

Analysis and Modeling of Social and Information Networks
CIS 4524/5524, Spring 2021

Assignment 5, due March 4 by 5pm on Canvas

Problem 1.

Solve exercise 3, part A at the end of chapter 5 in Easley and Kleinberg textbook (pages 133-134 at the hard-copy book or pages 150-151 at <https://www.cs.cornell.edu/home/kleinber/networks-book/networks-book-ch05.pdf>).

Problem 2.

Generate a network of 10,000 nodes using the Preferential Attachment algorithm that adds nodes 1 at a time, each with edges to m of the previous existing nodes (find code at stack overflow or at GitHub or write you own). Then solve the following 3 tasks:

- (a) Plot on log-log scale the degree distribution at intermediate steps for networks of 100, 1,000 and 10,000 nodes.
- (b) Compute the average clustering coefficient as a function of the number of nodes on these networks.
- (c) Measure the degree dynamics of one of the initial nodes and of the nodes added to the network at time $t=100$, $t=1,000$ and $t=5,000$.

Problem 3.

Propose two topics that you would like to study independently as to present a lecture in class on one of these topics. These topics should be different from topics already discussed in class. Each topic should be appropriate for a 18 minutes presentation. For each topic list literature that you would use to prepare the lecture. Possible topics to consider (you can also consider different topics):

- Evolving networks
- Degree correlation
- Network robustness
- Communities in networks
- Spreading phenomena
- Epidemics on networks
- Weak ties
- Meme
- Advertising and recommendations
- Modeling network traffic
- Generative models for networks
- Voting
- Biological networks
- Industrial applications of information networks
- Network partitioning
- Percolation and network resilience
- Dynamical systems on networks
- Mobility network models of COVID-19 (S. Chang et al, Nature Vol 589, 7. January 2021)
- Representation learning on networks (WWW 2018 tutorial)
- Antisocial behavior on the web (WWW 2017 tutorial)