1.022 Introduction to Network Models **Fall 2018**

Homework 4

4.1 Random graph models

[15 points] Replicate the "small-world" experiment numerically. Start with a regular k-nearest neighbors ring-graph, and then keep adding random links to this graph. Observe how the clustering coefficient and average shortest path-length behaves as a function of the link-probability (see python notebook).

Describe the results you obtain in 5 or less sentences.

[15 points] You have learned about the Barabasi-Albert preferential attachment model in the lectures. Here we will explore it computationally. Use networkx to construct these graph for varying parameters and report on the result you obtain (see python notebook).

[30 points] In this exercise you are going to explore the stochastic block model. As you have already seen in the class, this random model is defined as follows:

We consider an undirected network with n nodes, which are divided into 2 equally sized groups which we name class 1 and class 2. The probability of a link between two nodes is now given by p if the nodes are in the same class, and by q if the nodes are in two different classes.

Your task is to

a) create this random graph model,
b) create graphs with varying parameters, and
c) use spectral clustering to see whether you can recover the blocks. For more details see the python notebook.

Describe your findings in 5 sentences or less.

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