

Solutions to Week3-Assignment1

1. A

In social networks, friends lead to strong ties and acquaintances lead to weak ties.

2. C

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 to each other. Hence the clustering coefficient of all the nodes will be 1, 1, 1, 1 respectively.

3. B

Granovetter argued that while searching for a new job, acquaintances are more likely to provide details that even the close friends may not be able to provide.

4. C

Triadic closure implies that two people having a common friend have a good probability of becoming friends with each other.

5. A

Triadic closure is the property among three nodes A, B, and C, such that if an edge exists between A-B and A-C, there is a good probability of an edge between B-C. Therefore, triadic closure leads to triangles.

6. B

An edge joining two nodes A and B in a graph is a *bridge* if deleting the edge would cause A and B to lie in two different components. Further, an edge joining two nodes A and B in a graph is a *local bridge* if its endpoints A and B have no friends in common. In other words, if deleting the edge would increase the distance between A and B to a value strictly more than two. Now, as per the definition, the *span* of a *local bridge* is the distance its endpoints would be from each other if the edge were deleted. Therefore, on the similar lines, if a *bridge* is deleted, its end points will be at infinite distance from each other, because the graph will become disconnected. Hence, the span of a bridge will be *infinite*.

7. C

The GirvanNewman algorithm is used for communities' detection, by progressively removing edges from the original network. The connected components of the remaining network are the communities.

8. A

An edge joining two nodes A and B in a graph is a *bridge* if deleting the edge would cause A and B to lie in two different components. In real-world social networks, it is highly unlikely that there is only a single edge that is connecting two components, deletion of which may completely divide the network into two parts. Hence, in a real-world social network, *bridges* are rare.

9. D

Weak ties in a network connect different components (communities) of the network. Hence, through these weak ties only, nodes of one community may connect with the nodes in the other communities. In the absence of these ties, many parts of the network will become difficult-to-reach. The more weak ties we have, the more connected to the world we are and are more likely to receive important information about ideas, threats and opportunities. Hence option (D) is correct.

10. B

GirvanNewman algorithm focuses on removal of *edges* that are most likely '*between*' communities, hence, it is based on the concept of 'Edge Betweenness'.

11. B

As per the well-known history of Karate club, a fight happened between the instructor and the club administrator, due to which the network got divided into *two* communities by the end.

12. B

The GirvanNewman algorithm is used for communities' detection, by progressively removing edges from the original network. The edges with high betweenness are removed, since they usually connect different communities.

13. C

Betweenness centrality is a measure of centrality in a graph based on shortest paths. For every pair of nodes in a connected graph, there exists at least one shortest path between the nodes. The betweenness centrality for each node is the number of these shortest paths that pass through the node.