Broadcasting a message within a Social Network

Overview

This project investigates the problem of making an announcement which I want to reach everybody within a social network. How many people do I need to announce that? I just want to find the smallest number of people to essentially announce to the social network that something's true, and everyone will hear it.

Data

The provided UCSD facebook data.

Questions

Easier. I want to find the group of people highly connected, so with this group I can reach everyone in the network. This will be the dominating set.

Harder. I want to know if the group of people I found in the easier question is the minimum group of people in order to reach the whole network. This will be the mínimum dominating set.

Algorithms and Data Structures:

Main Data Structure: The network has been laid out as a classic graph using an adjacency list. Each individual in the graph is a vertex and an edge between vertices represents a relationship. In order to represent the Graph I use a map, each entry in the map is a vertex(key) and the value is a list with its neighbors. This should work for both problems.

Easier Question. I will try a greedy algorithm that is described in (Johnson, 1973). Basically, at each stage, the greedy algorithm chooses the set which contains the largest number of uncovered elements. Starting from an empty set, if the current sub-set of vertices is not the dominating set, a new vertex which has the most number of the ad-jacent vertices that are not adjacent to any vertex in the current set will be added.

Harder Question. Finding a minimum set seems like it might be problematic. The algorithm depicted in the easier question is an approximation algorithm for the Set Cover problem. We will always find out the dominating set and sometimes the mínimum dominating set, but not always. I will try the “Big Step Greedy Set Cover Algorithm” depicted in: https://arxiv.org/pdf/1506.04220.pdf

Algorithm Analysis, Limitations, Risk:

Easier Question. The Greedy approximate algorithm takes a polynomial time, the greedy algorithm provides a Log(n) approximate algorithm (Source: http://math.mit.edu/~goemans/18434S06/setcover-tamara.pdf).

Harder Question. Formalizing the problem I can say, given a graph, find the smallest set of vertices S, such that every vertex not in S is adjacent to at least one vertex in S. This problem is actually hard and is related to the minimum dominating set problem, that is an NP hard problem taking no polynomial time instead exponential or factorial.