Seoul National University

M1522.001400 Introduction to Data Mining

Spring 2016, Kang

Homework 9: Mining Social-Network Graphs (Chapter 10)

Due: June 8, 09:30 AM

Reminders

- The points of this homework add up to 100.
- Like all homeworks, this has to be done individually.
- Lead T.A.: Jinhong Jung (montecast9@gmail.com)
- Please type your answers in English. Illegible handwriting may get no points, at the discretion of the graders.
- If you have a question about assignments, please upload your question in eTL.
- If you want to use slipdays or consider late submission with penalties, please note that you are allowed one week to submit your assignment after the due date.

Remember that:

- Whenever you are making an assumption, please state it clearly

Question 1

For the example graph from Figure 1, use the Girvan-Newman approach to find the fraction of shortest paths from each of the following nodes that pass through each of the edges when we start BFS from the following node. [25 points]

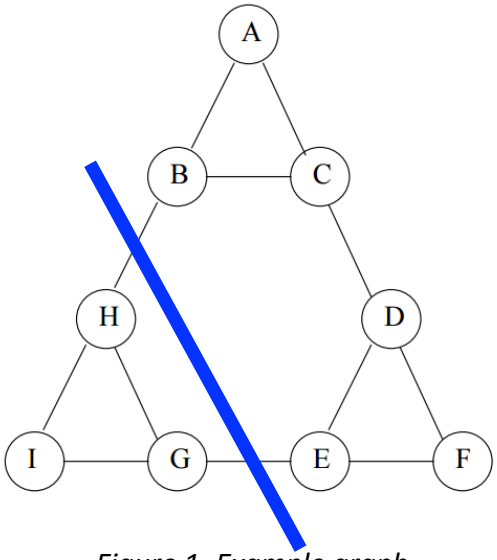

Figure 1. Example graph

(a) A

(b) B

Question 2

Using symmetry, the calculations of Question 1 are all you need to compute the betweenness of each edge. Do the calculation. [25 points]

Question 3

For the graph of Question 1, answer the following questions. [30 points]

(a) Write down the Laplacian matrix of the graph.

(b) For the Laplacian matrix constructed in the above, after computing the second-smallest eigenvalue and its eigenvector, draw two partitions of the graph based on the eigenvector. The splitting point is zero. (Hint: use 'eig' function of MATLAB or OCTAVE)

- There would be multiple second-smallest eigenvalues; thus multiple answers are possible. In that case, just select one of them (i.e., select the first appeared one). If your partition result is based on the second-smallest eigenvalue, then we will give you a full point.

Question 4

For the example graph from Figure 2, how many instances of $K_{s,t}$, complete bipartite subgraph, are there for: [20 points]

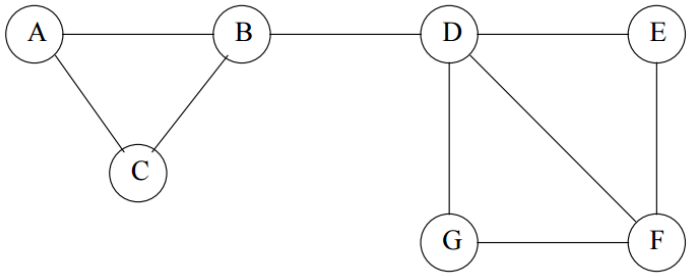

Figure 2. Example graph

(a) $s = 1$ and $t = 3$

(b) $s = 2$ and $t = 3$