Pseudo-core

Social Networks - July 2020

MCQ Assignment - Week 12

1. As per the definition, in a core-periphery structure (*Choose the TRUE statement*):

   A. Low status people are linked in densely connected core while the high status people atomize around this core as periphery of the network.
   B. Core and the periphery occupy interchangeable positions in the network.
   C. The notion of a node being in a core or in a periphery does not depend on the social status or the wealth of a node.
   D. High status people are linked in densely connected core while the low status people atomize around this core as periphery of the network.

   ANSWER: D
   In a core-periphery structure, high status people are linked in densely connected core while the low status people atomize around this core as periphery of the network.

2. The i^{th} iteration of k-shell decomposition algorithm

   A. Removes all the nodes of degree i from the graph.
   B. Recursively keeps removing the nodes of degree i from the graph, i.e., keeps removing the degree i nodes from the graph till there are no degree i nodes in the graph.
   C. Recursively keeps removing the nodes of degree $\leq i$ from the graph, i.e., keeps removing the nodes of degree $\leq i$ from the graph till there are no degree $\leq i$ nodes in the graph.
   D. Recursively keeps removing the nodes of degree $\geq i$ from the graph, i.e., keeps removing the node of degree $\geq i$ from the graph till there are no degree $\geq i$ nodes in the graph.

   ANSWER: C
   In i^{th} iteration of k-shell decomposition, we recursively prune the nodes having degree i as well as the nodes having degree less than i.

3. Identify the 1-core, 2-core and 3-core in the Figure 1 (Based on the definition of k-core).

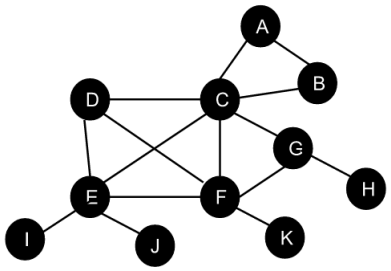

Figure 1: The network

A. 1-core: A,B,C,D,E,F,G,H,I,J,K ; 2-core: A,B,C,D,E,F,G ; 3-core: C,D,E,F
B. 1-core: H,I,J,K ; 2-core: A,B,G ; 3-core: C,D,E,F
C. 1-core: C,D,E,F ; 2-core: A,B,C,D,E,F,G ; 3-core: A,B,C,D,E,F,G,H,I,J,K
D. 1-core: I,J,K,H,A,B,G ; 2-core: Empty ; 3-core: C,D,E,F

ANSWER : A

1. All the nodes in the network have degree at least 1 and hence all the nodes fall in 1−core.
2. Nodes A,B,C,D,E,F,G have degrees at least 2, hence they are in 2− core.
3. Nodes C,D,E,F have degrees at least 3, hence they are in 3− core.

4. Pseudo-cores are the nodes

A. which belong to the core of the network (synonymous to core).
B. which belong to the periphery of the network (synonymous to periphery).
C. which do not belong to the innermost core of the network but have equal spreading power (cascade capacity) as the innermost core.
D. which do not belong to the outermost periphery of the network but have equal spreading power (cascade capacity) as the outermost periphery.

ANSWER: C
Pseudo-core are the nodes which do not belong to the innermost core of the network but have equal spreading power (cascade capacity) as the innermost core.

5. The nodes of degree 1 in a graph

A. Will always belong to 1-core.
B. Will always belong to 2-core.
C. Can belong to any core.
D. Will always belong to the innermost core of the network.

ANSWER: A
Any node of degree 1 in a network will always be removed in the first iteration only. That's why the nodes of degree 1 will always belong to 1−core.

6. Given the graph as shown in Figure 2. Which nodes from this graph will be removed in the first iteration of k-shell decomposition algorithm?

A. A and E
B. A, E, G and C
C. A, E, G, C and F
D. A, G and E

ANSWER: B
In the first iteration, first of all, nodes A and G are removed as they have degree 1. As soon as they are removed, E ends up having degree 1, hence removed. Once E is removed, the degree of node C is reduced to 1. Hence it is also removed. After the removal of C, all the nodes in the graph have degree 2. Hence, the first iteration ends.

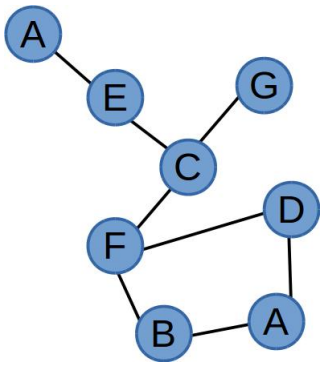

Figure 2: The Graph

7. The core number of a node in a graph can not be

   A. Greater than its degree
   B. Lesser than its degree
   C. Equal to its degree
   D. Can't say

ANSWER: A

If the degree of a node is d, then it will be removed atmost at the iteration d of the k-shell decomposiion. In other words, a node of degree d is removed in either an iteration less than d or at d. Hence, the coreness of the node can not be greater than d.

8. Given that a node in a network is a part of exactly 3 cliques (complete subgraphs), of size 3, size 4 and size 6 respectively. Then the core number of this node can not be

   A. greater than 3
   B. less than 7
   C. less than 6
   D. less than 5

ANSWER: D

Given a node is a part of k-clique in a network. Then, every node in this k-clique is connected to at least $k-1$ other nodes in the graph; hence can not be removed before the iteration $k-1$. Hence the coreness of all these nodes will be at least $k-1$. Since, the given node is a part of a 6 clique, it can not be removed before the iteration 5. Hence, its coreness can not be less than 5.