SOCIAL NETWORKS - NPTEL July 2024

Week 12

1. Which of the following is True in a hierarchical network structure?

   (a) Low-ranking employees form the densely connected core, while high-ranking employees disperse around the core as the periphery

   (b) The core and the periphery can swap roles within the network

   (c) Whether an individual is in the core or the periphery is independent of their rank or position

   (d) High-ranking employees form the densely connected core, while low-ranking employees disperse around the core as the periphery

   Answer: (d)

   Explanation: In a hierarchical network structure, high-ranking employees are part of the densely connected core, while low-ranking employees disperse around this core as the periphery.

2. A node in a network belongs to exactly 3 cliques (fully connected subgraphs) of sizes 3, 4, and 6. Which of the following cannot be the core number of this node?

   (a) 1

   (b) 3

   (c) 4

   (d) 6

   Answer: (a)

   Explanation: While 1 can be a core number, given that the node participates in higher cliques with higher degrees, the implication is that the lowest core number consistent with its connections should be greater than 1.

3. In a social network of a popular online community, the "core" refers to the group of users who are highly interconnected and influential. The "periphery" refers to users who are less connected. Which of the following best describes a "pseudo-core" in this context?

   (a) Users who are part of the highly connected core group

   (b) Users who are part of the less connected periphery group

   (c) Users who are not in the innermost core group but have a similar influence or spreading power as the innermost core

   (d) Users who are not in the outermost periphery group but have a similar influence or spreading power as the outermost periphery

   Answer: (c)

   Explanation: Pseudo-cores are users who do not belong to the innermost core of the network but have equal spreading power or influence as those in the innermost core.

4. Choose the most relevant option that represents an Internet meme:

   (a) A widely shared video of a cat doing something humorous, circulated across social media

   (b) A text message from your friend asking for help with an assignment

   (c) An official email from your boss about a company meeting

   (d) A news article discussing global economic trends

Answer: (a)

Explanation: An Internet meme is typically a piece of content, such as an image, video, or phrase, that spreads rapidly across the internet, often in a humorous or relatable way. Option A describes a humorous video of a cat that is shared widely on social media, which fits the definition of an Internet meme. The other options refer to messages or content that are personal, formal, or informative, and not intended for viral, humorous sharing.

5. What defines a k-core in a sub-graph of a graph?

   (a) The maximum degree of nodes in the sub-graph is exactly k

   (b) Each node in the sub-graph has a degree less than k

   (c) Each node in the sub-graph has a degree greater than k

   (d) Each node in the sub-graph has a degree greater than or equal to k

   Answer: (d)

   Explanation: A k-core is a sub-graph of a larger graph where each node has a degree (the number of connections it has) that is greater than or equal to k. The k-core structure helps in identifying the most connected parts of a network.

6. In a corporate organization, which factor is most correlated with an employee's ability to influence decision-making?

   (a) The number of direct reports the employee has (degree of the node)

   (b) How quickly the employee can access other departments (closeness)

   (c) How often the employee acts as a key connector between departments (betweenness)

   (d) The employee's position within the central management team (coreness)

   Answer: (d)

   Explanation: Coreness refers to the employee's position within the central management team, which correlates strongly with their ability to influence decision-making due to their central role in the organization.

7. Which of the following statements is true about myopic search algorithms?

   (a) Myopic search algorithms always perform as well as optimal search algorithms

   (b) The time complexity of myopic search algorithms is generally high

   (c) Myopic search algorithms are guaranteed to find the optimal solution every time

   (d) Optimal search algorithms typically have lower time complexity than myopic search algorithms

   Answer: (b)

   Explanation: Myopic search algorithms can have high time complexity. They may require exploring many potential solutions locally and can be less efficient in finding a solution compared to more globally informed algorithms.

8. In a network of n social media users, where each user has a degree (number of direct connections) of x, for which value(s) of x will the following statement hold true: "For every user with degree x, their shell number will also be x?

   (a) 1

   (b) n-1

   (c) n

   (d) n+1

   Answer: (a)

   Explanation: The shell number of a node in a graph represents the node's position relative to the core structure of the graph. For a node with degree 1, which is connected to only one other node, its shell number will also be 1 because it belongs to the outermost shell in a shell decomposition. For nodes with degrees 2 or higher, the relationship between degree and shell number becomes more complex and does not necessarily equate to the degree. Thus, the statement specifically holds true for nodes with degree 1.

9. In a social network analysis using the k-shell decomposition algorithm, what does the i^{th} iteration involve?

(a) Removing all users with exactly i connections from the network.

(b) Recursively removing users with exactly i connections until no such users remain in the network

(c) Recursively removing users with i or fewer connections until no such users remain in the network

(d) Recursively removing users with i or more connections until no such users remain in the network

Answer: (c)

Explanation: In the i^{th} iteration of the k-shell decomposition algorithm, nodes with degree i or less are recursively removed from the graph until none remain. This helps in identifying the structure of the network in terms of its k-shell layers.

10. What is the number of nodes in the 4-core of the given graph H?

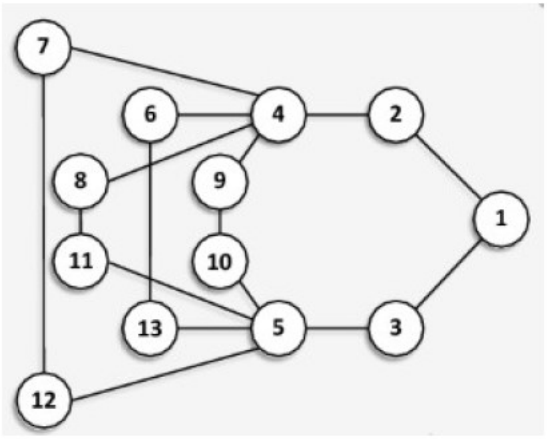

Figure 1: Graph H

(a) 0

(b) 1

(c) 2

(d) 3

Answer: (a)

Explanation: First all the nodes with degree 2 are removed. Then, nodes 4 and 5 become isolated nodes, they are also removed in the same iteration. Hence, entire network falls in a single shell/core.