

Quan Yuan

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Project 6 report

This project simulates the lottery play and wealth distribution between different income groups.

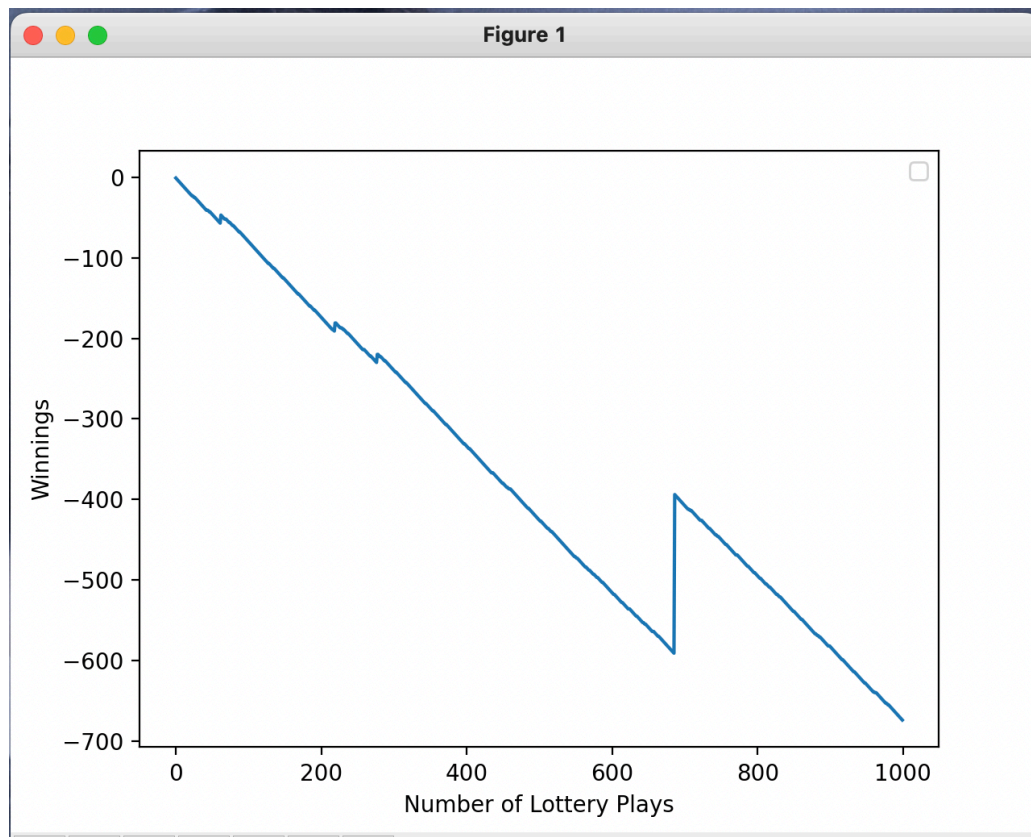
The play lottery simulation reflects the wealth accumulation of a single person playing certain times of lottery. The input will be the amount of total plays. And the output is a graph visualizing the accumulated wealth (including both the cost to play and the winning amount).

The functions involved in this simulation are:

- generateLotteryNumbers( ), which generate a list of 5 random ints between 1 and 42, without duplicates;
- countMatches( ), which takes in 2 lists of numbers and return the amount of same numbers between these 2 lists;
- playLottery( ), which return the reward(including entry cost) of 1 lottery play, by self-generating the player's number and winning number, then count the matched in-between.

The project draw a line graph reflecting the total rewards when a single person played certain times.

Here is a graph of the simulation when a single person played 1000 times.



We could observe that the overall trend is downward, which means that it is very likely one will spend more on buying tickets when he win some lottery. And there are some vertical increasing lines in the graph, which reflects that the person wins a small amount in that single lottery play.

The community simulation reflects the wealth changes in a community containing high-income people and low-income people. The input will be the total years we want to simulate, and the total community population we want to set. And the output is a graph reflecting the wealth change along the years, as well as the messages telling the percentage of wealth possessed by high-income group and low-income group, for every 10 years.

The functions involved in this simulation are:

- `getDisParityMessage()`, which takes in 2 lists of high-income and low-income, and a int as decade, then return the message saying that in which decade, the percentage of total wealth in the community possessed by the high-income group and the low-income group;

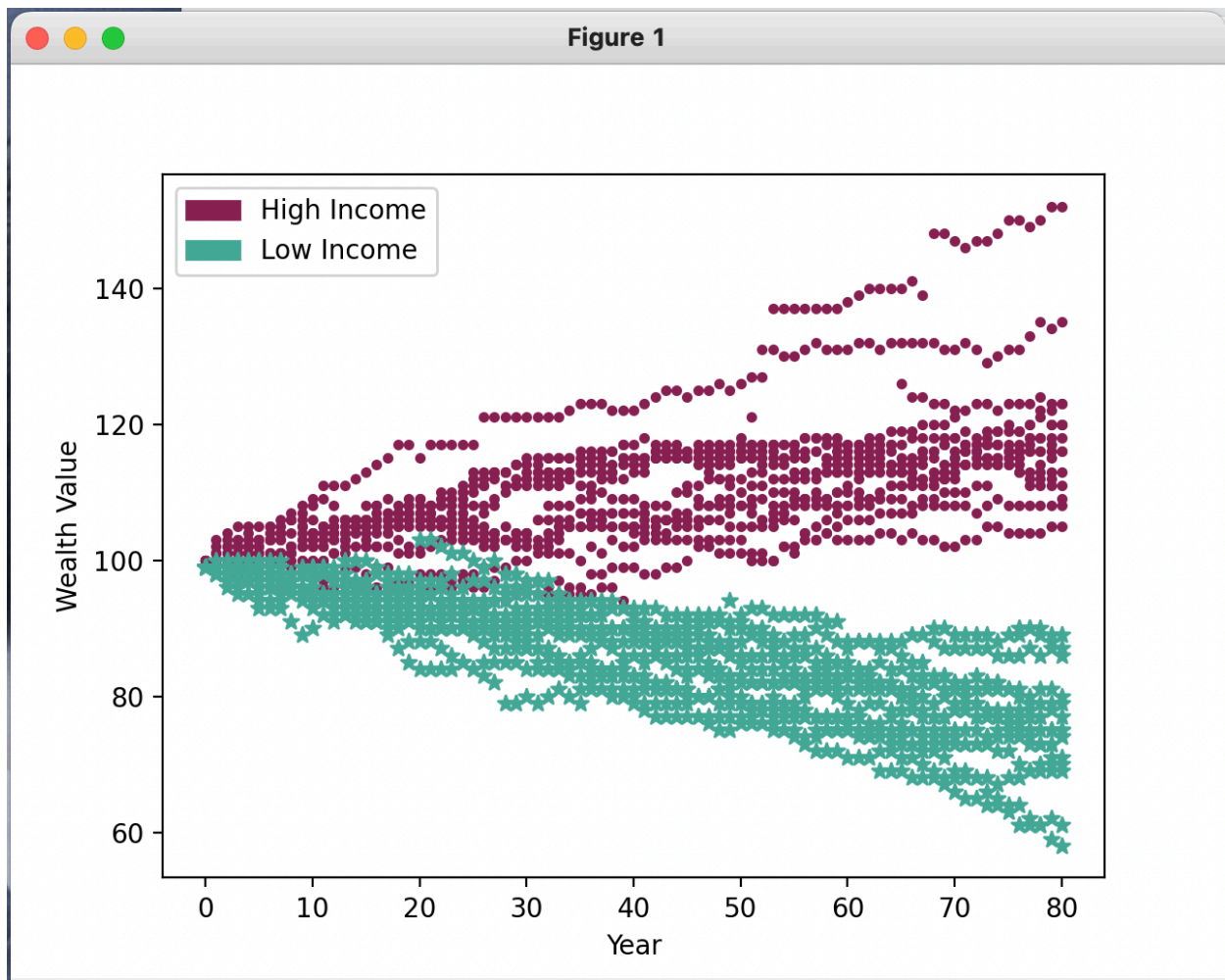
- `simLottery()`, which takes in a list of int as wealth held by different people, and an int as how many people in this group will play lottery. Then randomly draw this amount of people to play lottery and change their wealth accordingly. TO MAKE later functions simple, this function returns the lottery fund this round of simulation accumulated, as it is the revenue received minus the winning amount by players;
- `awardScholarship()`, which takes in a list of int as wealth held by different people, and an int as the total scholarship amount that will be distribute in the group. Then randomly draw the amount of people to give the scholarship. This function has no return, as it directly amend in the input list;
- `simCommunity()`, which takes in an int as total years we want to observe, and an int as community size we want to set. Then it assumes half of the community is high-income, and initialize it as a list of 100, with the length of `communitySize/2`, and half of the community is low-income, and initialize it as a list of 99. Then assumes 40% in high-income group will play lottery every year while 60% in low-income will play lottery every year. Then the lottery funds will be distributed as scholarships with 70% to high-income group and 30% to low-income group every year. Use a spot graph to reflect each year's wealth distribution and print the percentage message every 10 years.

Here is the printed message for the simulation with 80 years and community size of 30:

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Decade 1: The high income group possesses 52% of the community's wealth, while the lowincome group possesses 48% of the community's wealth.
Decade 2: The high income group possesses 53% of the community's wealth, while the lowincome group possesses 47% of the community's wealth.
Decade 3: The high income group possesses 54% of the community's wealth, while the lowincome group possesses 46% of the community's wealth.
Decade 4: The high income group possesses 56% of the community's wealth, while the lowincome group possesses 44% of the community's wealth.
Decade 5: The high income group possesses 57% of the community's wealth, while the lowincome group possesses 43% of the community's wealth.
Decade 6: The high income group possesses 59% of the community's wealth, while the lowincome group possesses 41% of the community's wealth.
Decade 7: The high income group possesses 60% of the community's wealth, while the lowincome group possesses 40% of the community's wealth.
Decade 8: The high income group possesses 61% of the community's wealth, while the lowincome group possesses 39% of the community's wealth.
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We could observe that the total wealth possessed by high-income group are increasing over decades, and by low-income group are decreasing over decades.

And here is the graph of the simulation with 80 years and community size of 30:



We could observe that the overall trend for high-income group is upward, while the overall trend for low-income group is downward. It means that with the lottery play and scholarship distribute, the wealth gap between high-income group and low-income group will expand. We can also see some green spots in the range of purple spots in the graph, which reflects that those persons win some medium amount of lottery in certain year's lottery play. And then afterwards, the overall trend is still downward.

## Follow-up Questions

1. In the previous simulation, at the end of 8 decades, 61% of total wealth are possessed by high-income group, while 39% of total wealth are possessed by low-income wealth.
2. It surprises me that when you keep playing lottery, it is still a minimal chance that you can win a huge one. Even if you win some amount, the total spending on the tickets is still larger than the winning amount, So play lottery won't get you rich generally.
3. Occasionally, some green lines and purple lines are higher than others, it means that the corresponding person wins a medium or large amount of lottery one or several times, which accelerate the accumulation progress of his wealth.
4. In my country, China, top 1% of people possess around 30% of total wealth, and 10% of people possess around 55% of total wealth, while lowest 25% of people possess only 1% of total wealth, and lowest 50% of people possess about 10% of total wealth. The major reasons that cause this disparity are the incompleteness of tax system, the incompleteness of social welfare system, and the unbalanced development among regions.
5. In general, there is a growing consensus that problematic socioeconomic conditions, such as unemployment, income inequality and poverty, are causes of violent crime and homicide. Social studies have two theories for explaining these interrelationships. The first theoretical framework is by Becker. The crime is a function of an individual's calculations in weighing the expected utility of crime against the utility of using the same time and resources to pursue legal activities. This theory suggests that inequality leads to crime by placing low-income individuals who have low returns from market activity in proximity to high-income individuals who have things that are worth taking. In particular, a larger income gap between the poor and the rich people would lead to high criminal behavior because the expected gains of criminal activity are related to the wealth and assets of the potential targets. The second approach is based on sociological theories of crime by Merton, who focuses on emotional feelings that lead people to become delinquents. According to these studies, individuals of low social structure are frustrated by their failure to attain the material attributes of success,

and this failure is more galling when they are confronted by the success of those around them. Poor and unhappy people would be more likely to become violent in a place where inequality is high when compared with a similar individual living in a more egalitarian society. In short, both theories suggest that high levels of inequality boost crime, even after controlling poverty levels.

6. Complete the basic construction system. The country has already imposed a high tax rate on high-income group. However, the charged taxes are not used to create more jobs and close the wealth disparity by creating construction projects. These projects can provide jobs to the unemployed labor and hence increase their income.

Reflection:

When realizing a complicated function, like simulate the wealth distribution, we could start from dividing the whole program into several functions, each in charge for 1 thing. And then draft the details of each small/basic function. If it is still too complicated, divide it again. In this way, it is easier for understanding and testing.

Acknowledgment:

online paper: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3134438](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3134438)