

## HW 10: due Thursday, December 5 in class

1. (This question is due to Jon Kleinberg). In the basic “six degrees of separation” question, one asks if most people in the world are connected by a path of length at most six edges in the social network, where an edge joins any two people who know each other on a first name basis. Now let’s consider a variation on this problem. Suppose we consider the entire population of the world, and suppose that we create a directed edge from each person only to their ten closest friends (but not to other people who they know on a first name basis). In the resulting “closest friend” version of the social network of people in the world, is it possible that for each pair of people in the world, there is a path of length at most six? Explain.
2. (This question is also due to Jon Kleinberg). Suppose that some researchers studying educational institutions are studying data to address the following two questions.
  - (a) As a function of  $k$ , what fraction of Tufts classes have  $k$  students
  - (b) As a function of  $k$ , what fraction of 3rd grade elementary school students in New York State have  $k$  pupils.

Which of these two functions do you think is more likely to follow a power law distribution?? Why??

3. Suppose we find on a popular internet music site the number of times a song is downloaded follows a power law distribution. Write 1-2 paragraphs to describe what sort of incentives you might put in place 1) to increase the popularity of the most popular songs even further OR 2) to try to “flatten out” the distribution more so that downloads become more even. (This is more an economics or a marketing question than a graph theory question!)

Reminder: takehome final will be handed out on Thurs, December 6th and is due by Wed, December 12th at 5pm under my office door or in my department mailbox.