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Q. Describe the strategy you implemented for having each player work toward a monopoly. Write this in prose so that a non-technical person would understand the approach you took for trading toward a monopoly. (200 words maximum)

The key to achieving monopoly in this game is to let go of the cards which are the least in number in the current collection and accept more and more of those which are highest in number.

In the simulation of the game, while making an offer, I made each player to find out the least frequent card in the collection and offer it. While doing so, I also made sure that they check if they have already achieved monopoly; if so, they do not play further. Also, shuffling the cards plays an important role in achieving a perfect monopoly. Otherwise, some cards get alphabetical advantage and always get traded.

At the same time, I made each player to check if the offered card would increase the chances of achieving monopoly. If so, the player accepts it for sure. If not, there is still 80% chance that the player will accept it. This 80% acceptance is essential to avoid deadlocks (a player is constantly sending his least frequent card, but the players on the other end also don't accept it because they too don't have it in majority).

In short, removing least frequent cards and becoming greedy for more of most frequent cards is the key to monopoly in this game.

Q. Looking at your sequences of 10 snapshots, perhaps run several or many times, describe what you find interesting about any patterns of players moving toward achieving monopolies. How well did these patterns match or not match what you expected of your strategy? How well did your strategy result in one or more players achieving monopolies? (400 words maximum)

In my particular logic, keep removing least frequent cards and keep accepting more of the most frequent cards, the very first thing I observed is that either the acceptance or removal of cards can be made strict, but not both. If we make both strict, a kind of deadlock is achieved, and the players do not ever achieve monopoly. Hence, I have added 80% chances of card acceptance, irrespective of the chances of that card helping in achieving monopoly.

Another interesting thing I found while running is that, when the cards are not shuffled, some cards (especially Barley and Wheat) are the only ones which get traded. In that case, all the players have two of each card except Barley. This can be seen below:

Player	Quantity: Wheat	Quantity: Corn	Quantity: Coffee	Quantity: Soybeans	Quantity: Oats	Quantity: Barley
0	2	2	2	2	2	1
4	2	2	2	2	2	1
5	2	2	2	2	2	1
1	2	2	2	2	2	3
3	2	2	2	2	2	3
2	2	2	2	2	2	3
Sum	12	12	12	12	12	12

Figure 1: Only the card which comes first alphabetically is traded

I also found out that, while traversing the cards, if unique cards are shuffled and traversed to find out their frequency, the players achieve monopoly quickly. Otherwise, the snapshot is over before the players achieve monopoly. The image below illustrates this.

Player	Quantity: Wheat	Quantity: Corn	Quantity: Coffee	Quantity: Soybeans	Quantity: Oats	Quantity: Barley
0	0	0	0	0	2	9
4	0	0	12	0	3	0
5	4	5	0	2	1	0
2	0	0	0	10	1	0
3	8	0	0	0	0	3
1	0	7	0	0	5	0
Sum	12	12	12	12	12	12

Figure 2: Players are on their way to achieve a perfect monopoly, but the snapshot process got over before it happens

When we fix this, but do not make sure that the players stop after achieving monopoly, all players can keep only 11 of the cards of the same commodity. Otherwise, they have to give out a card, no matter what.

Player	Quantity: Wheat	Quantity: Corn	Quantity: Coffee	Quantity: Soybeans	Quantity: Oats	Quantity: Barley
5	0	0	0	0	0	11
4	11	0	0	1	1	0
2	0	0	11	0	0	0
0	0	1	1	0	11	0
1	1	11	0	0	0	0
3	0	0	0	11	0	1
Sum	12	12	12	12	12	12

Figure 3: Players keep playing after achieving monopoly and can have only 11 of the same commodity cards

Finally, when we make sure that (i) the players are shuffling their cards, (ii) they offer only the least frequent cards, (iii) they accept monopoly-leading card for sure, and lastly, (iv) they accept other cards 80% of the times (perhaps anything above 50%), a perfect monopoly is achieved in all the snapshots. This can be seen in the image below (the full screenshot is also included in the submission).

Player	Quantity: Wheat	Quantity: Corn	Quantity: Coffee	Quantity: Soybeans	Quantity: Oats	Quantity: Barley
1	12	0	0	0	0	0
0	0	0	0	0	12	0
3	0	0	12	0	0	0
4	0	0	0	0	0	12
5	0	0	0	12	0	0
2	0	12	0	0	0	0
Sum	12	12	12	12	12	12

Figure 4: Perfect monopoly

Finally, all the players achieve a perfect monopoly. 🍌🍌🍌

In all my attempts, I expected all the players to achieve a perfect monopoly. Some attempts did not match that expectation (like the 2-2-2-2-2-2 case or the deadlock state where no player achieved a monopoly), some partially matched the expectation (like in the figures 2 and 3 above where 1-2 players achieved monopoly), and only the last one matched the expectations perfectly.