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Analysis of the System

Your analysis should include:

- What general behaviors arise in this system? How does the wealth of the agents change over time? At the aggregate level? At the individual level?

The general behaviors that the researchers noticed is that high and low generally earn the same amount of money, with randomly selecting pools always earning the most. This can be seen through figures 1-3 where the number of income received has a small difference. This is because the high pool has a 25% chance to earn $1.6 while the low pool has a 50% chance to earn $0.8 and with 100 runs the total amount earned by both pools is $40 in the assumption that the high and low pool payout 25 and 50 times respectively.

Overtime it can be seen that the income of the agents increase only slightly with randomly choosing being the highest nature of income, due to the nature of the implementation of the system. The system is implemented to find the baseline of income of each of the pools then comparing the income of staying in a single pool or shifting randomly. This means that the system only accounts for agents with herd mentality or impulsive agents.

Through the system, the researchers found that at the aggregate level, with regards to impulsive agents, the average income is $35 away from lowest earning agent and $50 away from the highest earning agent. Meaning that the distribution of income, though unregulated, is somewhat well distributed, as seen in figure 4. On the individual level, the gap between the highest earning agent and lowest earning agent is roughly $89. This means that there is a clear difference in income and an overall low precision when being an impulsive agent.

- How does the diversity of strategies influence the dynamics of the system?

The system that the researchers implemented on the agents is impulsive and herd mentality. These two systems are used to provide a baseline through the understanding of the income provided by each of the pools individually and as an unbiased whole.

This creates a system with low diversity, thus making the system itself simple. Through this understanding, it can be articulated that a more diverse group of agents exploring several strategies would make a system more dynamic through providing more outcomes through the different strategies.

As shown in the diagrams below, the different kinds of strategies affect the lowest, highest, and average income per run executed except if the strategy chosen by the population is

“Safe” since you always have an income of $1 as compared of choosing any other strategy that offers either a 25% chance to gain $1.6 or a 50% chance to gain $0.8.

• Are there generally classes of agent behavior (say, based on what data they use, how they process it, or the agent's overall sophistication) that lead to better performance?

Through the implementation of herd mentality and impulsive agents, it can be said that simply staying in a single pool because the other agents are in the same pool does provide an income close to that of an impulsive agent.

This is because the agents have a higher chance to earn less than average when the pool the agent is in provides no income for 1 step, as seen in figures 1-3. Through these findings it can be said that imploring a sophisticated strategy would entail a greater income for the agent due to the performance of the impulsive agent juxtaposed the herd mentality agent.

• What happens to the system if you violate one of the original assumptions of the problem and allow the agents to alter their strategies over time by observing the performance and strategic details of the other agents?

If such a scenario would be implemented on the simulation, then the agent would be more careful in selecting a pool since they are now aware of its costs. Along with this, if they could observe the performance and the strategy of the other agents, then the agents would eventually account the strategy and outcome of other agents, as well as the information gathered from the agent’s current strategy, and create an amalgamation of its current strategy and the observed strategies to increase the agent’s income.

The data gathered below provides a sufficient learning curve for the agents to decide the strategy they would utilize instead of their originally assigned strategy. An agent’s ability to change its preset strategy to adapt to its surroundings provides the agent with an understanding of which pool is earning the most income consistently throughout each of the turns rather than only at the beginning of the cycle, essentially changing from 100 steps to a single step and an adjustment of strategy at the end of each step. However, it is safe to assume that impulsiveness will still be seen due to the lack of certainty in earning income which at times would lead an agent to choose a safer option over any of the probability based pools.

• Suppose that meta-agents exist that can coordinate the behaviors of a subset of the agents (and split the resulting payoffs equally across the subset) how does this impact the system's behavior?

Depending on the number of meta-agents, the highest earning agent should be far beyond the average and more so the lowest earning agent. If all the agents are meta, then the difference between highest, average, and lowest would be negligible. This is due to each agent following a strategy that increases its own income through following the highest earning agent.

The system could still look similar to its current implementation with the highest, average, and lowest lacking any difference due to the nature of income in each of the pools and assuming each meta-agent aims to become the highest earning agent at the end of 100 steps. As mentioned previously, these meta-agents would treat the 100 step system as a single step 100 times where their strategy is modified during each step to better increase their income.

The data gathered, as seen in figures 1-3, show a baseline for the income that an agent could receive should the agent never move from its current pool. This baseline could provide the meta-agents with enough information to make several proper moves that maximize income without directly relying on other agents for information, rather than impulsively selecting the first few set of pools and losing income due to an incorrectly selected pool.

- How do the answers to the above questions change as:

o Tau is altered?

  o If tau (tax) is altered, then the results shown in the simulation will change depending on the value set. If the tax is higher, chances are that the average, highest, and lowest money will be lower than normal. Else if tax is lowered, chances are that the average, highest, and lowest money will be higher than normal.

o You change the total number of agents in the world?

o Like in tau, if the total number of agents is decreased then chances are that the average, highest, and lowest money will be higher than normal. Else if the total number of agents is increased then chances are that the average, highest, and lowest money will be lower than normal.

o Apply only one strategic implementation?

o The data gathered below shows 4 kinds of strategy. Random where agents randomly select a pool, low where agents always goes to the pool with a 50% chance to gain \$1.8, safe where agents always goes to the pool where it is a constant gain of \$1, and high where agents always goes to the pool with a 25% chance to gain \$2.6. Graphs below show that having a random strategy will be the most successful outcome since it does not rely on the chances of 50% and 25%, and it also does not only constantly gain \$1.

Figure 1.

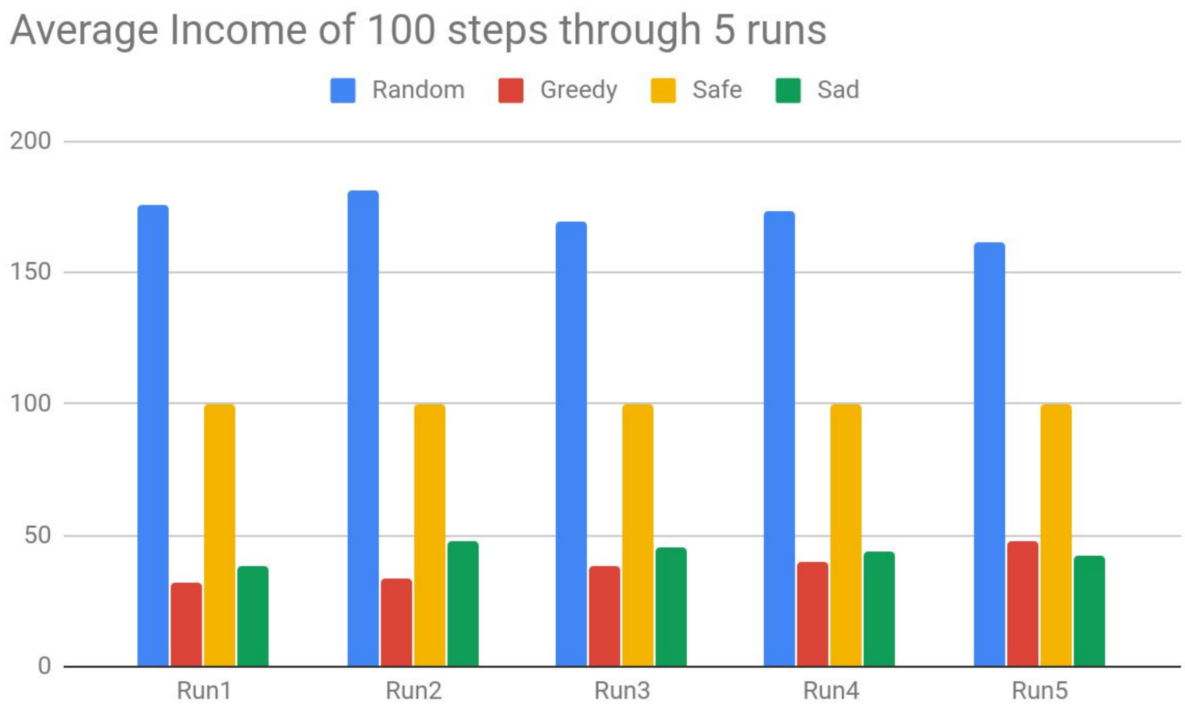


Figure 2.

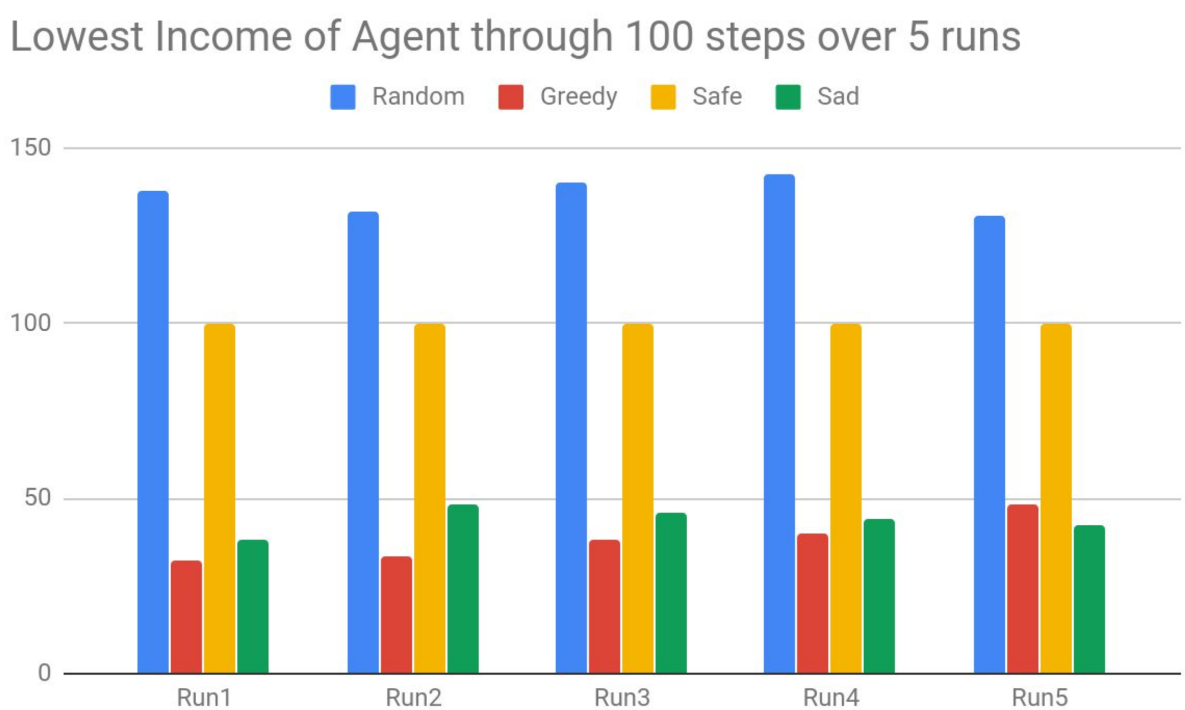


Figure 3.

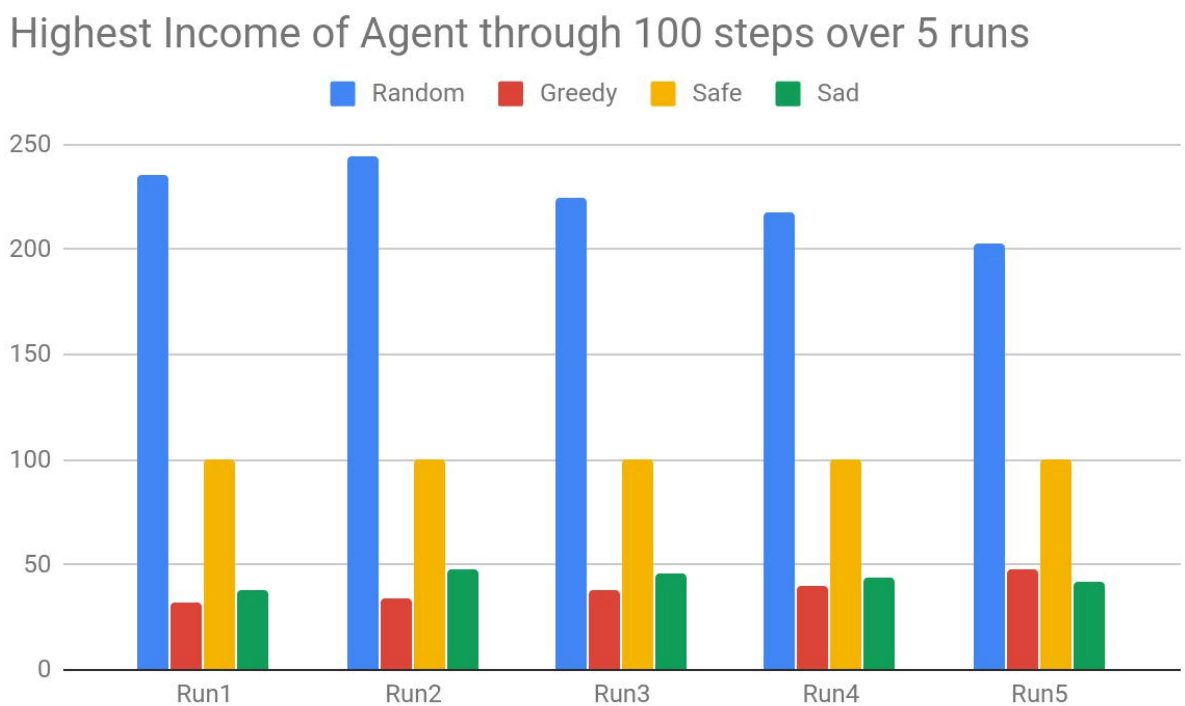
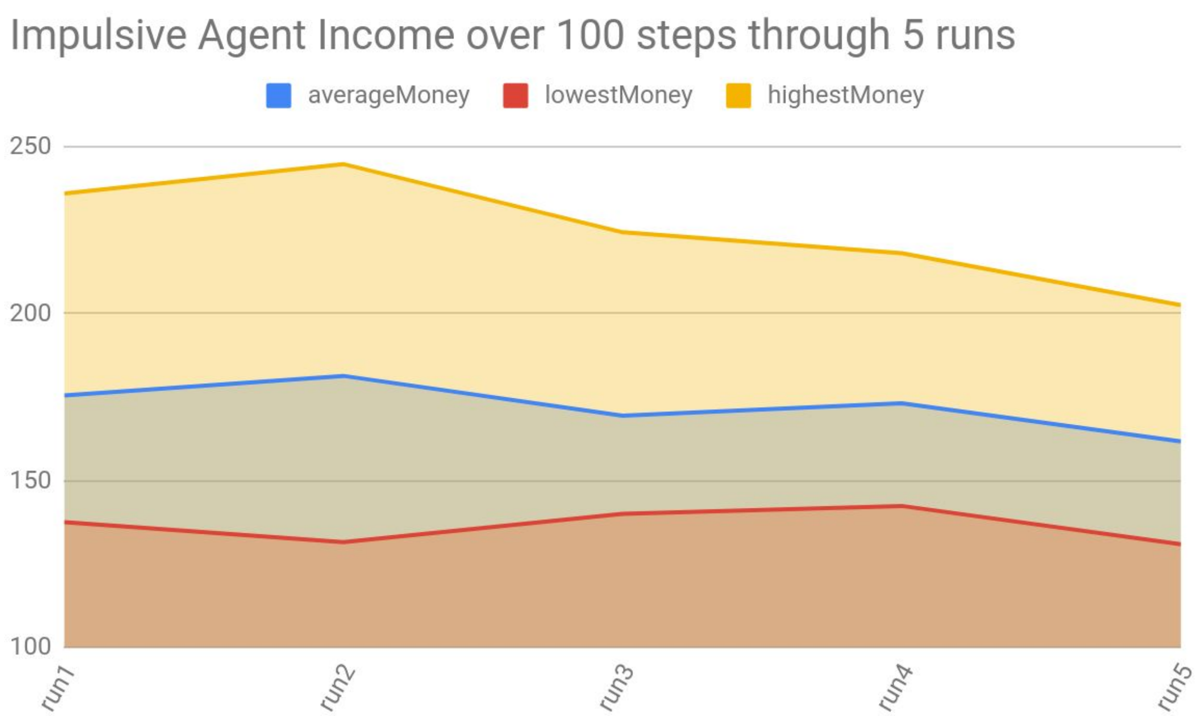

Highest Income of Agent through 100 steps over 5 runs
Random
Greedy
Safe
Sad
250
200
150
100
50
0
Run1
Run2
Run3
Run4
Run5

Figure 4.


Impulsive Agent Income over 100 steps through 5 runs
averageMoney
lowestMoney
highestMoney
250
200
150
100
run1
run2
run3
run4
run5