

CSI 445/660 – Network Science – Fall 2015

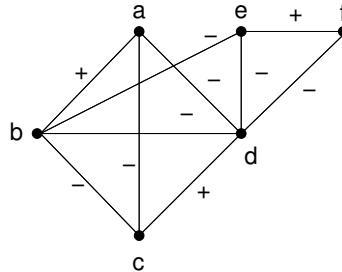
Homework III

Date given: Oct. 15, 2015

Due date: Oct. 27, 2015

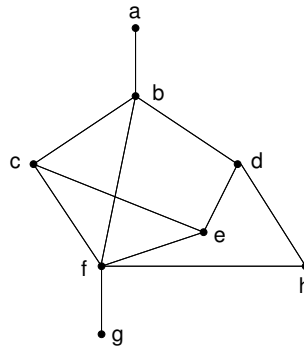
**Instructions:** All students must do Problems 1 and 2. Undergraduate and graduate students in Computer Science must also do Problem 3.

**Problem 1:** Consider the following signed graph. Use the algorithm based on Harary’s characterization of balance to determine whether or not the graph is balanced.



Your answer must clearly indicate whether or not the above graph is balanced and how the algorithm allowed you to reach that conclusion.

**Problem 2:** Consider the following undirected graph.



- (a) For each node in the above graph, show the values of (i) closeness centrality and (ii) eccentricity.
- (b) Indicate the radius of the graph and identify all the center nodes of the above graph.

**Problem 3:** For any positive integer  $n$ , prove that there is an undirected graph with  $N \geq n$  nodes and exactly  $N$  edges such that each node has a clustering coefficient of 1. (An undirected graph  $G$  with  $N$  nodes is **sparse** if the number of edges in  $G$  is  $O(N)$ . This problem points out that sparse graphs may have large clustering coefficients.)

Your answer must clearly explain how to construct such a graph for any integer  $n \geq 1$  and why the clustering coefficient of each node is 1.