Network Science, Fall 2016

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Homework 4, due by October 28th, 9:30am (before the class)

Write your name at the top of your homework before handing it in, and show the detailed calculation. Staple all pages together.

a) Find the normalization factor A, assuming that the network has a power law degree distribution with $2 < \gamma < 3$, with minimum degree $k_{\min}$ and maximum degree $k_{\max}$.

b) Calculate the average degree of the neighbors of a randomly chosen node in a network with $N = 10^4$, $\gamma = 2.3$, $k_{\min} = 1$ and $k_{\max} = 1,000$. Compare the result with the average degree of the network, $\langle k \rangle$.

c) Calculate the $k_{\min}$ of a network with $N = 10^4$, $\gamma = 2.3$, and $\langle k \rangle = 6$. Note that $k_{\min}$ is not necessary to be an integer, for example $k_{\min} = 2.5$ means that there is the same fraction of nodes with degree 2 and 3, and the minimal degree is 2.

d) Write a computer code to generate networks of size N with a power-law degree distribution with degree exponent γ, and with minimal degree $k_{\min}$. Generate three networks with $\gamma = 2.5$, $N = 500$, and with minimal degree $k_{\min} = 1$, $k_{\min} = 2$, and $k_{\min} = 3$, and visualize the networks.

e) Generate a network with $N = 1,000$ nodes using the Barabasi-Albert model with $m = m_0 = 4$, and calculate the maximum degree.