Final Project Report

Covid19 Spread Simulation

Section:02

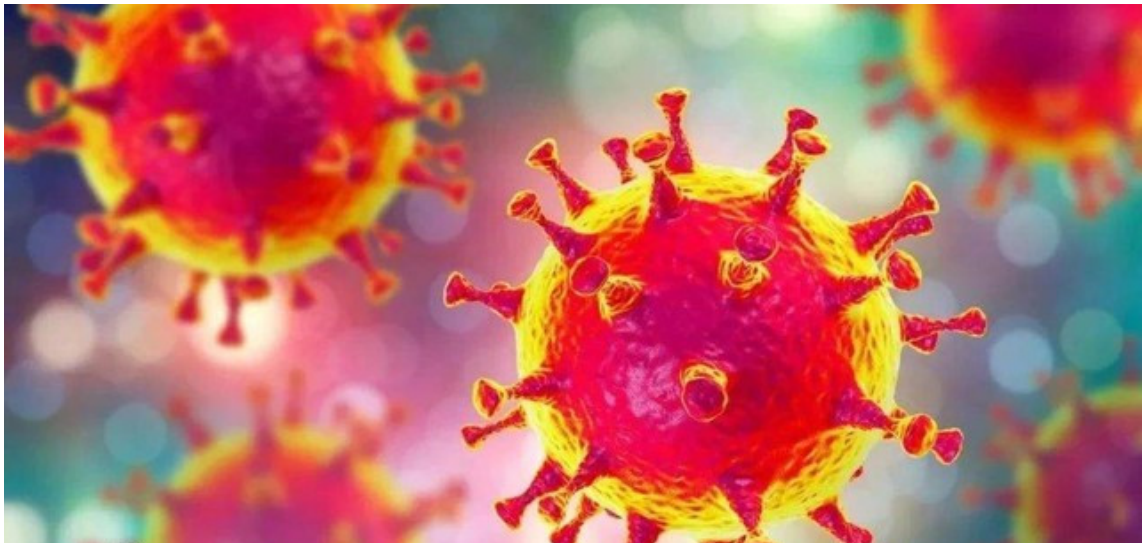
Team Member:

Pei-Ling Chiang, 001533847

Wenxiao Zhao, 001084868

■ Introduction about the topic

Speaking of the differences compared with the past few years, the breakout of Covid19 must be the biggest one. On December 1, 2019, a worldwide epidemic suddenly found in Wuhan, a city of China, then, it rapidly started spreading. By the end of 2020, the latest statistics shows that there are over 800,000 people have been confirmed to be infected and 38,831 people died. Thus, it is vital to build a model to simulate the Covid-19 virus spreading process for us to get a deeper understanding of it.



■ Aim of the project

We build a virus simulator in order to demonstrate how virus will spread widely without further protection, and how effective each measure of protection is to stop the spread, including social distancing, quarantine, masks and hand sanitization. Although the virus is still unpredictable, we understand the ways to fight against. One day the epidemic hits in the future, we will be equipped with the skills to protect ourselves and stop the spreading of virus.

■ Project Details

Our project must use Greenfoot IDE to show the dynamic simulation and it also needs additional resources to run unit test. For Details, please see README.md on the repository.
To model the virus in the world, we build:

1. A world:
   - There is a population of 300 people, and one infected person will pop up randomly in this world.
2. Three people model: normal, infected, immune
   - **Normal**: normal means that this person **has not** got infected by the corona virus. It is shown via blue little person image as below.

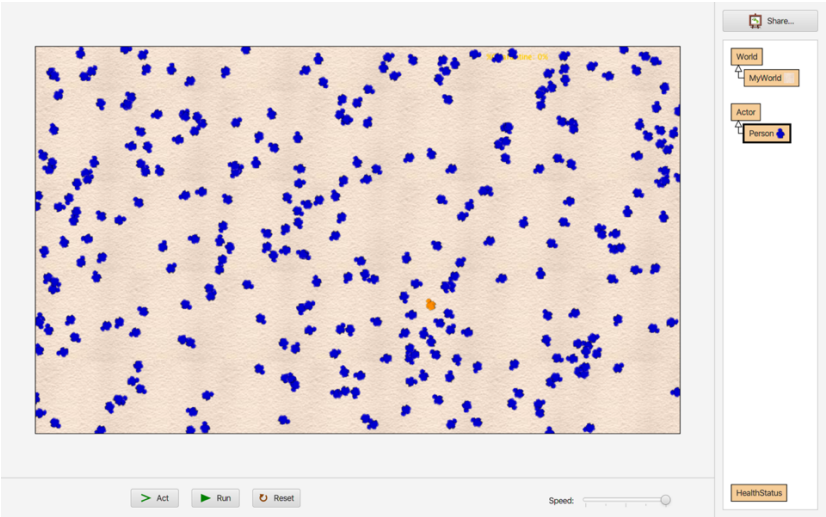
- **Infected**: Infected means that this person **has got** infected by the corona virus. It is shown via orange little person image as below.

- **Immune**: Immune means that this person **had got** infected by the corona virus but now **cured** and will never get infected again. It is shown via green little person image as below

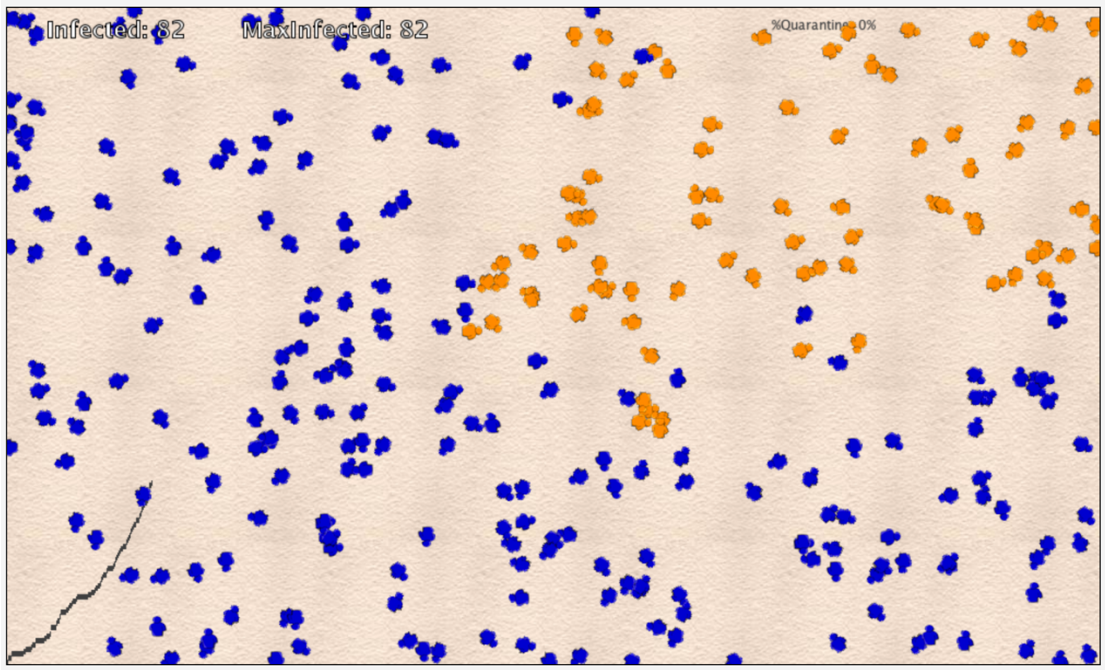
3. Factors that may reduce the infection spreading:
   I. Social distancing: this means that people maintain an appropriate distance to interact with others, the social distancing rate is set to be 0, 25, 50, 75, 90 %.
   II. Quarantine: this means that people stay at home and avoid interacting with others. Without interaction, there is no chance for people in quarantine to get infected. The quarantine rate is set to be 0, 25, 50, 75, 90 %.
   III. Wearing masks: this means that people wear masks and even if they get intersected with others, the chance of being infected will reduce. We set wearing masks as Boolean in this world, and the chance being infected reduces from 1 to 0.6.
   IV. Hand Sanitization: this means that people wash their hands often so even if they got intersected with others, they will get lower chance to be infected. We set hand sanitization as Boolean in this world, and the chance being infected reduces from 1 to 0.8.

■ Implementation

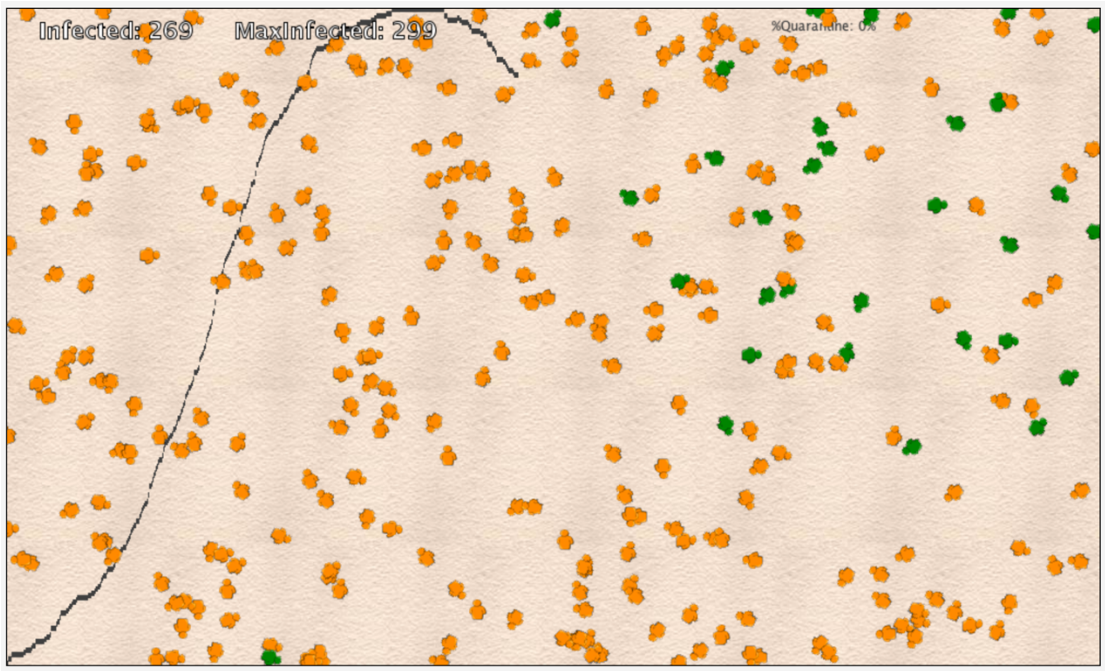
1. Initialization:
   In this simulator, we create a world with a population of 300 people. There is only one infected person in orange, which randomly pops up in the world. The rest of people in blue represent susceptible people.



2. Infection:
   When infected people in orange intersect with susceptible people in blue, blue will get infected and turn to orange.

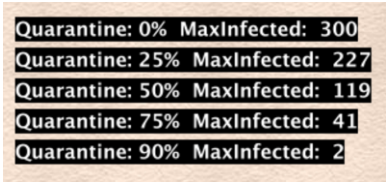


3. Heal:
   We set the time to heal 400, when infected people in orange get fully cured, they become immune in green.



4. When the program runs, the background will automatically show current infected numbers and maximum numbers of infected people so far on the top right corner. And the curve automatically drawing means current infected cases.

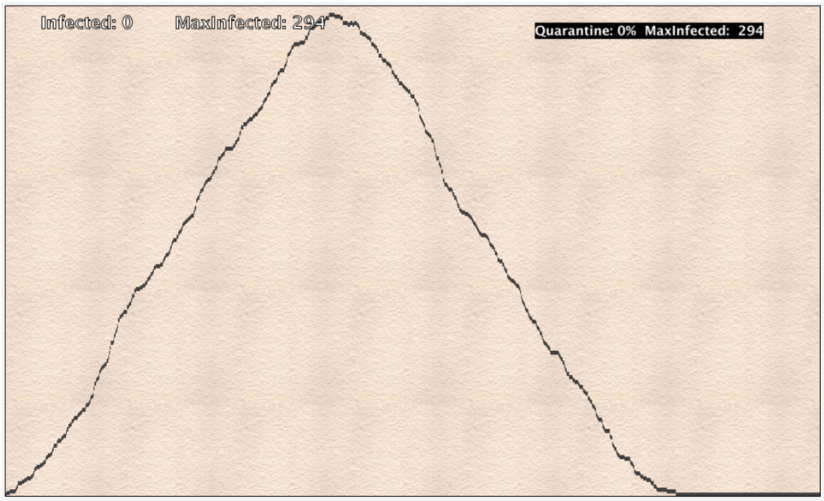
On the top left corner, it will show the numbers of maximum infected people under different circumstances,



■ Output & Evidence

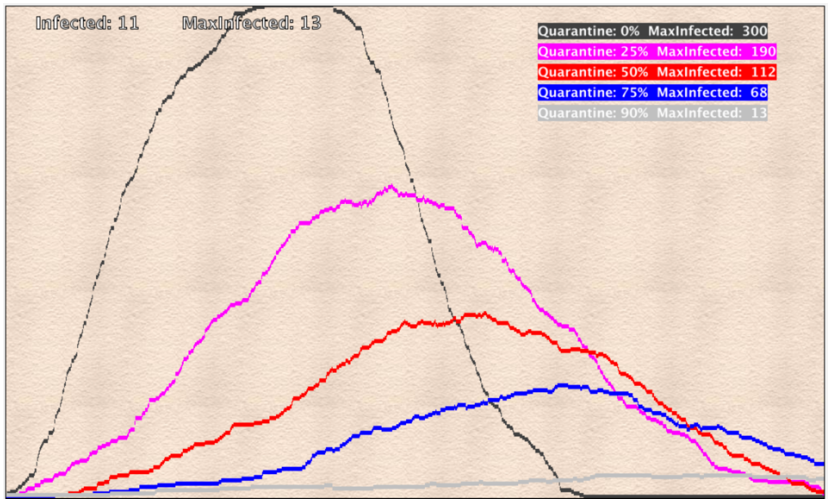
1. Without any protection

   If the virus suddenly hits and human still do their routine without any protection, the virus will have exponential growth and almost everyone in the world will get infected. Numbers of maximum infected people will approximately equal to the total number of people in average.



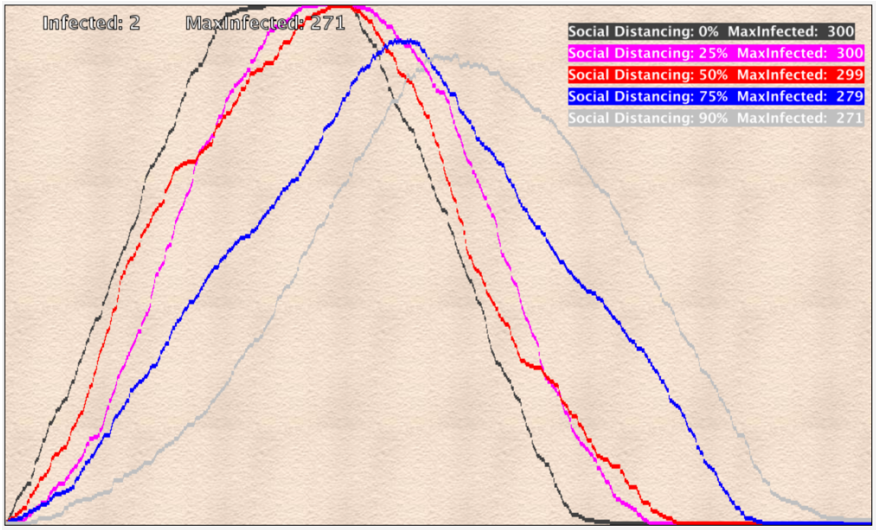
2. Quarantine

   We set people in quarantine at home with different proportion. From the graph below, we can see as more people stay in quarantine, the virus will spread more slowly, and the maximum infected people will drastically reduce. The time for virus to reach its peak is delayed as the proportion of quarantine increases.



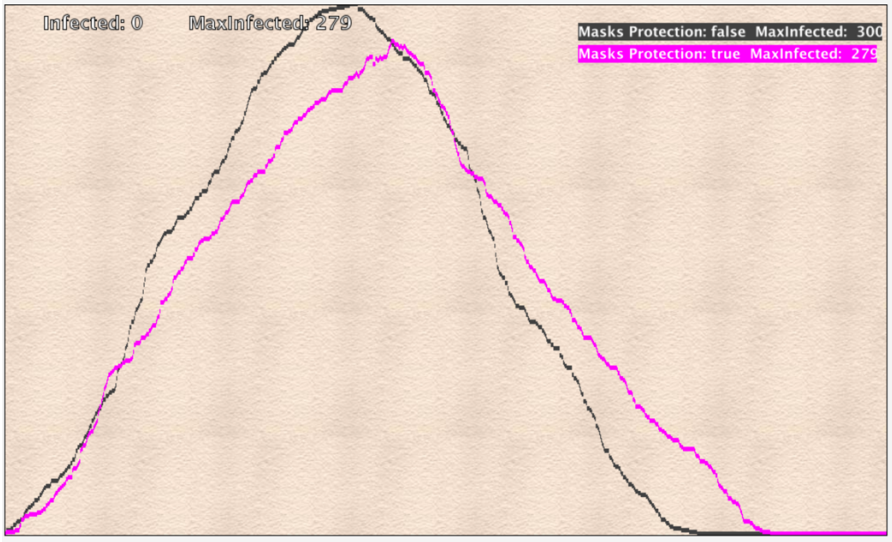
3. Social distancing

We set people follow social distancing with different proportion. If we implement social distancing without other protection, there is only a little decrease in the maximum infected cases. The time for the spread to reach its peak is also delayed as the proportion of social distancing increases.



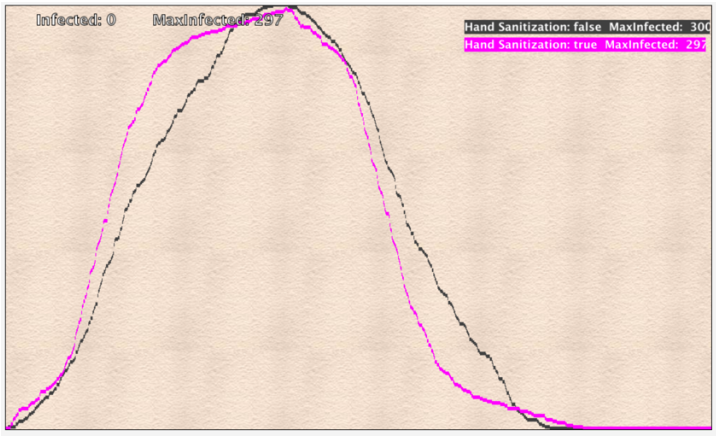
4. Masks

We set people in two scenarios, wear masks or not. If people wear masks, we set the possibility to be infected from 1 reducing to 0.6. If we implement masks rule without other protection, there is only little decrease in the maximum infected cases. The time for the spread to reach its peak is a little delayed if people all wear masks.



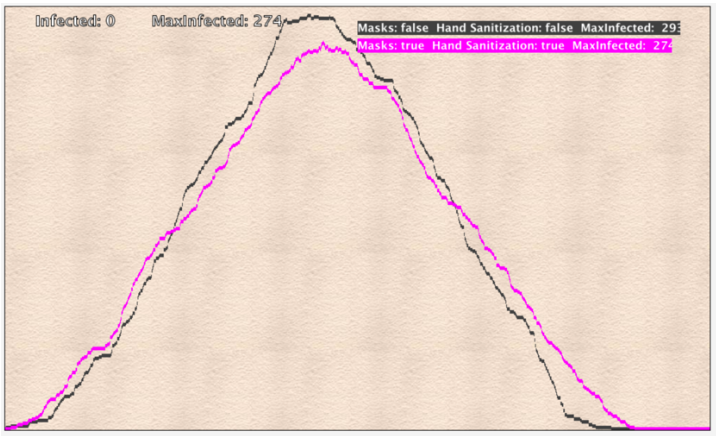
5. Hand sanitization

We set people in two scenarios, doing hand sanitization or not. If people do hand sanitization, we set the possibility to be infected from 1 reducing to 0.8. If we implement hand sanitization rule without other protection, there is tiny decrease when we do hand sanitization.



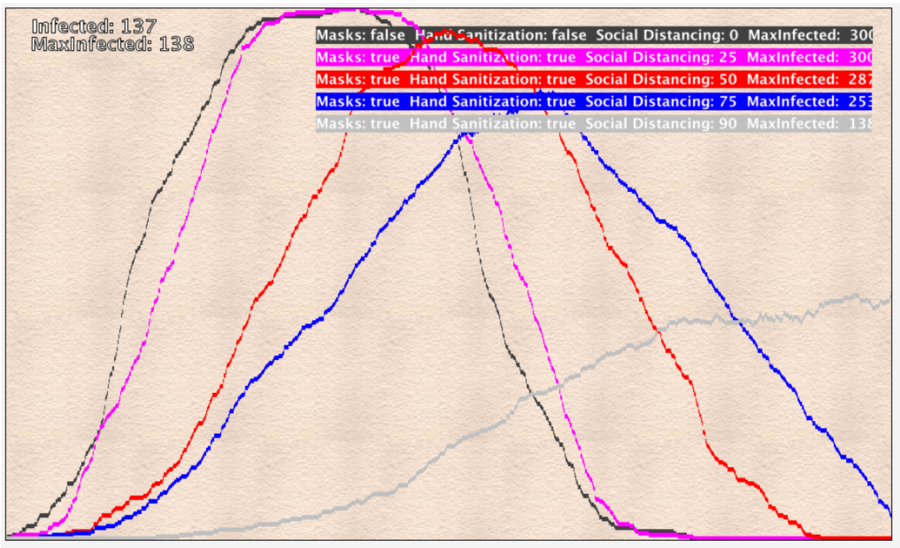
6. Masks + Hand Sanitization

If we set people to wear masks and do hand sanitization at the same time, the maximum infected cases will reduce slightly.



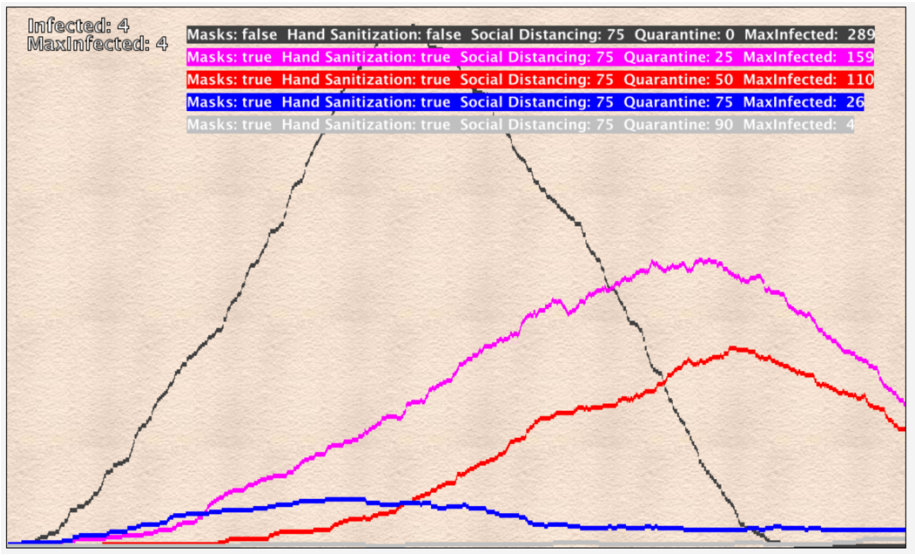
7. Social Distancing + Masks + Hand Sanitization

If we set people to wear masks, do hand sanitization and maintain social distance at the same time, the maximum infected cases will reduce significantly. But the time for the spread to reach its peak also gets delayed as the proportion of social distancing increases.



8. Quarantine + Social Distancing + Masks + Hand Sanitization

If we set people to wear masks and do hand sanitization. Assume 75% of people will follow the rule or social distancing. We also set 5 different proportions of people in quarantine. The maximum infected cases will reduce significantly. But the time for the spread to reach its peak gets delayed when the proportion is 25 % and 50%. As the proportion increases to 75%, and 90%, the spread becomes really weak that only few people get infected.



■ Conclusion

The most effective way to stop the spread of disease is to stay in quarantine and avoid interacting with others. But it is unlikely to require all of the people to stay in quarantine because it will cause the economic crashed and the society will lose important functions. An alternative way is to find other options to prevent infection, such as wearing masks, social distancing and hand sanitization. Although each factor only reduces the spread a little, as long as we explore sufficient measures, we can sum up this tiny effectiveness and stop the pandemic without requiring all people to stay in quarantine.

■ Unit Test Screenshots