1. Diffusion in a random graph (SI model)

In the simple SI model (not "School of Information" :) ), each node is either susceptible (S) or infected (I). That is, the population starts out with all individuals susceptible to infection, and one individual infected, and thereafter, each non-infected individual who has an infected neighbor is at risk of infection.

We'll first look at our good old friend, the Erdos-Renyi random graph.

Access http://projects.si.umich.edu/netlearn/NetLogo4/ERDiffusion.html

Vary the probability that an infected node infects a particular neighbor at each time step. How does this influence the rate at which the infection is spreading?

How does varying the density (average degree) of the network influence the speed of diffusion? Explain in terms of the network structure.

2. Diffusion in a network resulting from a growth process (SI model)

Access http://projects.si.umich.edu/netlearn/NetLogo4/BADiffusion.html

How does varying gamma (which influences whether the growth is preferential or not) influence the speed of diffusion?

How does the degree of each node correlate with the how early it gets infected?

3. Diffusion in a small world (SI model)

In this model, access
http://projects.si.umich.edu/netlearn/SmallWorldDiffusionEB.html

Start by setting the rewiring probability to 0. Observe the speed of diffusion in terms of the cumulative number of individuals infected.

Increase the rewiring probability just a bit, so you have only a few shortcut edges. How is the rate of diffusion affected?

4. Diffusion in a small world (SIS model)

Next we'll be looking at a SIS model. Individuals have a constant probability of returning to a susceptible state if they are in an infected state at every time step. This means that they may recover before getting to infect all of their neighbors.
Access http://projects.si.umich.edu/netlearn/NetLogo4/SmallWorldDiffusionSIS.html

Try plotting the values for different rewiring probabilities and observe how long the infection survives in the network, and how far it spreads.

What happens as the probability of recovery increases?
What happens as the probability of infection increases?

Can you find a critical threshold in the infection and recovery probabilities such that for a given rewiring probability, below these threshold values the disease always dies out, and above the threshold value, it tends to persist in the network?

5. Diffusion of an innovation in math teaching

We'll be using Pajek for this, and following pretty much exactly the flow of things in Ch 8 of the Pajek book.