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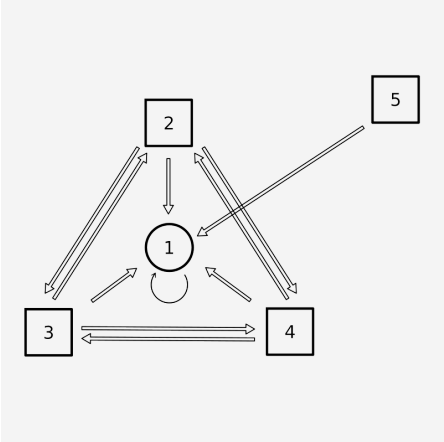
Problem A: Group Affinity and Fashion Sense

This problem is about someone's likelihood to alter their appearance and conform to particular expectations based on the influence of someone else in their group or clique. We are going to explore a person's likelihood, Person A, to change their appearance based on if they like the influencer, Person B, or not and how much influence Person B has on Person A. Another factor we looked at is how much influence someone has on his/herself, i.e., their ability to resist the change. We modeled how a group of people in a social network adopt to new ideas over a period of time using an adjacency matrix and a vector of probabilities.

To start approaching this problem, we will assign probabilities to each person. A probability of zero means the person has no chance of changing their appearance. A probability of one means the person has a one hundred percent chance of changing their appearance. This is what we will be changing in our model. A person can have any probability of adoption ranging from zero to one. This change is adoption probability is modeled by

$$\frac{dP_i}{dt}$$

For example, we could look at how adoption probabilities change over time in a social network like the one shown in the graph below.



In this graph the circle represents a proponent who changes his/her appearance with a one hundred percent probability for all of time. The squares represent the people whose likelihood to change their appearance initially starts at zero percent but changes over time due to the influence of the circle and others. Persons 2,3, and 4 all have influence on each other along with influence from Person 1. Because Person 1 has a constant one hundred percent adoption probability the only person who influences Person 1 is Person 1. Person 5 is the control for the situation. The arrows represent influence. The person with the arrow on them is the influencer that influences the person on the other end of the arrow. The flow of information would follow the opposite direction of the arrows. The information would flow from the influencer to the other person.

Now looking at a general case we will use Person i and Person j where i,j=1,2,3... . Denote the influence Person i gets from Person j withA_{ij} where A is the adjacency matrix . To find the change in the probability of Person i with respect to time we used the equation

$$\frac{dP_i}{dt} = \sum_{j=1}^{n} A_{ij} * \left\{ \begin{matrix} P_j, \text{if Person i likes Person j} \\ 1 - P_j, \text{if Person i has contempt for Person j} \end{matrix} \right\} - P_i$$

The sum of each row in the adjacency matrix has to sum to one and no value can be negative. This differential equation was inspired by the transfer of heat where the weighted average of all neighboring adoption probabilities is analogous to the environment's temperature.

This is the graph of probability vs time for the figure used above with all outward going edges having uniform weight. It was generated using Euler's method.