SI 301
Assignment 3
Due in class on Tue September 26th

Reading: Sections 4.1 – 4.4 of textbook.

1. Problem 2 in textbook.
2. Problem 3 in textbook.
3. In the network shown on figure 1, the gray-shaded nodes represent boys and the orange-shaded nodes represent girls in an elementary classroom. The edges represent friendships.
    a. Use the *homophily test* to show that there is evidence of homophily in the network.
    b. Imagine that you are running an intervention in this classroom with the goal of removing homophily. The intervention involves pairing up students so that new friendships form, and thus adding new edges to the network. What is the smallest number of friendships you would need to add so that the network no longer exhibits homphily? Draw the new network and use the homophily test to show that there is no longer evidence of homophily.
    c. Represent the network as a social-affiliation network, where students can be members of the "Boys" group or "Girls" group.

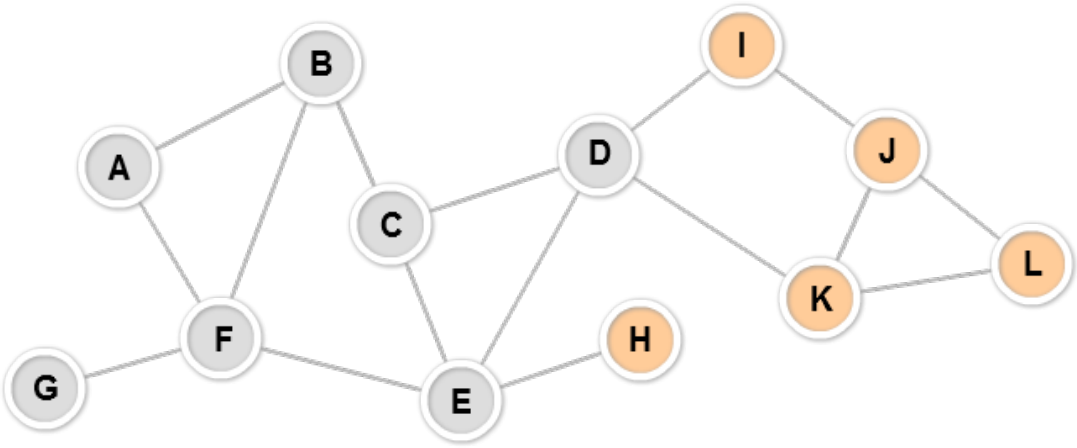

Figure 1

4. Consider the social-affiliation network shown in figure 2. Every edge has a number next to it. These numbers represent the order in which the edges appeared in the network. For example, edge BSI–D came first, CS–B came second, and so on. For each edge, say whether it is an example of *(i) triadic closure, (ii) group or focal closure, or (iii) membership closure*. Note that some edges may be examples of more than one closure and some may not be an example of any closure.

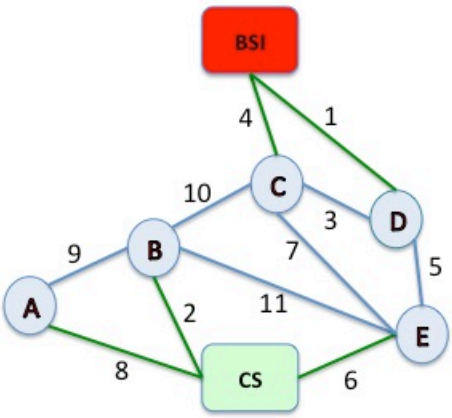

Figure 2

5. The figure below shows snapshots of a social-affiliation network at different points in time, from t=0 to t=4. Is the evolution of the network more consistent with the *selection* mechanism or the *social influence* mechanism? Explain.

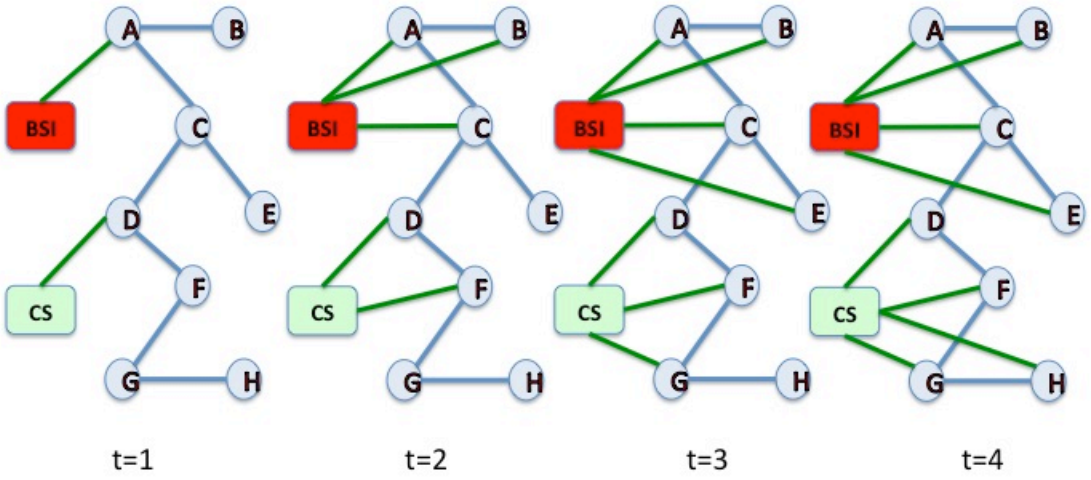

Figure 3

6. Researchers D. Lusseau, K. Schneider, O. J. Boisseau, P. Haase, E. Slooten, and S. M. Dawson have studied the associations between dolphins in a community and have created a dolphin social network. It is an undirected network dolphins from a community living off Doubtful Sounds, New Zealand. You can find the network data in the file dolphins.gml in the Assignments folder on Canvas.

- Download the dataset and copy it to the directory where your IPython notebook is present.
- The network data is in gml format (you can read more about gml format here: https://networkx.github.io/documentation/networkx-

1.10/reference/readwrite.gml.html). You can read the data into a Networkx graph using the following command:

G = nx.read_gml("dolphins.gml")

You will use NetworkX to run a high-level analysis of the structure of the dolphin network. Use NetworkX to answer the questions below. The following NetworkX functions may be useful to answer the questions: number_of_nodes, number_of_edges, number_connected_components, average_shortest_path_length, diameter, clustering, average_clustering, transitivity, draw_networkx. Remember you can always consult NetworkX's documentation to learn more details about the library: https://networkx.github.io/documentation/latest/

a. How many nodes and edges does the network have?
b. How many connected components does the network have?
c. What is the average shortest path length in the network (or in the giant component, if the network has more than one component)?
d. What is the diameter of the network?
e. Which dolphin in the network has the highest local clustering coefficient? What is its clustering coefficient?
f. What is the Mean Clustering Coefficient of the network?
g. What is the transitivity of the network?
h. Visualize the network. Looking at the visualization, does the network have any local bridges?

Turn in the code and output you used to answer the questions.

Full paper about this dolphin community:

Lusseau, D., Schneider, K., Boisseau, O. J., Haase, P., Slooten, E., & Dawson, S. M. (2003). The bottlenose dolphin community of Doubtful Sound features a large proportion of long-lasting associations. Behavioral Ecology and Sociobiology, 54(4), 396-405.