

A Probabilistic Model of Information Flow

Hypothesis: Suppose success probability p is very small. Then, if the target is more than two hops from an initial user, the change is not likely to happen. Hence, the person with greater degree will be more influential initial user. If p is medium range, then a target person far from initial user is less likely to change to use the product. So, the person with greater node closeness centrality is more important in the network. If p is very large, then whoever you choose as an initial user, the result will be pretty same.

Result:

Result Graph: Success probability p vs. Percentage of people changed. (Stronger color represents smaller node number.)

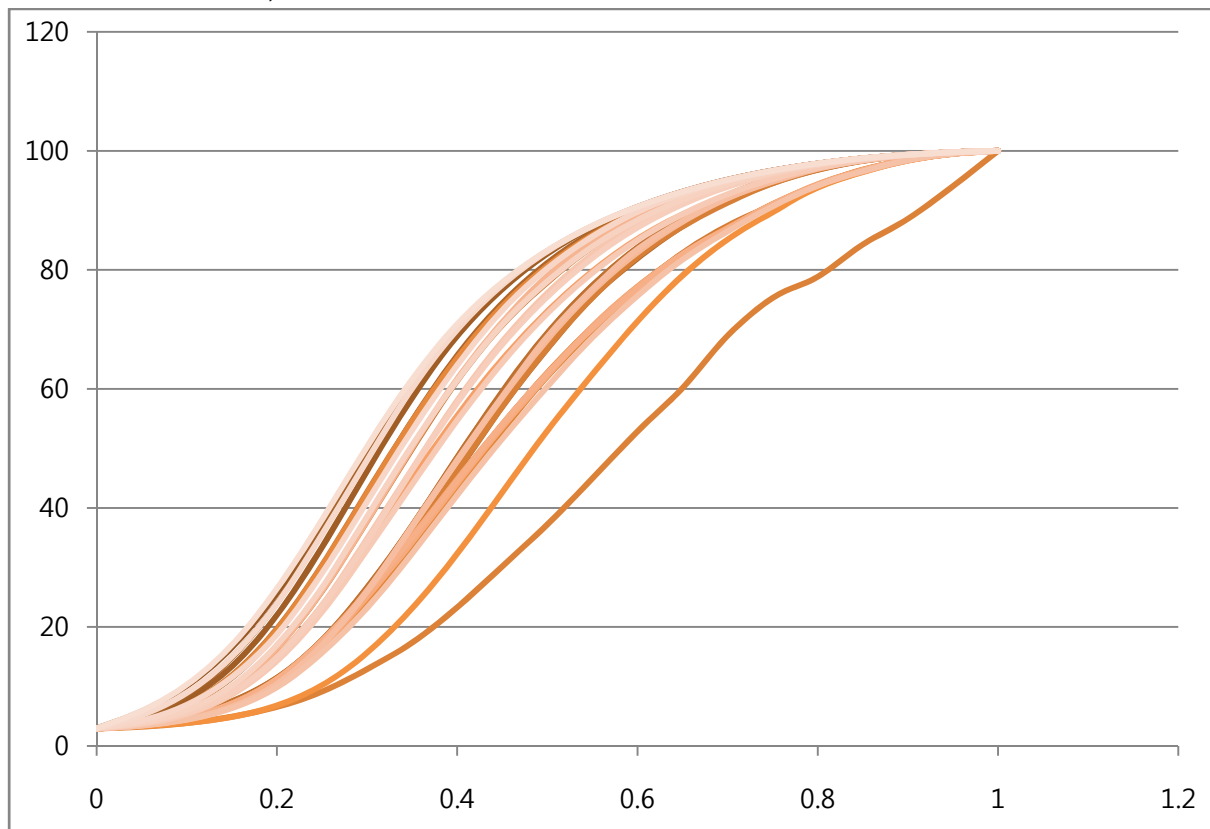


Table: Top 5 people for each probability

	1st	2nd	3rd	4th	5th
0.05	33 (5.891)	0 (5.808)	32 (5.202)	2 (4.939)	1 (4.693)
0.10	33 (10.266)	0 (10.059)	32 (8.894)	2 (8.573)	1 (7.833)

0.25	33 (37.985)	0 (37.161)	2 (35.966)	32 (35.514)	1 (33.403)
0.50	33 (83.239)	0 (83.149)	32 (83.105)	2 (83.083)	1 (82.744)
0.75	0 (96.684)	32 (96.68)	1 (96.677)	33 (96.673)	2 (96.673)
0.9	1 (99.363)	32 (99.36)	31 (99.36)	8 (99.36)	33 (99.359)
0.95	1 (99.772)	33 (99.772)	30 (99.772)	31 (99.771)	32 (99.77)

Table: Degree of important nodes

Node #	0	1	2	32	33
Degree	15	9	10	12	17

Analysis: For small success probability p , it comes out pretty same as the hypothesis. If the node has larger degree, the node changes more people to use the product. For medium range of p , it is not enough to say whether the hypothesis is true or not. For large p , as you can see when $p = 0.95$, the order is pretty much random.

A Model of Peer-Pressure

- 1) For Karate Linear Network,

Optimal initial user: user 0 (total 7 people use the product)

Optimal set of two initial users: user 0, user 32 (total 18 people use the product)

Optimal set of three initial users: user 0, user 1, user 32 (total 29 people use the product)

- 2) Since b_{ij} is very local property (property of the relation between two friends), it would be good enough to consider two friends' characteristic. In my intuition, if a person has larger threshold, then the person must be cautious in changing his product. Therefore, it is likely to be trusted by other friends and influence them more. Also, if a person has small degree, then the person is cautious in making friends, and it is likely to trust his friends more than others do. Let t_i = threshold of person i , d_i = degree of person i . So, in a word, I want the property $b_{ij} \propto t_j / d_i$. I want that sum of b_{ij} for all j is most likely greater than $2 * t_i$ (this is from the intuition that if majority of one's friend is using the product, then the one is pretty much likely to change to use the product). So, if we assume $b_{ij} = k * t_j / d_i$ then $\sum b_{ij} = (k / d_i) * \sum t_j \geq 2 * t_i \Rightarrow k \geq 2 * t_i * d_i / \sum t_j$
Hence, we define $b_{ij} = k_{ij} * t_j / d_i$ where k_{ij} random factor that is highly likely to be greater than $2 * t_i * d_i / \sum t_j$.