# Strong and Weak Relationships

**Social Networks - July 2020**

**MCQ Assignment - Week 3**

1. If five nodes form a complete graph, then what will be their clustering coefficient?

   A. 1/4, 1/4, 1/4, 1
   B. 5, 5, 5, 5, 5
   C. 1, 1, 1, 1
   D. 1, 1, 1, 1, 1

**ANSWER: D**
Clustering coefficient of a given node tells the extent of friendships amongst the neighbors of a given node. In a complete graph on four nodes, all the neighbors of any node will be friends with each other. Hence the clustering coefficient of all the nodes will be 1, 1, 1, 1, 1 respectively.

2. Given an edge $E(u, v)$ in a network between nodes $u$ and $v$. Assume that the neighborhood overlap of two adjacent nodes $w$ and $x$ be represented as $NO(w, x)$ and embeddedness of an edge $E(w, x)$ be represented as $EM(w, x)$. Let the set of neighbors of a node $w$ be represented by $S(w)$. Which of the following is **not** correct.

   A.
   $$EM(u, v) = \frac{NO(u, v)}{|S(u) \cap S(v)|}$$

   B.
   $$NO(u, v) = \frac{EM(u, v)}{|S(u) \cup S(v)|}$$

   C.
   $$EM(u, v) = |S(u) \cap S(v)|$$

   D.
   $$NO(u, v) = \frac{|S(u) \cap S(v)|}{|S(u) \cup S(v)|}$$

**ANSWER: A**
Neighborhood overlap is defined as the number of common friends between the nodes divided by their total number of friends. Embeddedness simply refers to the common number of friends connected by both the endpoints of an edge. Hence the correct answer is A.

3. Which of the following is **incorrect** about the clustering coefficient of a node X in a friendship network?

   A. It is the probability that two randomly selected friends of X are enemies with each other.
   B. It is the probability that two randomly selected friends of X are friends with each other.
   C. The clustering coefficient of a node X always ranges from 0 to 1.
   D. Clustering coefficient $= \dfrac{\text{Number of friendships between X's friends}}{\text{Total possible friendships among X's friends}}$

**ANSWER: A**
Clustering coefficient is the probability that two randomly selected friends of X are friends with each other. It ranges from 0 to 1. It can also be formulated as: Number of friendships between X's friends / Total possible friendships among X's friends.

4. What is the highest and lowest embeddedness value among the edges in the network shown in Figure 1?

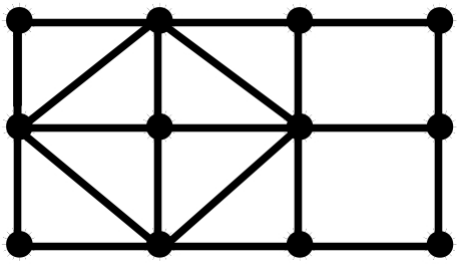

Figure 1: The network

   A. 3, 1
   B. 5, 2
   C. 2, 0
   D. 4, 2

**ANSWER: C**
Embeddedness simply refers to the common number of friends connected by both the endpoints of an edge. Therefore, the maximum embeddedness is 2 and minimum embeddedness is 0.

5. Which of the following is **not** true for every bridge:

   A. It is also a local bridge
   B. It is the only path between the nodes on which it is incident
   C. It leads to strong ties
   D. It implies presence of structural holes

**ANSWER: C**
Bridges do not lead to strong ties.

6. True or False.

In any graph $G$, every bridge is a local bridge.

A. True
B. False

**ANSWER: A**
For any bridge, neighbourhood overlap is zero.

7. Given that neighbourhood overlap of an edge $m$ is equal to 0. Then $m$ is _____

A. a strong tie.
B. an edge with high betweenness.
C. a local bridge
D. a triad.

**ANSWER: C**
If neighbourhood overlap is lower, then it is a local bridge.

8. Consider the graph below, where each edge is labelled as S (strong tie) or W (weak tie) - except the edge connecting $B$ and $C$. According to the theory of strong and weak ties, with the strong triadic closure assumption, what would be the label for the edge $BC$?

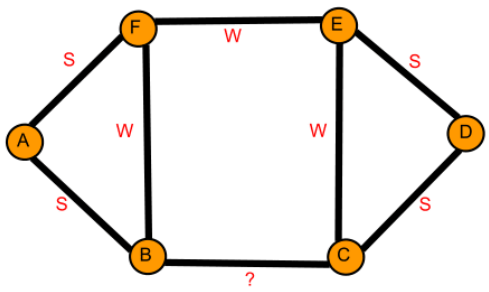


Figure 2: Graph $G$

A. S (Strong)
B. W (Weak)

**ANSWER: B**
If it were S, then we would have had an edge between A and C and an edge between B and D due to triadic closure property.

9. Let $G$ and $H$ be undirected loop-free graphs. Let $i$, $j$ be two nodes in graph $G$ such that the *neighborhood overlap* of an edge connecting $i$ and $j$, $NO(i, j)$, is less than 1. Let $p$, $q$ be two adjacent nodes in graph $H$. Add minimum number of edges between graph $G$ and $H$ such that the node subset $\{i, j, p, q\}$ forms a clique. The new updated neighborhood overlap between the node $i$ and the node $j$ is:

A. less than $NO(i, j)$
B. equal to $NO(i, j)$

C. equal to 1
D. greater than $NO(i, j)$

**ANSWER: D**
Hint: Adding a constant to a both numerator and denominator will increase the rational value compared to the original rational.

10. I have four friends. If my clustering coefficient is 0.33, what is the number of friendships between my friends?

A. 2
B. 3
C. 4
D. 5

**ANSWER: A**
Clustering coefficient=$\frac{Numberoffriendship}{Totalno.offriendships}$ , hence, no. of friendships= 2.