CLIQUE AND COMMUNITY

Clique

- Subgraph of nodes tightly connected within a larger network.
- Every node is directly connected to every other node in the subset
- Identifies groups of individuals or entities with strong relationships.
- Can be used for detecting clusters or communities within data.
- Helps in understanding patterns and interconnections within the network.
- Enables targeted analysis of specific subgroups or communities.

Clique: Real-life Uses

- Social Network Analysis: Reveals tight social groups, structures, and influences.
- Community Detection: Identifies related groups using cliques.
- Anomaly Detection: Flags unusual behavior or outliers through cliques.
- Collaborative Filtering: Recommends based on clique-based preferences.
- Computational Biology: Models proteins and genes with cliques.
- Data Mining: Extracts frequent patterns using cliques.

Example of Clique

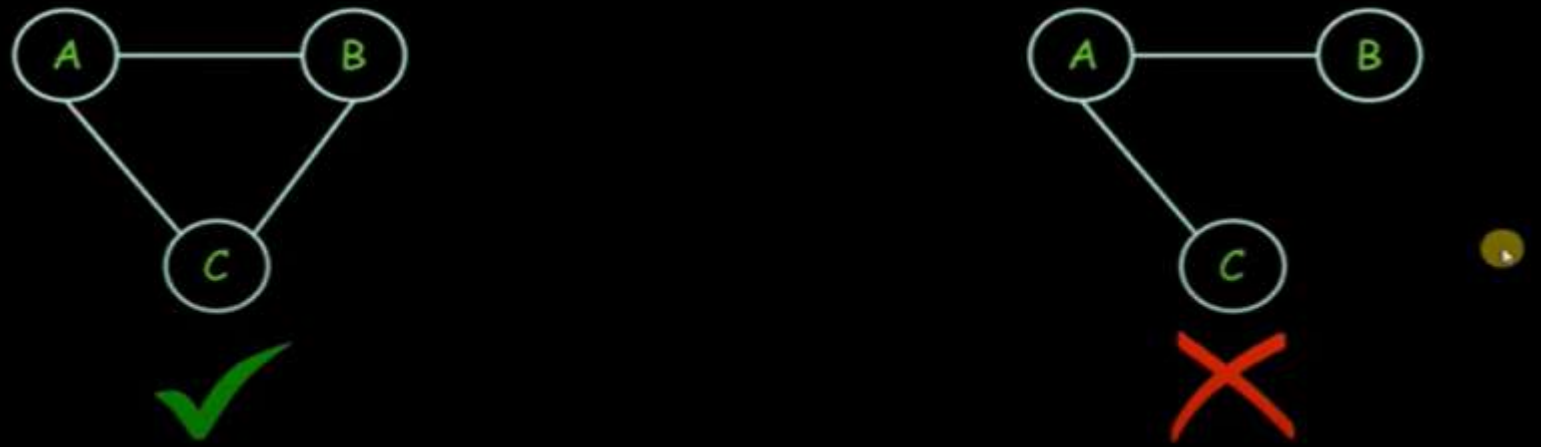
K is the number of nodes

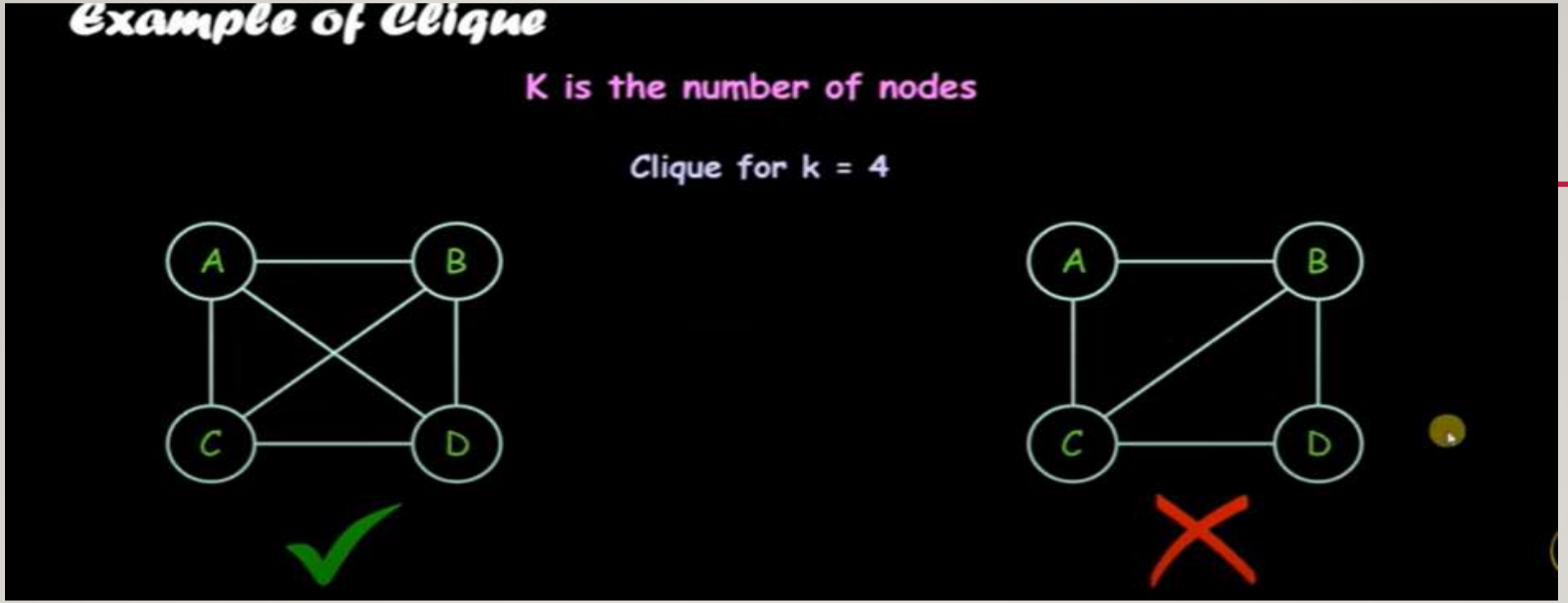
Clique for k = 2

Example of Clique

K is the number of nodes

Clique for k = 3




Example of Clique
K is the number of nodes
Clique for k = 4
A
B
C
D
A
B
C
D

Community

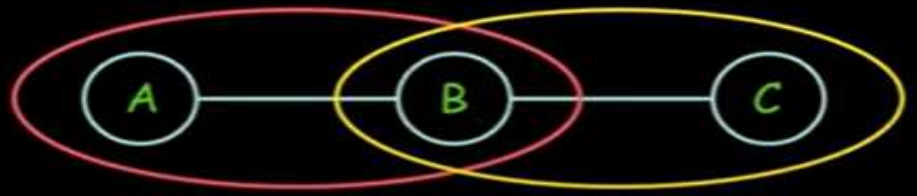
Group of cliques that share k-1 nodes in common

Example of Community

Community for cliques k = 2

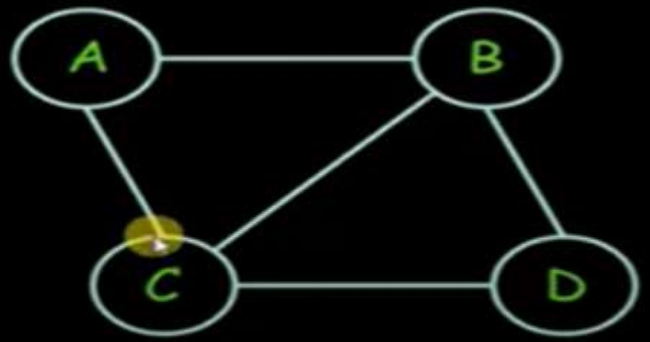
Example of Community

Community for cliques k = 2



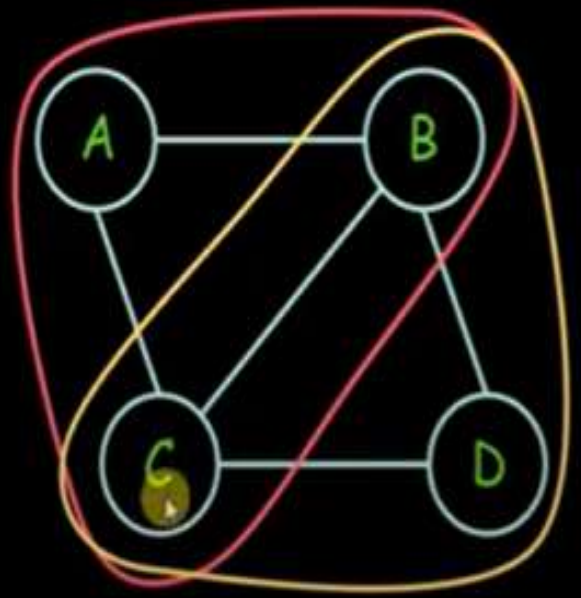
Clique 1: A,B
Clique 2: B,C
For k=2, k-1 is 1 and one node (B) is shared between these two cliques, hence it forms a community

Community for cliques k = 3



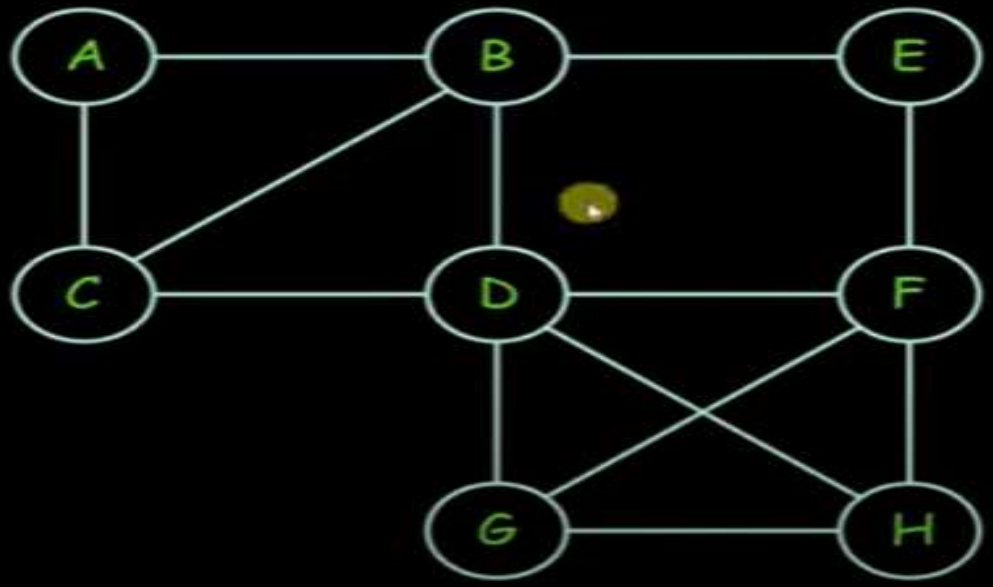
Example of Community

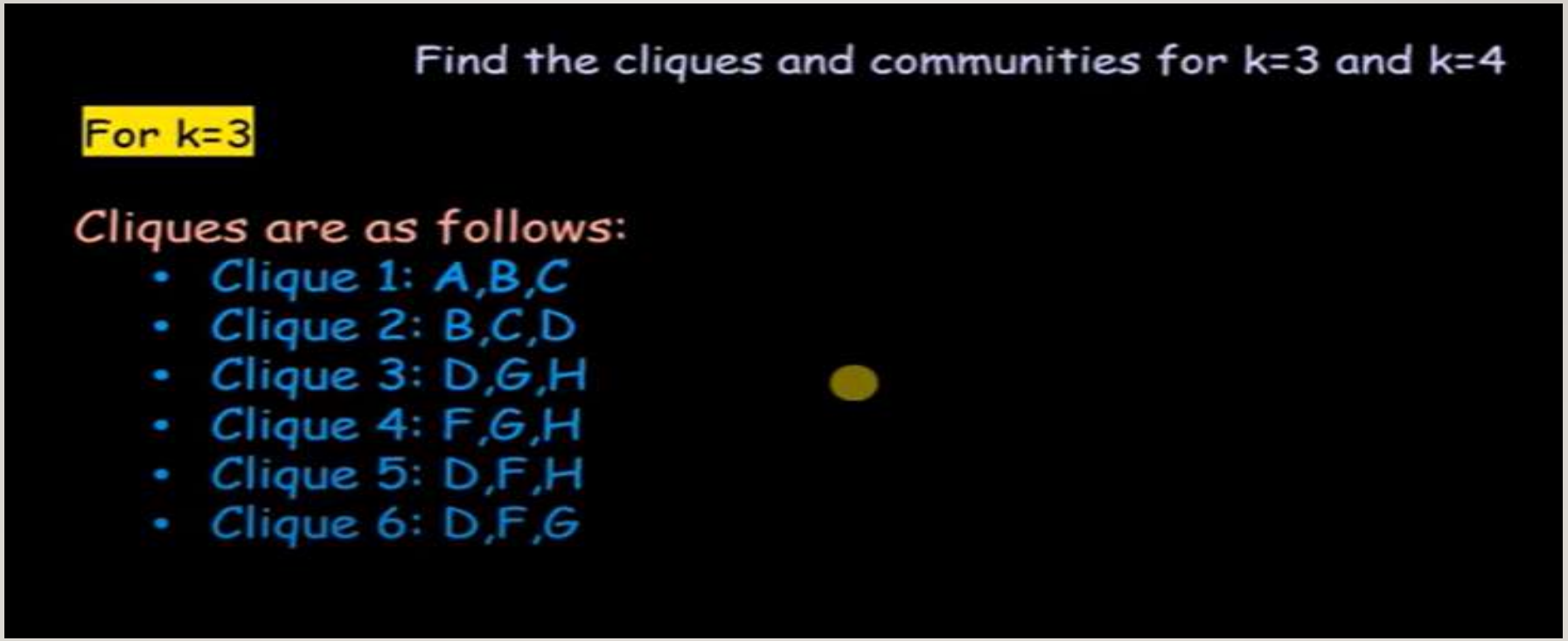
Community for cliques k = 3



Clique 1: A,B,C
Clique 2: B,C,D
For k=3, k-1 is 2 and two nodes (B and C) are shared between these two cliques, hence it forms a community

Find the cliques and communities for k=3 and k=4



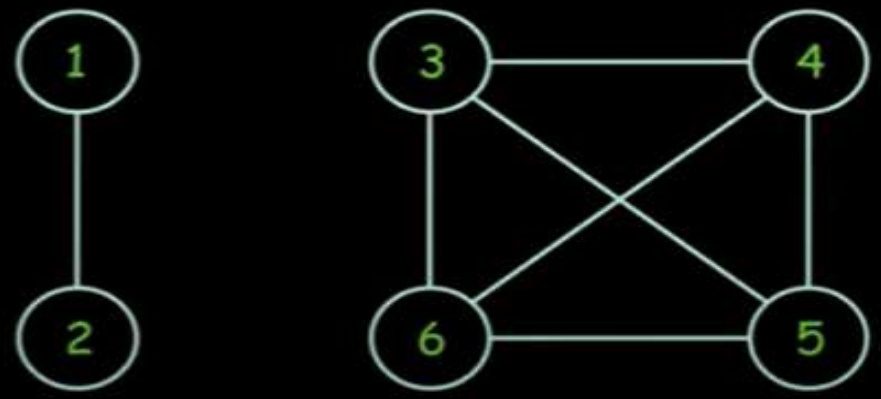

Find the cliques and communities for k=3 and k=4
For k=3
Cliques are as follows:
Clique 1: A,B,C
Clique 2: B,C,D
Clique 3: D,G,H
Clique 4: F,G,H
Clique 5: D,F,H
Clique 6: D,F,G

For k=3

D,F,G

Cliques are as follows:

- Clique 1: A,B,C
- Clique 2: B,C,D
- Clique 3: D,G,H
- Clique 4: F,G,H
- Clique 5: D,F,H
- Clique 6: D,F,G



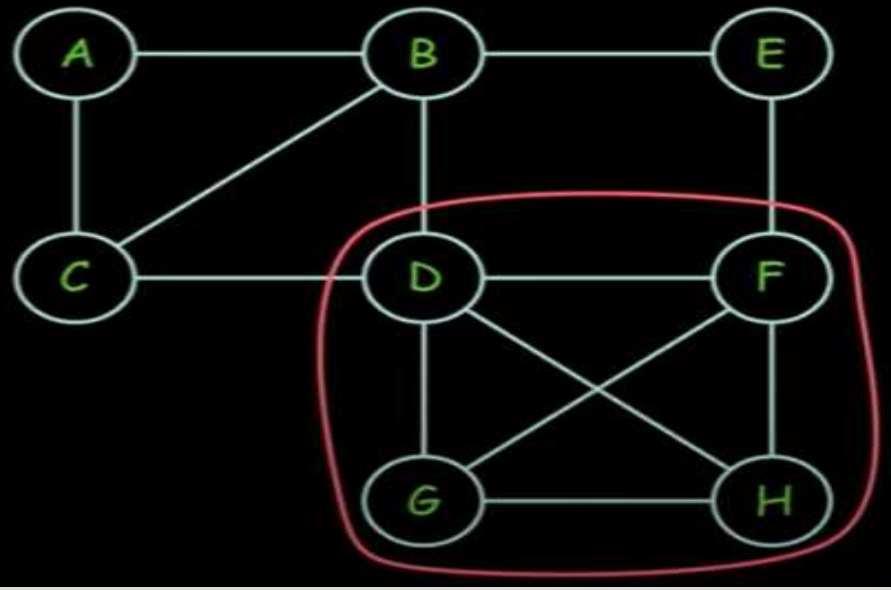
Find the cliques and communities for k=3 and k=4

For k=4

Cliques are as follows:

- Clique 1: D,F,G,H

No communities for clique k=4



CLIQUE PERCOLATION METHOD ALGORITHM

Input :- The social graph G , representing a network and a clique size k.

Output : Set of discovered Communities C

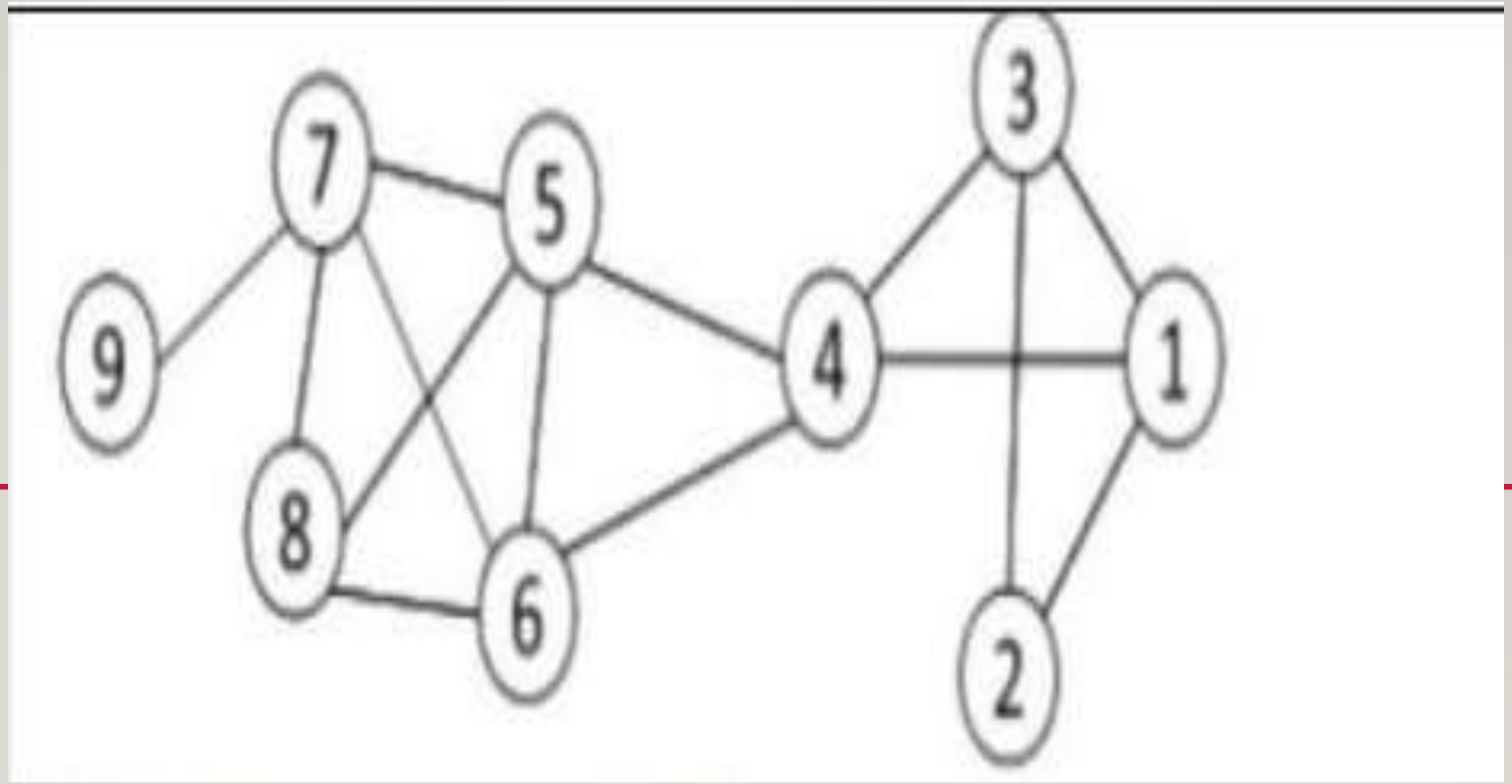
Step1 : All k-clique present in G are extracted

Step 2: A new graph, the clique graph ,Gc formed where each node represented an identified clique and two vertices in Gc are connected by an edge ,if they have k-1 common vertices.

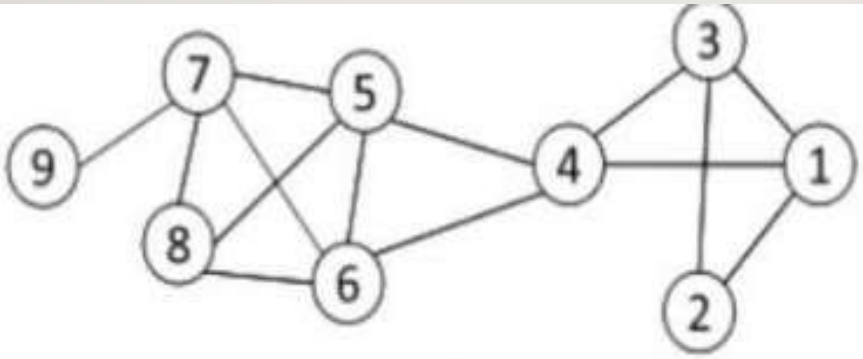
Step 3: Connected components in Gc are identified

Step 4: Each connected component in Gc represents a community.

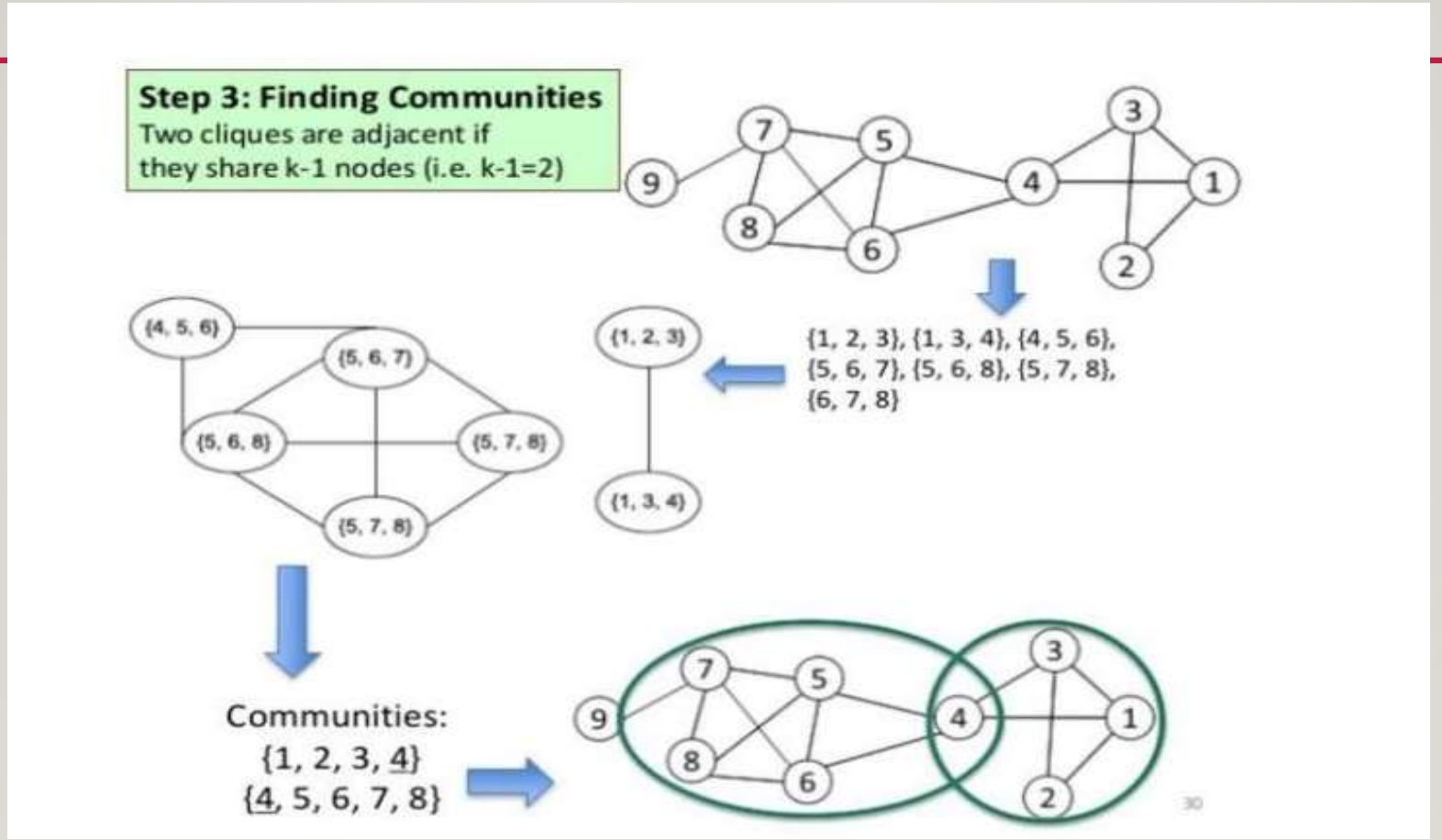
Step 5: Set C be the set of communities formed for G.

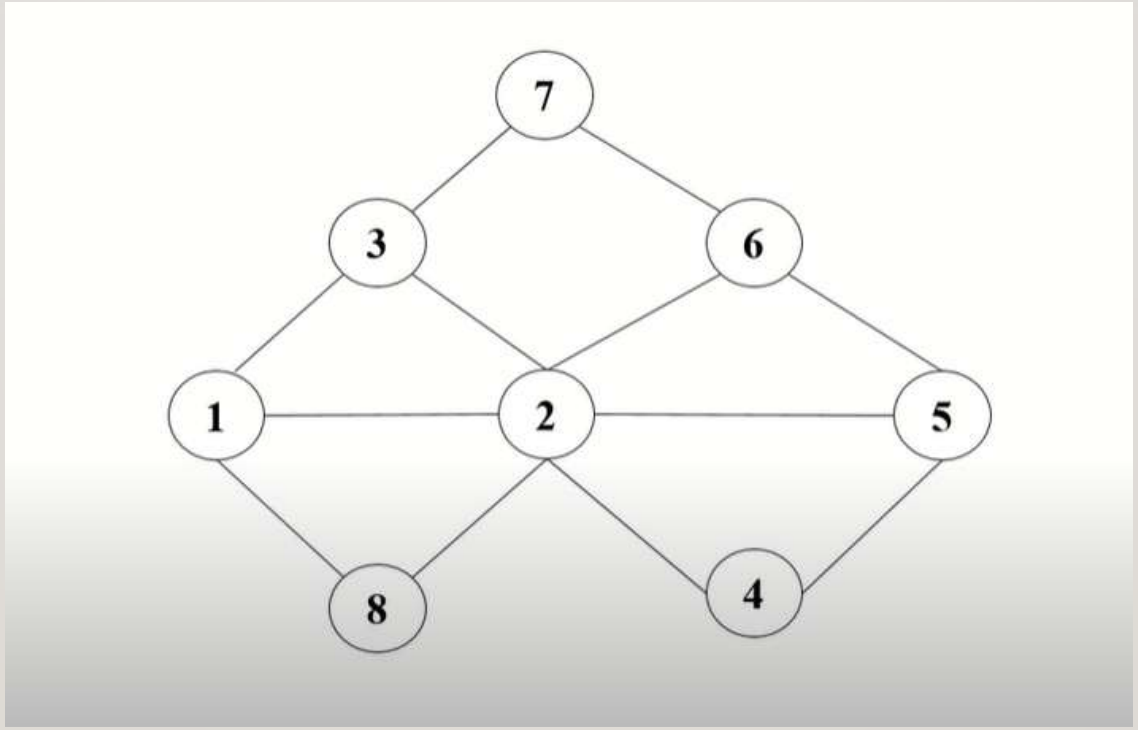


Write the algorithm for Clique Percolation Method. Apply the same to find the communities on the following graph. (Show the stepwise execution of the algorithm).

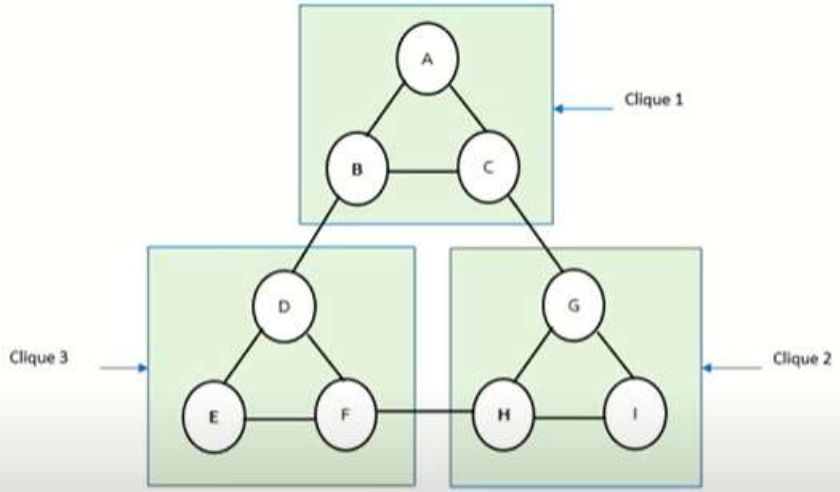


{1, 2, 3}, {1, 3, 4}, {4, 5, 6}, {5, 6, 7}, {5, 6, 8}, {5, 7, 8}, {6, 7, 8}

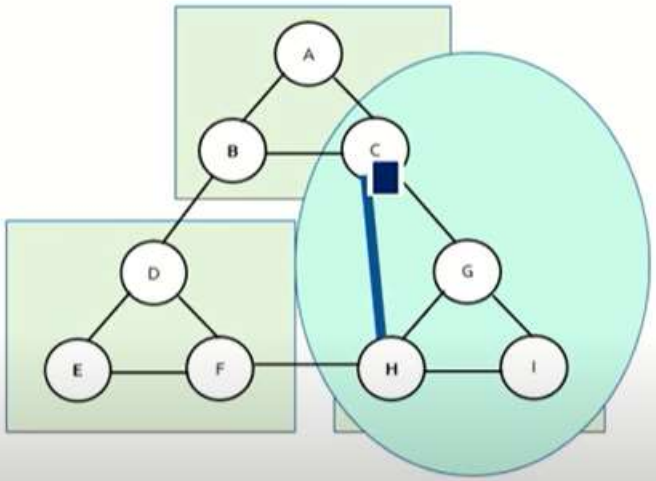

Step 3: Finding Communities
Two cliques are adjacent if
they share k-1 nodes (i.e. k-1=2)
9
7
5
3
4
1
8
6
2
{1, 2, 3}, {1, 3, 4}, {4, 5, 6},
{5, 6, 7}, {5, 6, 8}, {5, 7, 8},
{6, 7, 8}
{1, 2, 3}
{1, 3, 4}
{4, 5, 6}
{5, 6, 7}
{5, 6, 8}
{5, 7, 8}
{5, 7, 8}
Communities:
{1, 2, 3, 4}
{4, 5, 6, 7, 8}


7
3
6
1
2
5
8
4

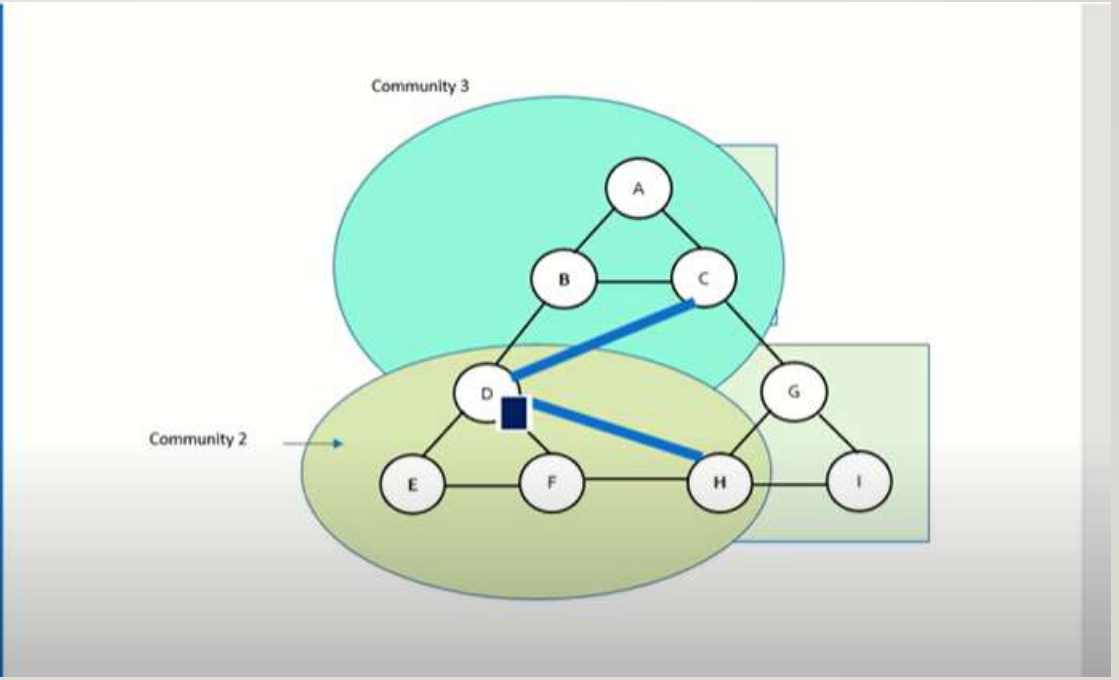
EXAMPLE



EXAMPLE



EXAMPLE



You can refer following YouTube video for more details.

https://youtu.be/kZ9pd59_ToU?si=rDFhBXHw-wyXKbsR


THANK YOU