ECON 390-Economics of Networks-Micro II

Test 1 -Spring 2023

NAME- Yashada Nikam

Part 1)
1. In a social graph from Facebook, the “friend” relation is represented by an undirected link.

2. In a social graph from Twitter, the “follower” relation is represented by a directed link.

3. Only two nodes can be connected by a single link.

In a full N-node graph, where each node is connected to every other node, a single node can have a maximum number of links equal to N-1. However, due to network heterogeneity and sparsity, the majority of real-world networks have far fewer links connecting each node than N-1.

4. c) Total in-degree must be equal to total out-degree.

Since each incoming link to a node must have an originating node with an associated outgoing link, the total number of incoming links in a directed network must equal the total number of outgoing links.

5. There are 6 nodes in this network.
There are 10 links in this network, represented by the non-zero entries in the matrix.
There are no self-loops in this network, since there are no entries in the diagonal of the matrix that are non-zero.

6. Node C has the property of having in-links but no out-links, as it has a in-degree of 2 and an out-degree of 0. Node C is therefore a sink node in the network.

7. The in-degree of node C is 2.

The out-degree of node C is also 0, as there are no outgoing links from node C in the network.

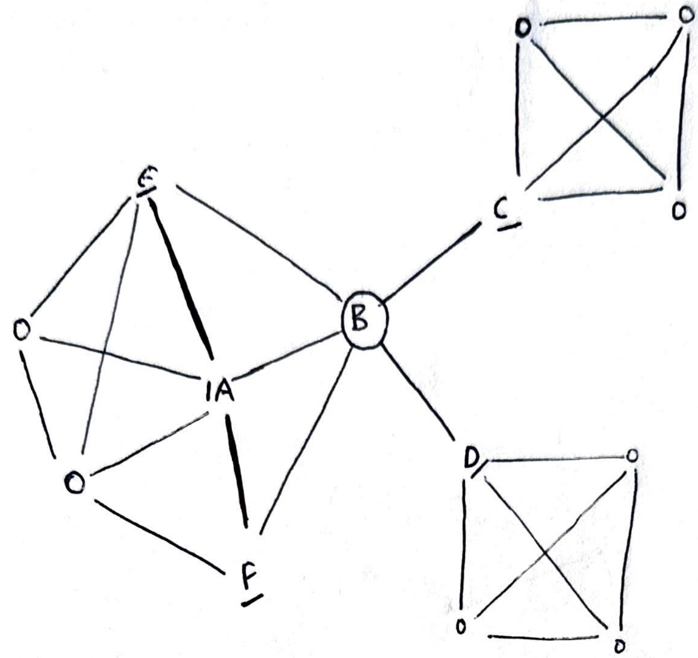
8. d) Social networks have small average path length

9. In a tree, a node's maximum clustering coefficient is 0. Given that trees are sparse networks devoid of triangles, each node in a tree has a clustering coefficient of 0. If there are no links between a node's neighbors, the clustering coefficient of that node is zero since the clustering coefficient is calculated as the ratio of the number of links between a node's neighbors to the number of possible links between them.

10. c) It has increased or stayed the same

Part 2

Q1)



B → node

K_B → degree

N_B → no. of links b/w neighbours of B

K_B → 5

N_B → 2

(a) Clustering Coefficient

$$CC(B) = \frac{2N_B}{K_B(K_B - 1)}$$

$$= \frac{2 \cdot 2}{5 \cdot 4} = \frac{1}{5}$$

(b)

Embeddeness of edge {B, F} = 1

Embeddness of edge {B, D} = 0

Embeddness of edge {B, C} = 0

Part 2)

2. A node violates the Strong Triadic Closure Property if If two other nodes are strongly connected to a node and there isn't an edge connecting them.
In this case, the two nodes C and E violate the Strong Triadic Closure Property. Node C is strongly connected to C and D, but there is no edge between C and D. This is why, nodes C and E violate the Strong Triadic Closure Property.

Question 4)
The Spread of Obesity in a Large Social Network over 32 Years by Nicholas A. Christakis and James H. Fowler (2007)

1. The main research idea in the paper "The Spread of Obesity in a Large Social Network over 32 Years" by Nicholas A. Christakis and James H. Fowler (2007) is to examine the influence of social networks on obesity. The authors aim to study how obesity spreads through social networks over time and the mechanisms behind it.

   The fact that people are embedded in social networks and are impacted by the outward actions and appearances of those around them suggests that weight growth in one person may influence weight gain in others. The authors claim that obesity is a result of intentional decisions or behaviors. A person's tolerance for obesity may vary or he or she may adopt certain habits as a result of having obese social relations.

2. In this paper, the authors argue that social networks play a significant role in the spread of obesity. They examine the social relationships between individuals and the influence these relationships have on the spread of obesity. The authors use a large long-term study of 12,067 individuals to understand the spread of obesity in a social network and how it changes over time. The authors used information from a group of offsprings to create a network dataset. Some of these people were members of Framingham Heart Study cohorts as well. This new data set contains all the information about their relatives - siblings, parents, children and spouses - dead or alive and at-least one close friend. At each time period, complete house addresses were also collected to determine how far apart people were geographically.

   They used the Kamada-Kawai algorithm in Pajek Software to graph the network, and further defined obesity as a body-mass index 30 or more than 30. The authors examined how the nature or direction of the social relationship between the ego and the alter altered the association between the ego's obesity and the alter's obesity in order to assess the potential that omitted factors or unseen events might explain the associations.
   By adding variables for the smoking status of egos and alters at times t and t+1 to the aforementioned models, they assessed the potential involvement of a spread in smoking-cessation behavior as a contributor to the spread of obesity. By including such

a variable, the authors also examined how distance between egos and alters affected their relationship.

3. The main conclusion of the article is that obesity spreads through social networks, and that individuals are influenced by the obesity status of those in their social network. The authors found that having an obese friend increased a person's likelihood of becoming obese by 57% compared to those who did not have an obese friend. They also found that this effect extends to the friends of friends, suggesting that obesity spreads in a chain-like fashion through social networks including emotional support and the observation of behaviors such as eating habits and physical activity.

Findings that the likelihood of weight gain in egos was unaffected by the weight gain of immediate neighbors and that distance did not change the effect for other types of alters (such as friends or siblings) help rule out the possibility that these observations are the result of common exposure to local environmental factors.
Compared to pairs of friends and siblings of the opposite sex, friends and siblings of the same sex appeared to have a greater impact on one another's weight growth. Contrarily, couples who share a lot of their physical space may not have as much of an impact on one another's weight growth as they do on one another. This is because the impacts of opposite-sex relationships and friendship may work against one another in a couple.

To recaptulate, the biological and behavioral characteristics of obesity seem to be related to network phenomena, and obesity seems to be contagious through social connections. For clinical and public health initiatives, these findings have consequences.