Class 2 Friday September 6

Intrinsic information from the SIR Model

Epidemic: We will use the term *epidemic* in a very specific way when referring to the SIR model. An infectious disease passing through a population is an *epidemic* only when the number of infecteds is on the rise. Once the number of infecteds begins to decrease, the disease is no longer considered an *epidemic*.

Warm-up Exercise:

So, to have an epidemic means I'_____

Given a specific S-I-R model:

$S' = -.00001SI$

$I' = .00001SI - I/14$

$R' = I/14$

with the present values:

$S(0) = 45400$, $I(0) = 2100$, $R(0) = 2500$,

how can we tell whether or not we are currently having an epidemic?

What if S was 5000, with everything else unchanged; would there be an epidemic?

What if S was 10000, with everything else unchanged; would there be an epidemic?

What is the HIGHEST possible value for S that will NOT turn into an epidemic?

This value is called the threshold value for an epidemic.

$$\begin{aligned} S' &= -aSI \\ I' &= aSI - bI \\ R' &= bI \end{aligned}$$

What is the threshold value for the generic S-I-R model given above?

Group Exercise: Consider the following SIR model.

$$\begin{aligned} S' &= -0.000004SI \\ I' &= 0.000004SI - (1/5)I \\ R' &= (1/5)I \end{aligned}$$

a. What is the transmission coefficient?_____

b. What is the recovery coefficient?_____

c. How long, on average, is someone ill?_____

d. What is the threshold value for this disease?_____

e. If, on average, 1 out of every 50 contacts produces an infection, what fraction of the infected population does a susceptible person encounter every day (again, on average)?_____

f. If, the infectiousness doubled to 2 out of every 50 produces an infection, what would have to change so that the threshold value for the disease remained the same? (How would that be accomplished, physically?)