CSC 485B/578B: Assignment 2

Due: 23:55 pm, June 16, 2014

Remarks

- Each question has two weights, with the first one for CSC 485B students and the second for CSC 578B students.
- You need to submit your solution in a **pdf** file to connex dropbox by the due time. Other format will not be accepted.
- For Question 1, you also need to submit your java source code to connex dropbox.

Question 1

(15%, 10%) Does the anonymized personal Facebook network, described with *Personal-May8-Anonymous.gephi*, which could be downloaded from Connex → Resource, exhibit homophily with respect to gender? Write a simple java code for homophily test. Note you need to ignore the nodes that do not have the gender information.

Problem 2

In the last question of Assignment 1 (i.e., Problem 4 of Assignment 1), you already know that the network is structurally unbalanced, implying that there are latent incentives for some farmers to change their social environment. In the same geographical setting, we still assume each farmer is friends with all the other farmers that live at most 20 miles from him or her. But for each farmer (say A), A is allowed to make friends with another farmer, who lives more than 20 miles away from A and by default is an enemy of A, with a cost proportional to the distance between the two farmers. Clearly, there is a simple scheme to enforce the structural balance if each farmer is willing to invest enough to "fix" the problem, e.g., making friends to every other farmer. But this may be too costly.

1. (15%, 15%) Is there a cheaper way to make the network structural balanced? If yes, provide your solution. If not, explain your reason.
2. (0%, 20%) Assume that we use the third generalization of structural balance (i.e., approximately structural balance) by requiring that at least 85% of triangles are balanced. For ease analysis, assume that the cost to introduce friendship between two farmers who live x miles

($x > 20$) away is x dollars. Assume that this is an undirected network and that the x dollars will be equally shared by the two endpoints involved. To make the network approximately structural balanced, what is the minimum total cost for the farmers?

You can write a program to solve the problem. You will get an extra bonus of 10%, if you could provide an analytical solution.

Problem 3

Assume that we have a group of $n + 1$ people sitting around a round table. Assume that there is a token circulated along the round table, and a person can speak only if he/she obtain the token. We assume that the time that a person can hold the token, once receiving it, is exponentially distributed with the mean value of λ seconds. At the end of this time, the token then has to be passed in the clockwise or counterclockwise direction with the same probability (i.e., 50%) to the neighboring person. Assume that every people always have something to speak. Assume that the token is initially at person 0.

1. (20%, 15%) What is the probability that person $i, (i = 1, 2, ..., n)$ is the last person that start speaking?

2. (15%, 10%) What is the expected time required such that person $i, (i = 1, 2, ..., n)$ can speak the first time?

Problem 4

We will consider the information cascades model introduced in class with specic values for the probabilities. Lets suppose that the probability that Accept is a good idea is $p = 1/2$; and the probability of a High signal if Good is true (as well as the probability of a Low signal if Bad is true) is $q = 3/4$. Finally, lets assume that Good is actually true.

1. (10%, 10%) What is the probability that the rst person to decide will choose Accept; whats the probability that this person will choose Reject?

2. (10%, 10%) What is the probability of observing each of the four possible pairs of choices by the rst two people: (A,A), (A,R), (R,A), and (R,R)? [A pair of choices such as (A,R) means that the rst person chose Accept and second person chose Reject.]

3. (15%, 10%) What is the probability of an Accept or a Reject cascade emerging with the decision by the third person to choose? Explain why a cascade emerges with this probability.