ECE 341 - Homework #12

Markov Chains and Corona Virus. Due Tuesday, June 8th

Please make the subject "ECE 341 HW#12" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

Simulate a disease outbreak.

Assume there are four groups of people

- Healthy: not infected yet but can be infected
- Carrier: infeted and can transmit the disease
- Cured: infected and cannot catch the disease again and cannot transmit the disease
- Dead: Cannot catch the disease and cannot transmit the disease

Assume that each person who is a carrier interracts with N other people each day (k).

- The person is selected at random from all people still alive
- If a carrier interracts with a healthy person, the person has an X% chance of being infected

$$\text{New Infections}=(\#\text{infected})(N)\left(\frac{\#\text{healthy}}{\text{total population}}\right)(X)$$

Also assume that each person who is infected has a

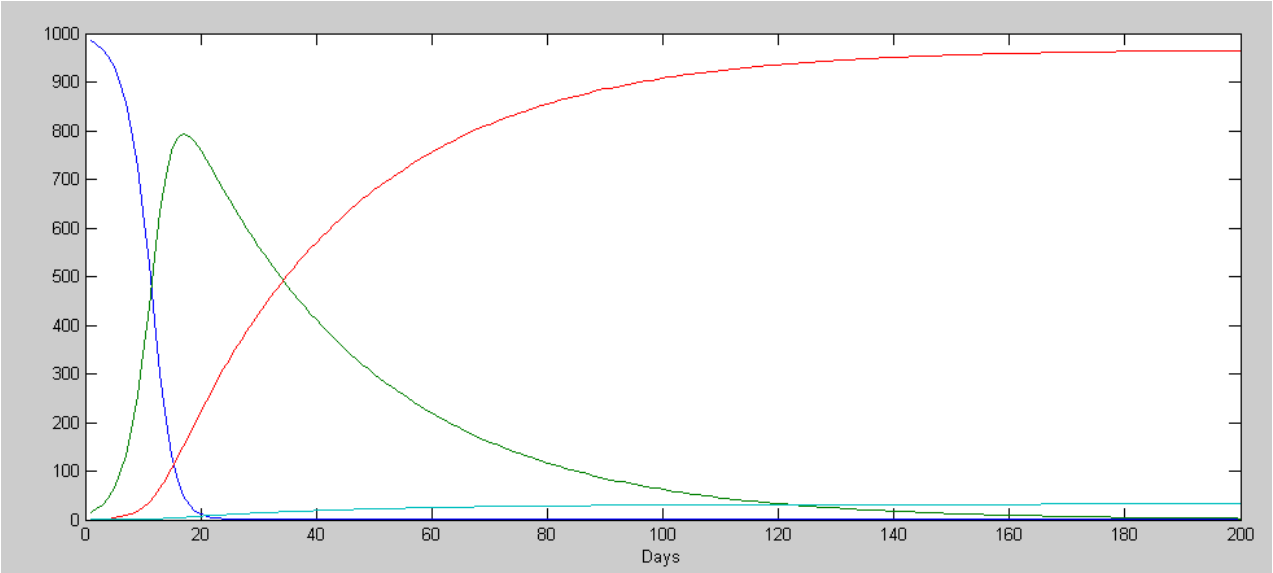
- 3% chance of being cured (30 day incubation time on average)
- 0.1% chance of dieing

Assume the initial condition is

- 990 healthy people
- 10 carriers
- 0 cured
- 0 dead

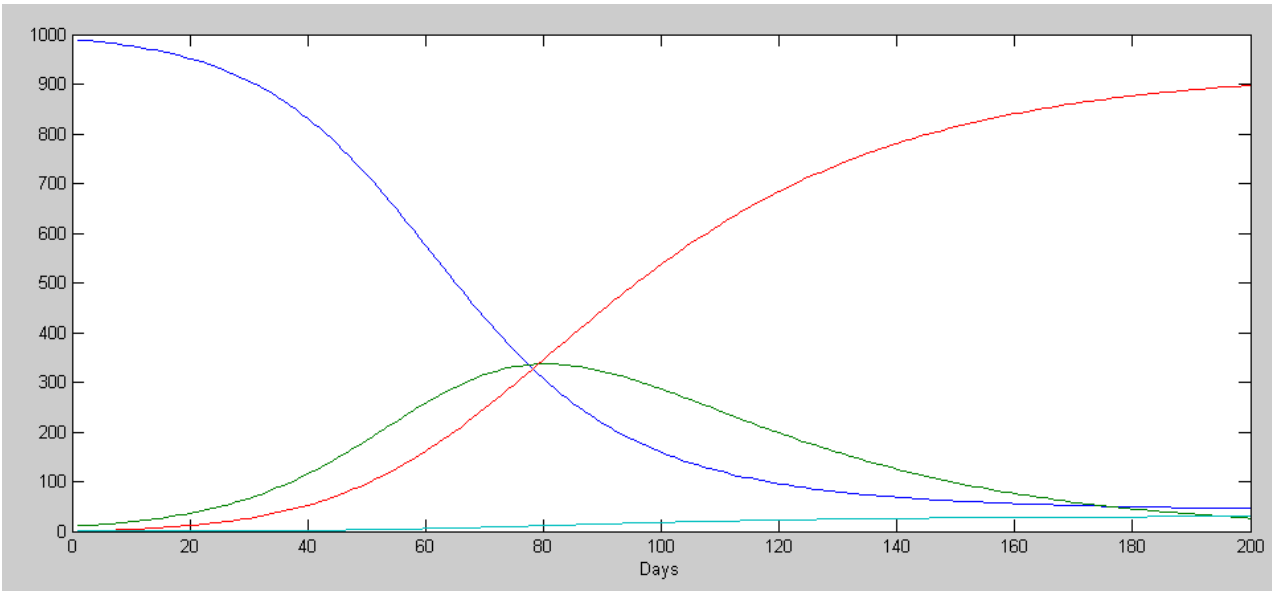
1) Simulate the disease spread for 300 days if

- N = 5 (each person is in close contact with 5 people each day)
- X = 10% (10% chance of the catching if exposed)



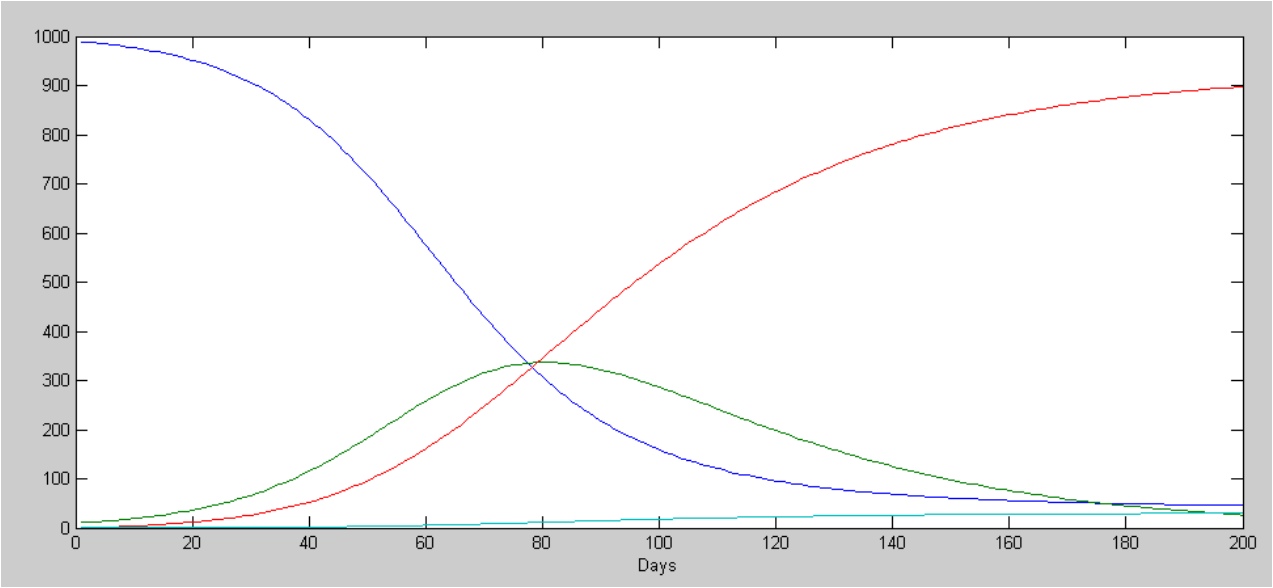
2) Simulate the effect of self isolation:

- N = 1 (each person interracts with 1/5th as many people each day)
- X = 10% (10% chance of the catching if exposed)



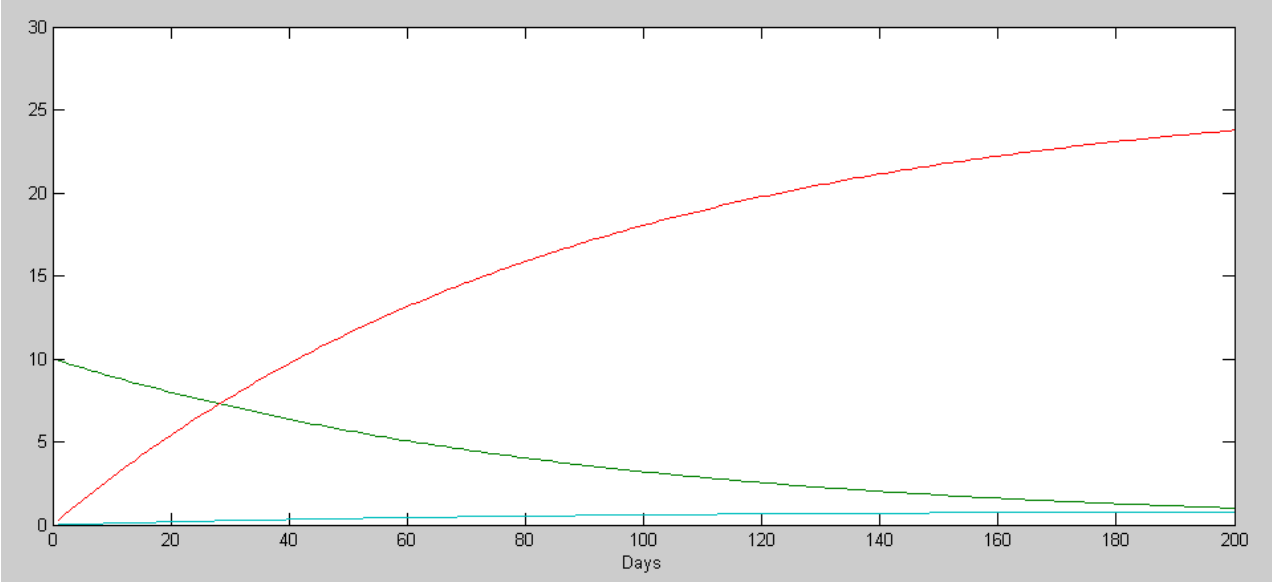
3) Simulate the effect of social distancing and wearing masks:

- N = 5 (each person interracts with 10 people each day)
- X = 2% (chance of being infected is 1/5th what it was before)



4) Simulate the effect of both social distancing and wearing masks:

- N = 1 (each person interracts with 1 person each day)
- X = 2% (2 chance of being infected is 1/3rd what is was before)



Code: (parameters are for problem #1)

```
% States X
% X(1) = Uninfected
% X(2) = Infected
% X(3) = Cured
% X(4) = Dead;
X = [990;10;0;0];
CureRate = 0.03;
DeathRate = 0.001;
Infectivity = .1;
N = 5; % interactions per person
% note: a = N * Infectivity
Y = [];
for i=1:200

 NewInfections = X(1) * X(2) * Infectivity * N / sum(X(1:3)) ;
 Cures = CureRate * X(2);
 Deaths = DeathRate * X(2);

 X(1) = X(1) - NewInfections
 X(2) = X(2) + NewInfections - Cures - Deaths;
 X(3) = X(3) + Cures;
 X(4) = X(4) + Deaths;
 Y = [Y ; X'];
end
plot(Y)
xlabel('Days')
```