ECE 498LV: Problem Set 6
Network Dynamics

Released: Friday, February 24
Due: Tuesday, March 7 (in class)

Be sure to show your work.

1. [Facebook Graph]
   Download a facebook network graph from https://snap.stanford.edu/data/egonets-Facebook.html.
   This problem has several fairly open-ended parts with unspecified, so please explore and report your most interesting findings.
   
   (a) Choose some small number of people in the network as patients zero for an epidemic. Run an appropriately-defined discrete-time SI epidemic model and describe the dynamics.
   
   (b) Choose some small number of people in the network as patients zero for an epidemic. Run an appropriately-defined discrete-time SIR epidemic model and describe the dynamics.
   
   (c) Choose some small number of people in the network as patients zero for an epidemic. Run an appropriately-defined discrete-time SIS epidemic model and describe the dynamics.
   
   (d) Compute the algebraic connectivity of the network and plot the Fiedler vector.
   
   (e) Give a random number in the unit interval to each person in the network and run a discrete-time consensus algorithm on the network. Describe the dynamics.

2. [Dynamics on Regular Graphs]
   Please complete Problem 18.1 in the Newman textbook.

3. [Dynamics on Graphs with Several State Variables]
   Please complete Problem 18.2 in the Newman textbook.

4. [Dynamics on Directed Graphs]
   Please complete Problem 18.3 in the Newman textbook.

5. [Oscillator Dynamics]
   Please complete Problem 18.5 in the Newman textbook.

6. [Courant-Fischer]
   Please complete Problem 18.6 in the Newman textbook.