CSE 255, Winter 2015: Homework 9

Instructions

Please submit your solution **at the beginning of the next lecture (March 9)** or outside of CSE 4102 beforehand. Please complete homework **individually**.

Download the "facebook ego-network" data from the course webpage:
`http://jmcauley.ucsd.edu/cse255/data/facebook/egonet.txt`

Tasks

1. What is the clustering co-efficient of the graph (average clustering coefficient of each node) (1 mark)?

2. What is the diameter of *the largest connected component of* the graph (1 mark)?

3. Fit an Erdös-Rényi model with the same number of nodes as the ego-network, and whose *expected* number of edges is the same as the number of edges in the ego-network. How do its clustering coefficient and the diameter of its largest component compare to those found above (1 mark)?

4. Compute the (unnormalized) rich-club coefficient

$$\phi(k) = \frac{2E_{>k}}{N_{>k}(N_{>k}-1)}$$

   (see the Lecture 9 'case study' for a description of this expression) for all degrees k in the graph (plot or write down the values) (1 mark).

5. Randomly re-wire the network in such a way that the degree distribution is preserved (see the Lecture 9 'case study' for a description of such a procedure). Compute the rich-club coefficients $\phi_{\text{rand}}(k)$ for this randomized graph, and the normalized co-efficients $\frac{\phi(k)}{\phi_{\text{rand}}(k)}$ (plot or write down the values). Would you say that the ego-network exhibits the rich-club phenomenon or not, and why might this be the case in a network of this type (1 mark)?