MA 1600 – Spread of Infectious Diseases Project

Suggested Resources

To get you started, you might want to look at the following resources. You *will* want to enhance this list by searching for additional material.

- Introductory slides to the SIR model http://www.samsi.info/sites/default/files/Slides_BasicEpi_SIR.pdf

Necessary Project Components

1. Discuss and implement the SIR model.
   - Susceptibles (S) have no immunity from the disease
   - Infected (I) have the disease and can spread to others
   - Recovered (R) are immune to further infection.

   For the same initial state, give examples of different behavior that can arise by choosing different infection and recovery rates.
2. Adjust the SIR model to allow for vaccination of the susceptible population. Discuss the effect on the duration and intensity of the epidemic. Consider the impact of different vaccination rates.
3. Implement an agent-based approach to solve the SIR model. Here is a quick outline of what I envision:
   (a) Imagine that we live in a one-dimensional world, i.e. people can only take steps to the left, and steps to the right.
   (b) (initialize) Randomly distribute a population, N, in the interval from $[0, 1]$, and assign states to each member of the population. For example, you could set $\frac{3}{4}N$ to have state 0, corresponding to susceptible people), and $\frac{1}{4}N$ to have state 1, corresponding to infected people.
   (c) loop, as desired
      - generate a random movement pattern for each agent, $\vec{v}$. I recommend sampling from a normal distribution with mean 0 and variance 0.1. A negative number means they step to the left, a positive number means they step to the right. To ensure that the population stays in the region $[0, 1]$, you can use the `abs` and `mod` commands on the new location.

- if a susceptible agent is within d of an infected agent, then the susceptible agent has probability p_i of getting infected.
- an infected agent has probability p_r of recovering.