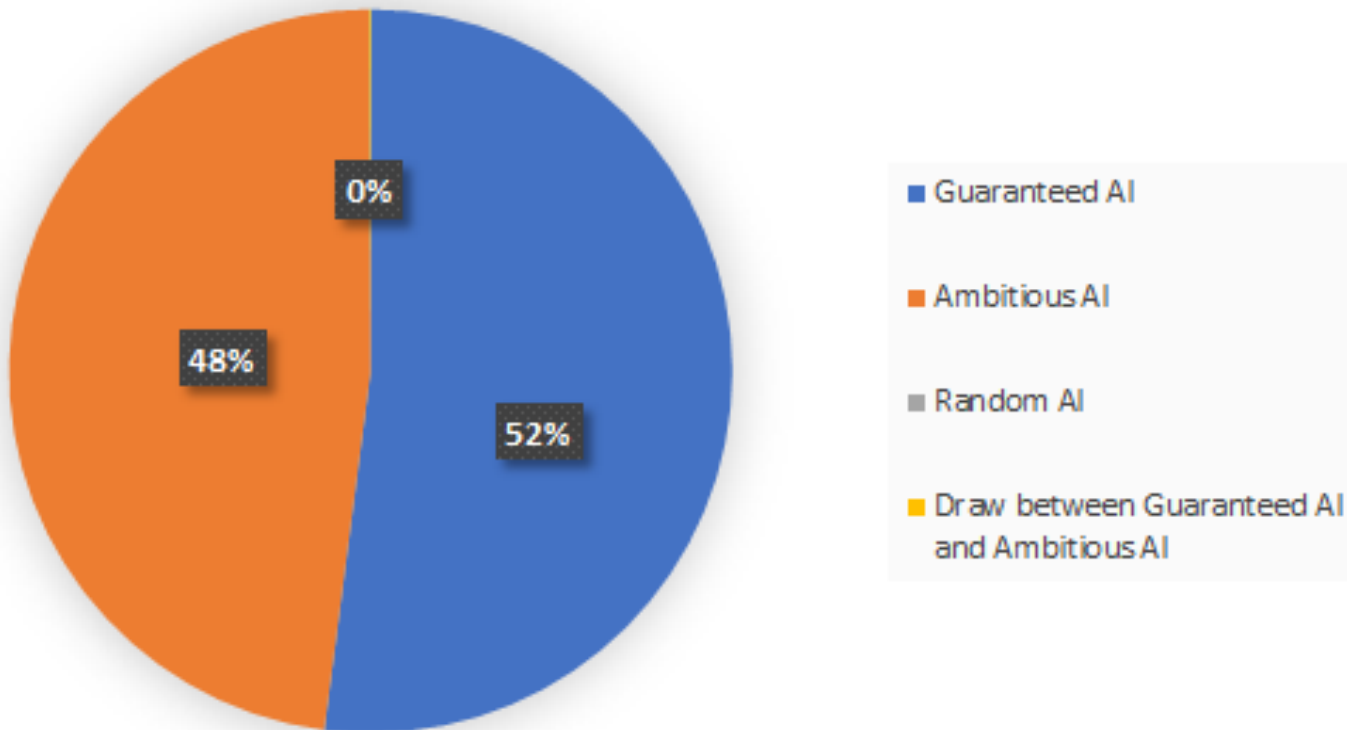


Ambitious AI wins more than Easy AI

- 1st Ambitious AI wins 390 games
- 2nd Ambitious AI wins 330 games
- Easy AI wins 280 games

Performance of Ambitious AI

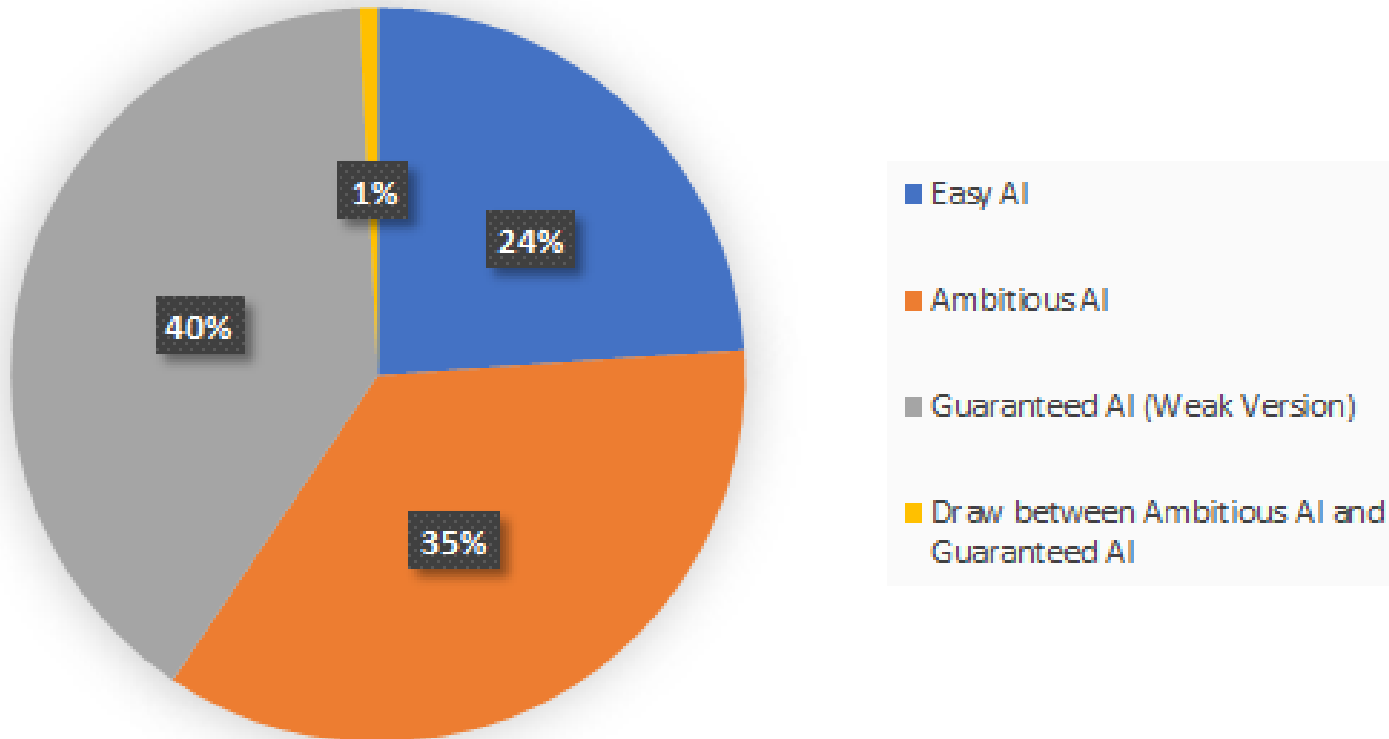
iii. Against Inefficient Guaranteed AI and Random AI



- Inefficient Guaranteed AI uses Scientific strategy and Civil strategy for all 3 ages.
- Ambitious AI wins 480 games as opposed to Guaranteed AI who wins 520 games.
- Random AI does not win any games.

Performance of Ambitious AI

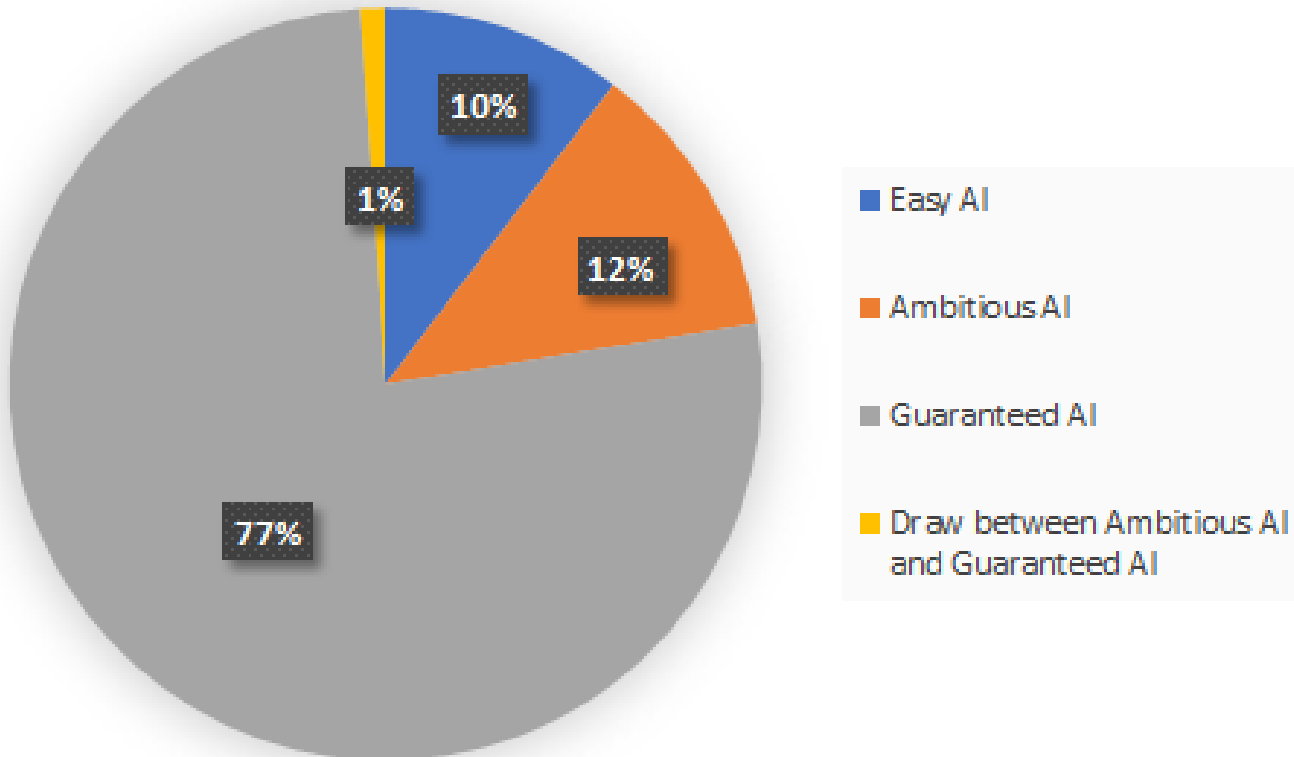
iv. Against Inefficient Guaranteed AI and Easy AI



- Inefficient Guaranteed AI uses Scientific strategy and Civil strategy for all 3 ages.
- Ambitious AI wins 350 games as opposed to Guaranteed AI who wins 400 games.
- Easy AI win 240 games.
- And there are also 10 games where Ambitious AI and Guaranteed AI.

Performance of Ambitious AI

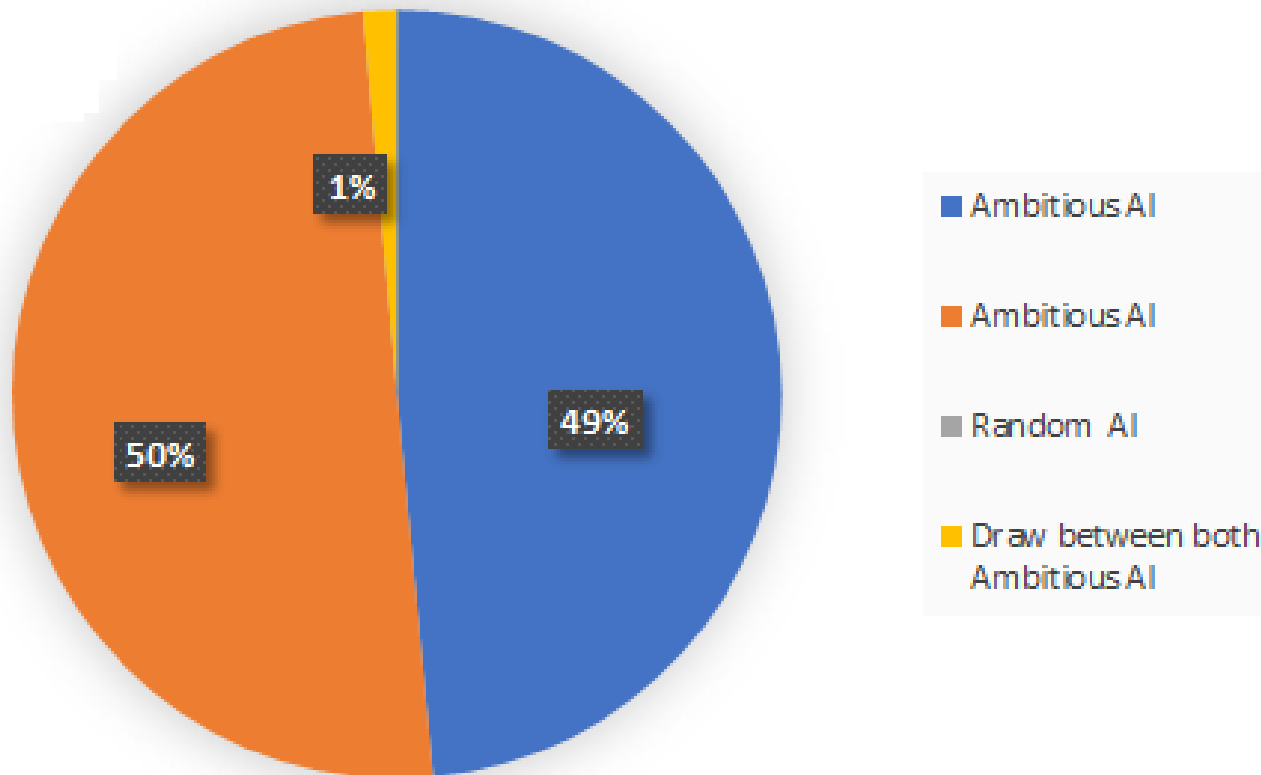
v. Against efficient Guaranteed AI and Easy AI



- Efficient Guaranteed AI uses RS, SC and SC.
- Ambitious AI wins 120 games as opposed to Guaranteed AI who wins 770 games.
- Easy AI win 100 games.
- And there are also 10 games where Ambitious AI and Guaranteed AI.
- However, we can observe that Ambitious AI is always more efficient than the Easy AI.

Performance of Ambitious AI

vi. Against Ambitious AI and Random AI



- 1st Ambitious AI wins 500 games as opposed to the 2nd Ambitious AI who wins 490 games.
- And there are also 10 games where both Ambitious AI tied.
- Random AI does not win any games.

Conclusion and future work

-We observed that the Ambitious AI is not better than the Guaranteed AI, however it is better than the Easy AI since it is not limited to playing the first playable card.

-The Ambitious AI lacks direction in the early game. It cannot always play the type of cards it has already played.

-The Ambitious AI is also derived from the Guaranteed AI, as a result, the rules implemented for each strategy is therefore inherited.

-This is a good starting point that should have allowed us to make the AI much more independent and efficient from a predetermined priority list. It was supposed to be improved by the Monte Carlo algorithm, otherwise it cannot be better than the Guaranteed AI.

-Future work

- Implement Monte Carlo algorithm.
- Develop more strategies that can be used by Ambitious AI.