

TSKS11 Hands-On Session 4

Fall 2019

Task 1: Small world

Use the program `task1.py` (run `task1.py` on the command line) to examine the effective diameter for

- A circle network with node degree 4
- A Watts-Strogatz network based on a circle network with node degree 4, and re-wiring probability 0.01
- A Watts-Strogatz network based on a circle network with node degree 4, and re-wiring probability 0.1
- The Amazon co-purchasing network (from the SNAP datasets)

Conclusions? Go through the program `task1.py` and explain what each lines does.

Task 2: Degree correlation

- Write a function that measures the degree correlation coefficient.
- Write a function that calculates and plots the degree correlation function, $k_{nn}(\cdot)$.
- Use your functions to measure the degree correlation coefficient, and plot $k_{nn}(\cdot)$, for
 1. the science collaboration network in Barabasi's dataset (`collaboration.edgelist.txt`).
 2. the Poisson random network (you can find one in the file `poission.edgelist.txt`)

- Use your functions to measure the degree correlation coefficient, and plot $k_{nn}(\cdot)$, for the same networks as above but that have undergone re-wiring through degree-preserving randomization. These networks are contained in the files `collaboration-R.edgelist.txt` and `poisson-R.edgelist.txt`. Conclusions?

This task will require some programming in Matlab, Python, or other language of choice. To test your program you can use the small test network in the file `mini-network.edgelist.txt`. The degree correlation coefficient and the $k_{nn}(\cdot)$ for this test network are given in the file `answers-mini-network.txt`.

Task 3: Structural cutoff

The files `n1.edgelist.txt`, ..., `n5.edgelist.txt` contain five realizations of a scale-free network with 100000 nodes and a power-law exponent of $\gamma = 2.5$.

Plot $k_{nn}(\cdot)$ for these networks (using your program developed in task 2) and comment on the result.

Examination

- The program code you have written should be submitted to Urkund: `ollab13.liu@analys.urkund.se`.
- Collaboration on this homework in small groups is encouraged, but each student should perform programming work individually, and individually demonstrate understanding of all tasks.
- Library functions from SNAP, Matlab and the Python standard library may be used freely, but copying of code from other libraries and/or toolboxes, from the Internet, from other students, or from previous years' students is prohibited.
- Individual oral examination takes place in class (computer lab).