CSC 499-06 Network Science, Fall 2014

Instructor: Dr. Natarajan Meghanathan

Project 1: Network Analysis and Visualization using CINET

Due: October 16, 2014: 4 PM

Project Objective: In this project, you will learn how to conduct network analysis and visualization using the CINET cyber infrastructure tool. CINET is a work-in-progress web-based application hosted at Virginia Tech. CINET comes pre-loaded with several network data that you can readily analyze and visualize from a computer without installing any software. Before you start this project, make sure you have a registered account in CINET (visit: http://cinet.vbi.vt.edu/granite/granite.html).

Tasks to do: For the network assigned to you, use CINET to find out the following:

1) Articulation points of the network

2) Whether the graph is bi-connected, bi-partite and Eulerian? What it means by each of these properties?

3) What is a bridge edge? List them if your network has any?

4) What is a clique? Determine the number of cliques of size 3 and larger in your graph.

5) What is Eccentricity for a node? How is it related to the diameter of a network? (Refer to Module 1 slides). For the network assigned to you, determine the largest of the node Eccentricity values.

6) All the centrality metrics that CINET can find out for you. Find out the top five vertices that have the highest centrality score for each of these metrics. Are these exactly or almost the same set of vertices for all the metrics or are they different? Explain your observations.

7) Find out the largest value for the Average neighbor node degree for any node in the network? Is this node among the top 5 vertices that you found for any of the centrality metrics above?

8) Probability (Frequency) degree distribution of the vertices. Retrieve the probability degree distribution data from CINET; plot it in Excel and interpret the shape - Explain whether it is Poisson, Scale-free, Exponential, etc. (Look at slides in Module 1 for more information on shapes for the distributions)

9) The maximum clique of your entire network and the maximum clique containing Node 1. Are they the same or different?

10) Determine the Authority and Hub scores as well as the Page rank score of the vertices in your network. Are the vertices with the top 5 authority scores or hub scores same as the vertices with the top 5 page rank scores? Explain your observations.

11) Visualize your network by varying the node size on the basis each of Degree and Betweeness Centrality. Try the Yifan Hu + Force Atlas layout.

12) Research on the following layouts: ForceAtlas 2, Fruchterman Reingold and Yifan Hu. Explain on what basis do they layout a network. Show screenshots of your assigned network appears in each of these three layouts.

Note: You could combine the Network Analysis for one or more questions into one single analysis to determine the metrics in one stretch and then extract the answers for the individual questions. For example, you could combine the questions for articulation points, cliques, bridge edge, etc into one single network analysis. CINET allows you to analyze more than one metric at a time.

My Demo Video: I have recorded a desktop video demonstrating the working of CINET and its features. It is posted at: https://www.youtube.com/watch?v=Px3ypKn9vSU
You can look at the video to learn more about CINET and use it as a reference to do this project.

Networks (pre-loaded in CINET) assigned for each student

Susmita Atluri - Karate Network
Bharath Gajjela - American College Football Network
Pratik Jannela - Dolphins' Social Network in NZ
Gulam M. Khan - Hypertext 2009 dynamic contact network
Joel Maddirala - Les Miserables
Ankamma Ravi - Politics books
Yuxiao Zhou - Word adjacencies
Alain Rafiki - Soccer World Cup 98

Submission:

For each of the questions 1 through 12, compile a report of your answers by taking appropriate screenshots and notes. Submit the report in class.

Also record a desktop video of how you did the project and found out the answers for the questions. You will have to basically walkthrough the steps that you execute in CINET to find out the answers for each of these questions. Submit the video through Google Drive (using your JSU email address); email the link to download to natarajan.meghanathan@jsums.edu.

You could try using one of the desktop recording software (or anything of your choice):
CamStudio: http://sourceforge.net/projects/camstudio/files/legacy/
Debut: http://www.nchsoftware.com/capture/index.html