168 - Homework 7. Homework is due on March 15th, with a penalty free late deadline of March 17th

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Exercise 1. In this exercise you will use community detection methods to analyze a famous network called the Zachary karate club.

(a) Read about the Zachary karate club social network in Newman (p. 503-4), and summarize in a few sentences what the network is, and why it has assumed such historical importance.

(b) Read this blog post about using Matlab to load, visualize, and analyze the Zachary karate club data:

`https://tinyurl.com/zachary-matlab`

(i) Make the modularity matrix for the network. (You do not need to show your answer here).

(ii) Detect the communities using the spectral method used in class. Make two plots: one in which the nodes are color-coded by the entries of the eigenvector, and one in which the sign of the eigenvector values is use to assign nodes to communities.

(c) In this case, 2 is the right number of communities to partition our nodes into. Could we anticipate this? Use spectral clustering (in Matlab, the code is spectralcluster.m) to partition the Zachary karate club data into 1, 2, 3, 4, 8 communities. (Matlab's spectralcluster uses the eigenvectors of the Laplacian of the network, rather than the modularity matrix. You may remember our discussing this in relation to the graph cut problem early in this course). Calculate the modularity of each of the partitions, and make a table showing the computed modularity as a function of the number of communities. What do you notice about the modularity as a function of the number of groups?

Exercise 2. Work through your midterm exam and correct the problems that you answered incorrectly when you took the exam.