CIS 4930/6930: Recent Advances in Bioinformatics, Spring 2014
Homework 1

Due date: 2 / 7 / 2014
Turn in hard copy in class

January 22, 2014

This is a programming homework. The purpose is to gain experience on network characteristics. For reference, see course slides available at `www.cise.ufl.edu/~tamer/teaching/spring2014/lectures` (Slides 2).

You will implement a code that (i) generates random network (ii) reports key characteristics of a given network. Details are below.

Create random networks Your code will create undirected random networks under three different network models. These are Erdos-Renyi (ER), Watts-Strogatz (WS), Scale-Free (SF). For each network, it will accept the appropriate parameter set in the following order.

- (ER)

  n = number of nodes

  p = probability of edge existence

- (WS)

  n = number of nodes

  k = average degree

  p = rewiring probability

- (SF)

  n = number of nodes

  λ = disparity index

Your code will label the n nodes with numbers 1, 2, ..., n and *print the network on the screen, one edge per line.* For instance a network with nodes 1, 2, 3, 4 can look like this:

1 3
1 4
2 3
3 4

Characterize random networks Your code will compute three characteristics of a given network: (i) degree distribution, (ii) clustering coefficient distribution, and (ii) closeness centrality distribution. Your code will *print the resulting distributions in three text files named degree.txt, clustering.txt and closeness.txt.*

The output format of the distribution will be two numbers in each line
(value) (frequency)

For instance the degree distribution may look like the following

0 0.3
1 0.4
3 0.2
4 0.1

Experiment Create networks for each random network model with different network sizes (n = 1000, and 10,000). Set the parameters, so that the number of edges (m) are $m = 2n$ and $m = 10n$ for each network. Plot the degree, clustering and closeness distributions. You can plot all three network models for the same (m, n) pair in the same figure. So, you will have four plots in total.

Return You will return a soft copy of the following items through Sakai.

1. A report that contains the four plots described above and a brief discussion of the results.
2. Source code.
3. A Readme file that describes how you compile and run your code. I should be able to compile and run your code simply by copy-pasting 1 or 2 lines from your readme file.

Also, bring a hard copy of the report to me on the due date.

Final details:

- You can use C, C++, Java, matlab or any other language that I can run on a standard linux machine.
- The first parameter of your code should be the model type (ER, WS, or SF) and the rest should be the parameters defining that model. For instance, to study an Erdos-Renyi network with 1000 nodes and 0.05edge probability, you code may run like:

```
> a.out ER 1000 0.05
```

- Make sure that the program runs on linux.
- zip the folder that contains all the files to a single file before you submit it. Submit this zipped file. I should be able to extract the files using "unzip".
- Make sure that your code does not crash easily.
- The code you deliver should not print junk messages. I should see only the two results described above.