Assignment 5: Discrete Population Models

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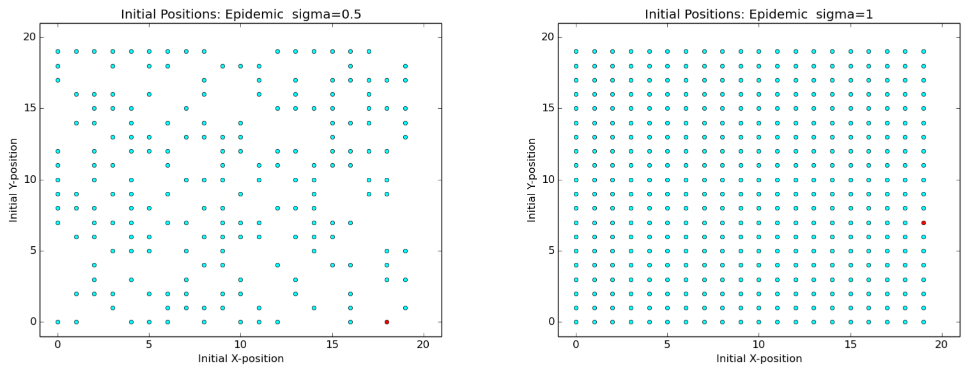
1 Part 1: Epidemic Simulation

For this model: cyan are healthy people, red are sick people, and green are immune or recovered people.

My version of the epidemic program allowed σ to be changed and also the initial position placed $(T^2) * \sigma$ people randomly on a TxT board. This is shown in Figure1.

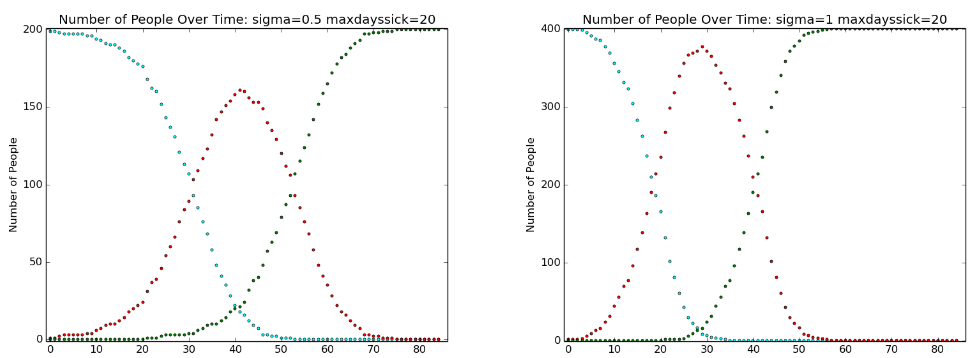
Comparing two different σ's with the same number of days the sickness lasted in people: as Figure 2 shows, the larger sigma is, the faster the disease spreads among the population.

Now I will look at the difference between graphs if the number of days the sickness lasts in people is changed. I will use $\sigma = 1$ for this comparison since there is a chance with a low D and a $\sigma = 0.5$ that no one will get sick or the disease will die before it spreads. In that case I would be modeling the chance of a disease spreading based on randomness instead of the actual time the disease would spread in a uniform distribution of points. As Figure 3b shows, the number of sick people is much higher when the days that the people are sick is longer, which is as expected. Therefore, more of the population will be sick for a longer period of time. However, as you can see from Figure 3, the time it takes the sickness to die off in the population is very similar. With a sickness that dies of 4 times as fast in individual people, the rate at which the sickness dies off in the population is only 1.25 times as fast.



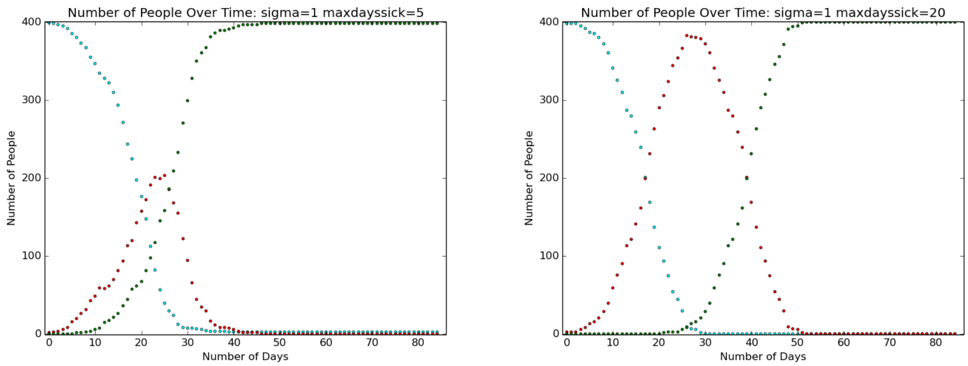
(a) Initial position, $\sigma = 1$ (b) Initial position, $\sigma = 1$

Figure 1: Initial Position



(a) Number of people, $\sigma = 0.5$, $D = 20$ (b) Number of people, $\sigma = 1$, $D = 20$

Figure 2: Differences based on σ



(a) Number of people, $\sigma = 1$, $D = 5$ (b) Number of people, $\sigma = 1$, $D = 20$

Figure 3: Differences based on D

2 Part 2: Population of Foxes and Rabbits

The initial conditions for the population of foxes and rabbits is very similar, except now I will place half of the population as rabbits and half the population as foxes as seen in Figure 4.

Unfortunately, I ran into a lot of errors in my code and couldn't get them fixed before the time this was due. An example plot of my fox and rabbit population is shown in Figure 5. There is a problem with the interaction function and I couldn't get it sorted out in time.

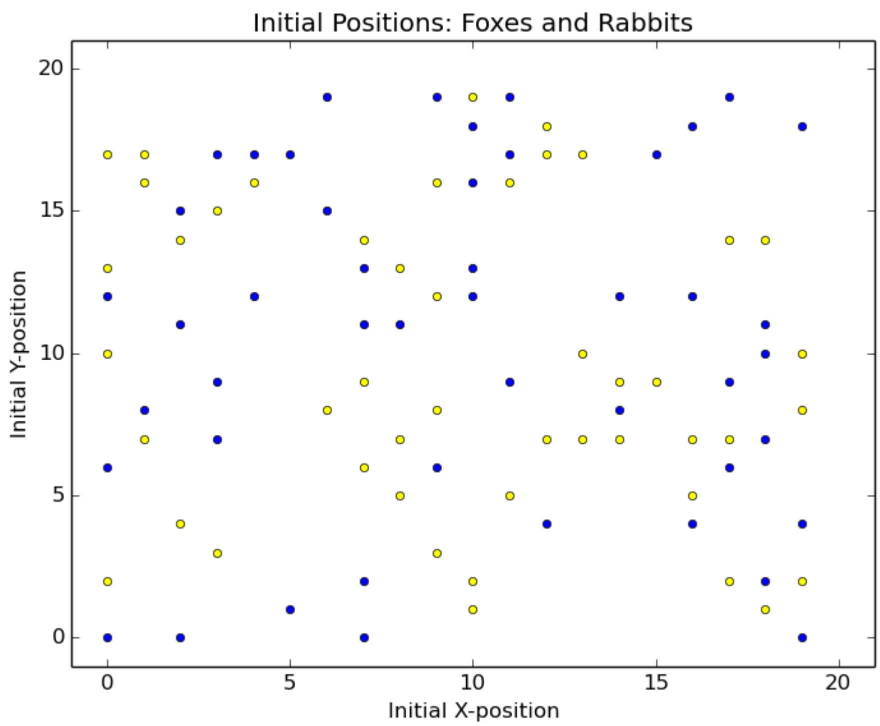


Figure 4: Initial Population of Rabbits and Foxes

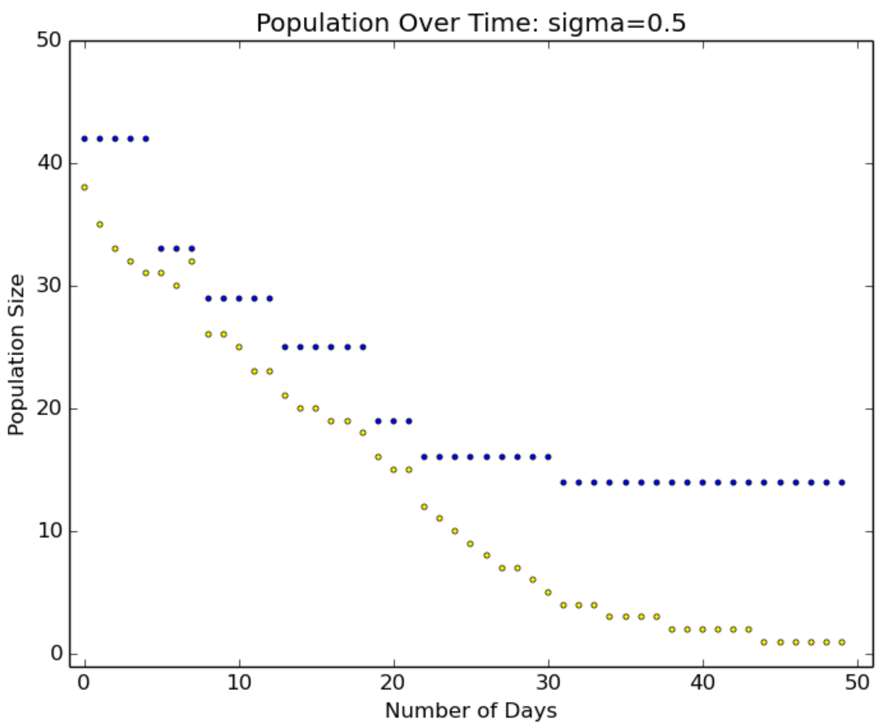


Figure 5: Failed attempt at fox and rabbit population model