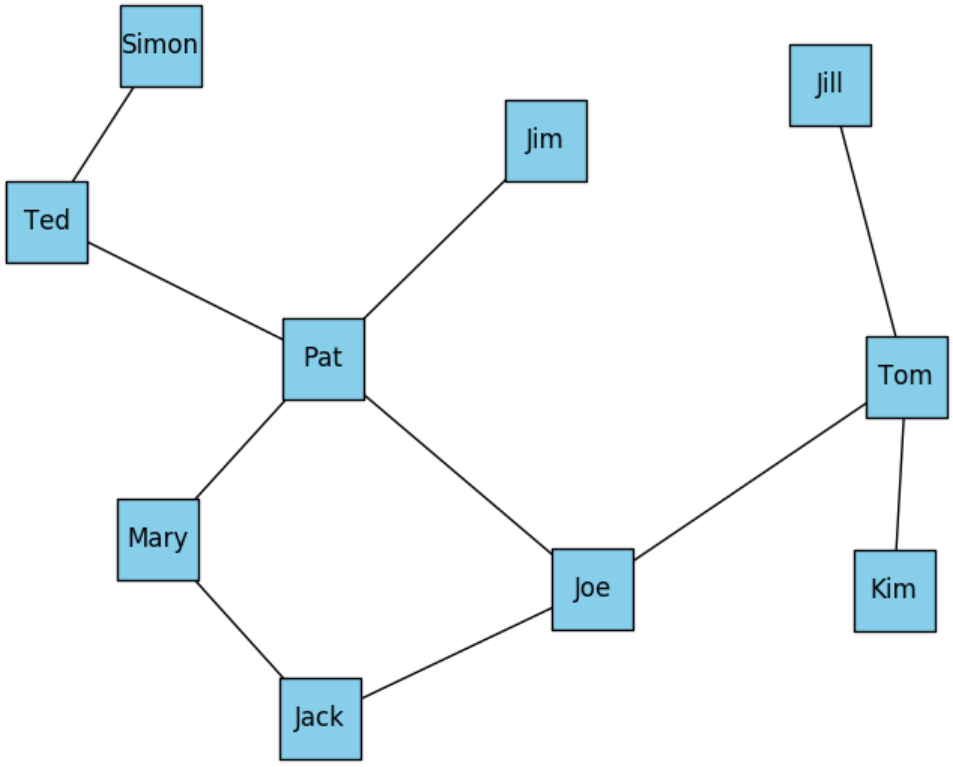
COMP 6925 Applied Operations Research

Project

Due Date: 24th November 2017 @ 11:59 PM

Problem

Online social networks serve as a main method through which advertisers try to inveigle consumers to purchase their products. In an ad campaign, advertisers pay for a budget of ads that are distributed to users of the social network. The goal of said campaigns is to maximize the number of clicks generated by an ad campaign.



In a social network, the actions of a user can influence the behavior of their friends. For example, consider the above graph. Consider the case where Joe is given an ad and clicks said ad. Joe's action of clicking, may positively influence Pat, Jack, and Tom to click the ad if they are given the ad themselves. Hence, we can develop a model of distributing ads to users where the potential

influence users have on one another can be exploited in deciding the distribution of users in a social network.

Our model for the above as a stochastic dynamic programming is as follows:

At the start of a campaign we are afforded a budget of impressions *M.* We wish to disseminate these *M* impressions over a set of *N* users in our social network over *K* stages. Moreover, at the start, all users have a probability 0.25 of clicking.

For the sake of simplicity, we shall consider only the case of 2 stages. In the first stage, we allocate a number of impressions, m_1. After a user has been allocated an impression in the first stage, they cannot be allocated an impression in the subsequent stages. We then consider the possible reactions to those m_1 allocations, and decide on the users to whom we distribute the remaining $M - m_1$ ads. Recall that the reactions of allocated users in the 1st stage affect the probabilities of other users in the 2nd stage. You may assume the probabilities for a user are adjusted by the following equation:

$$p \leftarrow \max\{0, \min\{1, 0.25 + \alpha\frac{n}{f}\}\} \qquad \text{(eq 1)}$$

where

α is the scalling constant, you may assume it has a value of 0.15
n is the number of a user's friends who were given an ad and clicked
f is the total number of a user's friends

Objectives

1) Write code in a programming language of your choice that determines the best allocation of 5 ads to users in a given social network across 2 stages. You will be provided an edge list.
2) Research and derive an alternative model for influence than the one we discussed in (eq 1) and use it in your code from (1).
3) Compare and contrast the results of (1) and (2).