AIs for the game of 7 WONDERS

Study and research project

Loïc Filippi
Alessandro Pepegna
Meryem Boufalah
Anastasiia Kozlova
Chaeyeon Shim

Table of contents

2

Game description
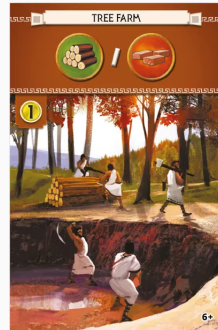
Seven Wonders' first version rules with two exceptions :

- The Wonder's resources can be bought
- Resources granted by binary choice cards can only be bought

Previous strategies

Various strategies :

- First $\rightarrow$ first card is played
- Wonder $\rightarrow$ focuses on building the step
- Random $\rightarrow$ random card is played
- "Dumb" $\rightarrow$ first card is sold

Rule-based AI

Algorithm

Priority list :

1. Best civil card

Algorithm

Priority list :

1. Best civil card
2. Military card

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward
4. Best science card at the moment

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward
4. Best science card at the moment
5. Card providing a lacking resource

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward
4. Best science card at the moment
5. Card providing a lacking resource
6. Card providing 2 or more resource types

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward
4. Best science card at the moment
5. Card providing a lacking resource
6. Card providing 2 or more resource types
7. Build step

Algorithm

Priority list :

1. Best civil card
2. Military card
3. Third age $\rightarrow$ card with the best immediate victory points reward
4. Best science card at the moment
5. Card providing a lacking resource
6. Card providing 2 or more resource types
7. Build step
8. Random card is played, else a random card is sold

Experimental method

We used *trial and error* to figure out the best arrangement of the previously stated rules.

Measurements

We put our AI against opponents with different strategies.

Rule-based	Dumb	First	Random	Wonder	Rule-based
89%	0%	11%	-	-	-
98,6%	6%	-	8%	-	-
73%	0%	-	-	27%	-
54,2%	0%	-	-	-	45,8%

Table 1: Each line presents the results of 1000 games between different combinations of AIs, "-" meaning the AI didn't participate

Monte-Carlo

Monte-Carlo algorithm.

2 approaches :

- Maximum **score**
- Maximum **wins**

Tried improvement : Simulating the end of the current age N times instead of the whole game.

MC Victory	Dumb	First	Random	Wonder	Rule-based	MC Victory	MC Score
88,9%	2,3%	8,8%	-	-	-	-	-
91,8%	5,9%	-	2,3%	-	-	-	-
77,3%	2%	-	-	20,7%	-	-	-
64,6%	0,4%	-	-	-	35%	-	-
50,9%	5,6%	-	-	-	-	43,5%	-
44,8%	1,7%	-	-	-	-	-	53,3%

Table 2: Each line presents the results of 1000 games between different combinations of AIs, "-" meaning the AI didn't participate

MC Score	Dumb	First	Random	Wonder	Rule-based	MC Victory	MC Score
92,1 %	0,1 %	7,8 %	-	-	-	-	-
97,9 %	0,8 %	-	1,3 %	-	-	-	-
78,4 %	0%	-	-	21,6 %	-	-	-
63,5 %	0%	-	-	-	36,5%	-	-
53,3 %	1,7 %	-	-	-	-	44,8 %	-
50,3 %	0,2 %	-	-	-	-	-	49,5%

Table 3: Each line presents the results of 1000 games between different combinations of AIs, "-" meaning the AI didn't participate

General performance

General performance

Rule-based	MC Victory	MC Score
34,7 %	25,2 %	40,1 %

Table 4: Winrates on 1000 games

Dumb	First	Random	Wonder	Rule-based	MC Victory	MC Score
0%	4,3 %	0,1%	10,9%	43,4%	13,2%	28,1%

Table 5: Winrates on 1000 games

Conclusion

- Higher number of simulations in Monte Carlo

- Higher number of simulations in Monte Carlo
- Adopting the strategy depending on the situation

Possible improvements

- Higher number of simulations in Monte Carlo
- Adopting the strategy depending on the situation
- Training/Prediction of players' moves

That's all folks !