Defining and Identifying Network Data

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Module Overview

Introduce and understand neighborhoods, paths and shortest paths

Implement neighborhoods and shortest paths methods

Introduce and understand centrality

Implement centrality using NetworkX

Introduce and understand cliques and clusters

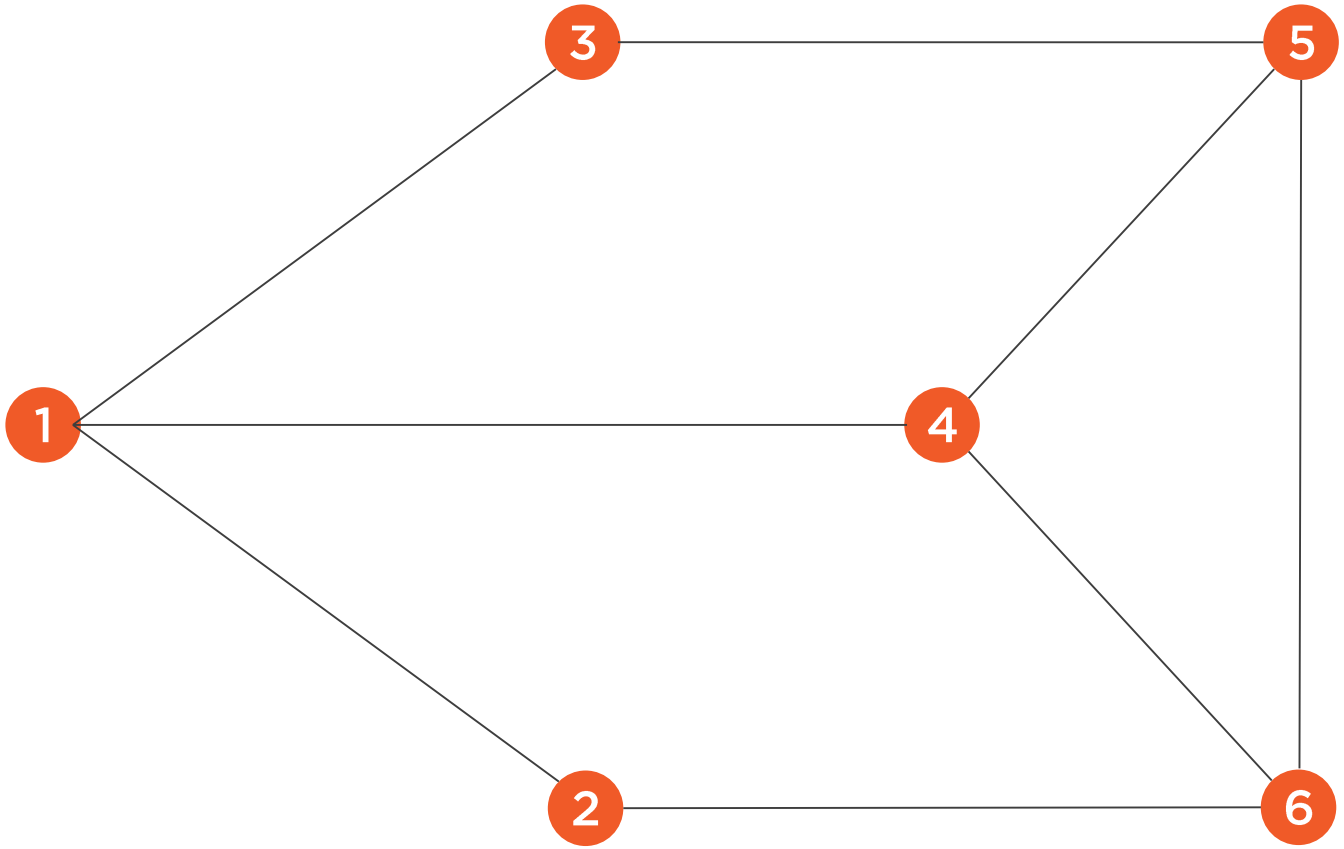
Implement cliques and clusters

Understanding Neighborhoods and Shortest Paths

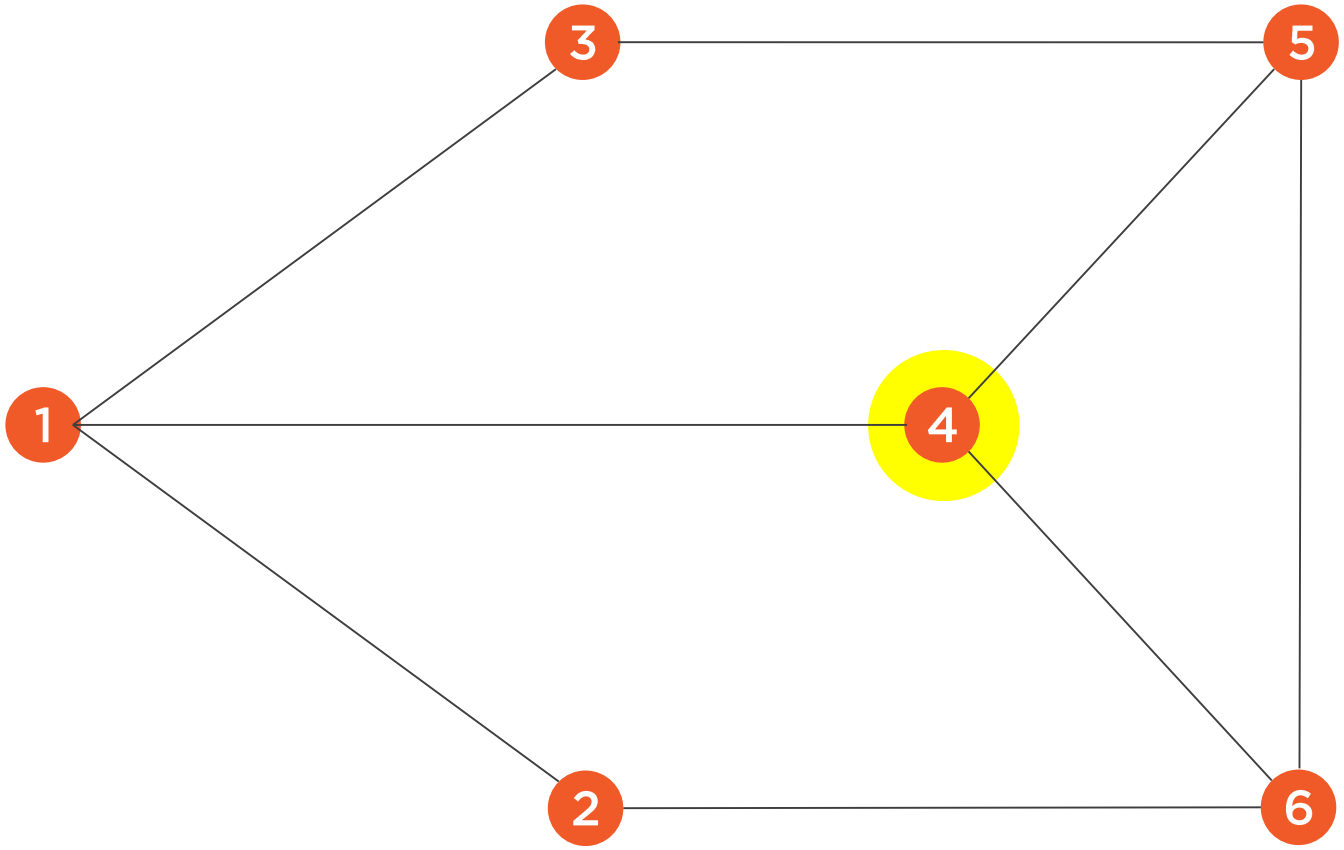
Neighborhood

A list of all adjacent or neighboring nodes to some particular node. Or a subgraph of all adjacent nodes and connections.

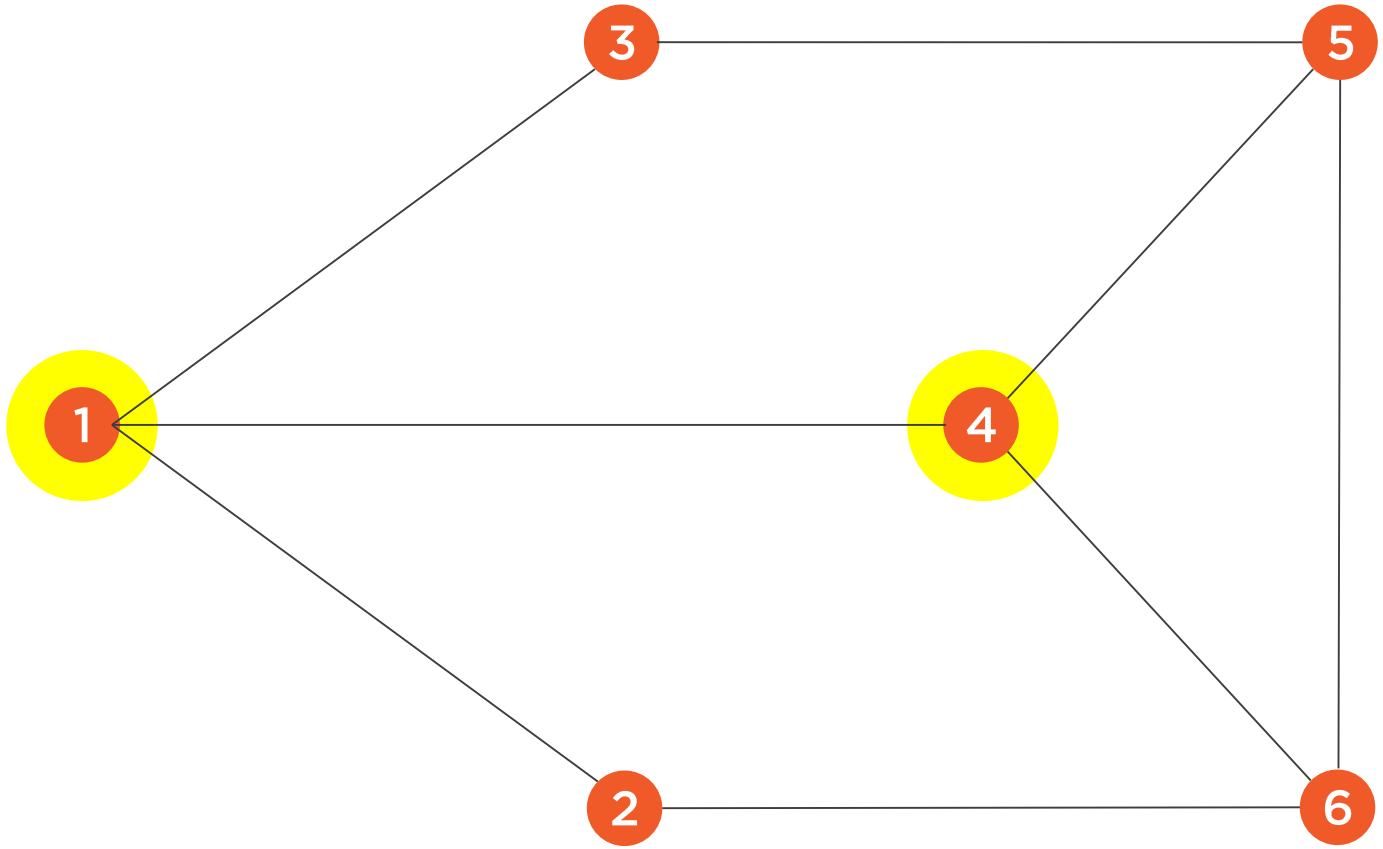
Neighborhood



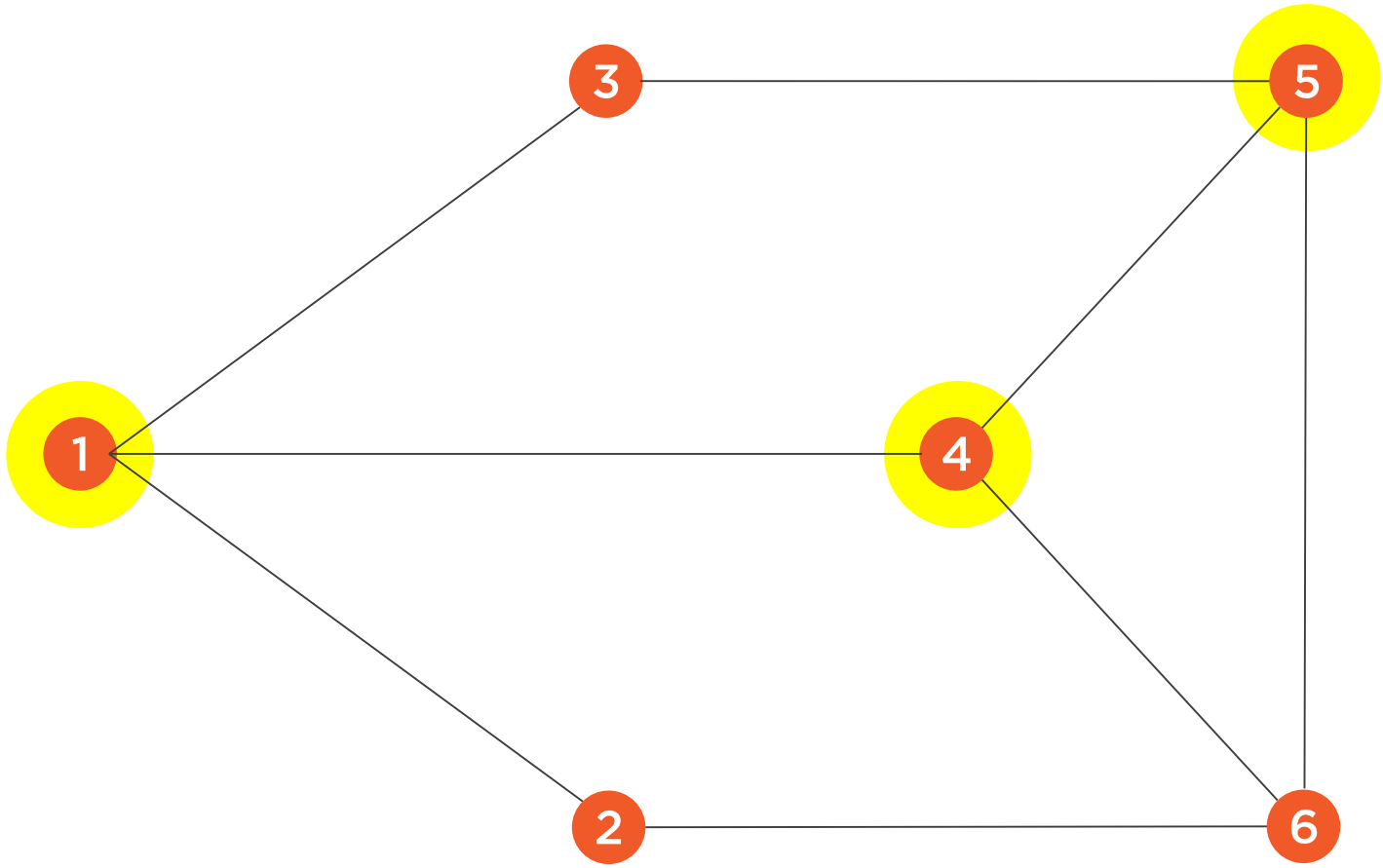
Neighborhood



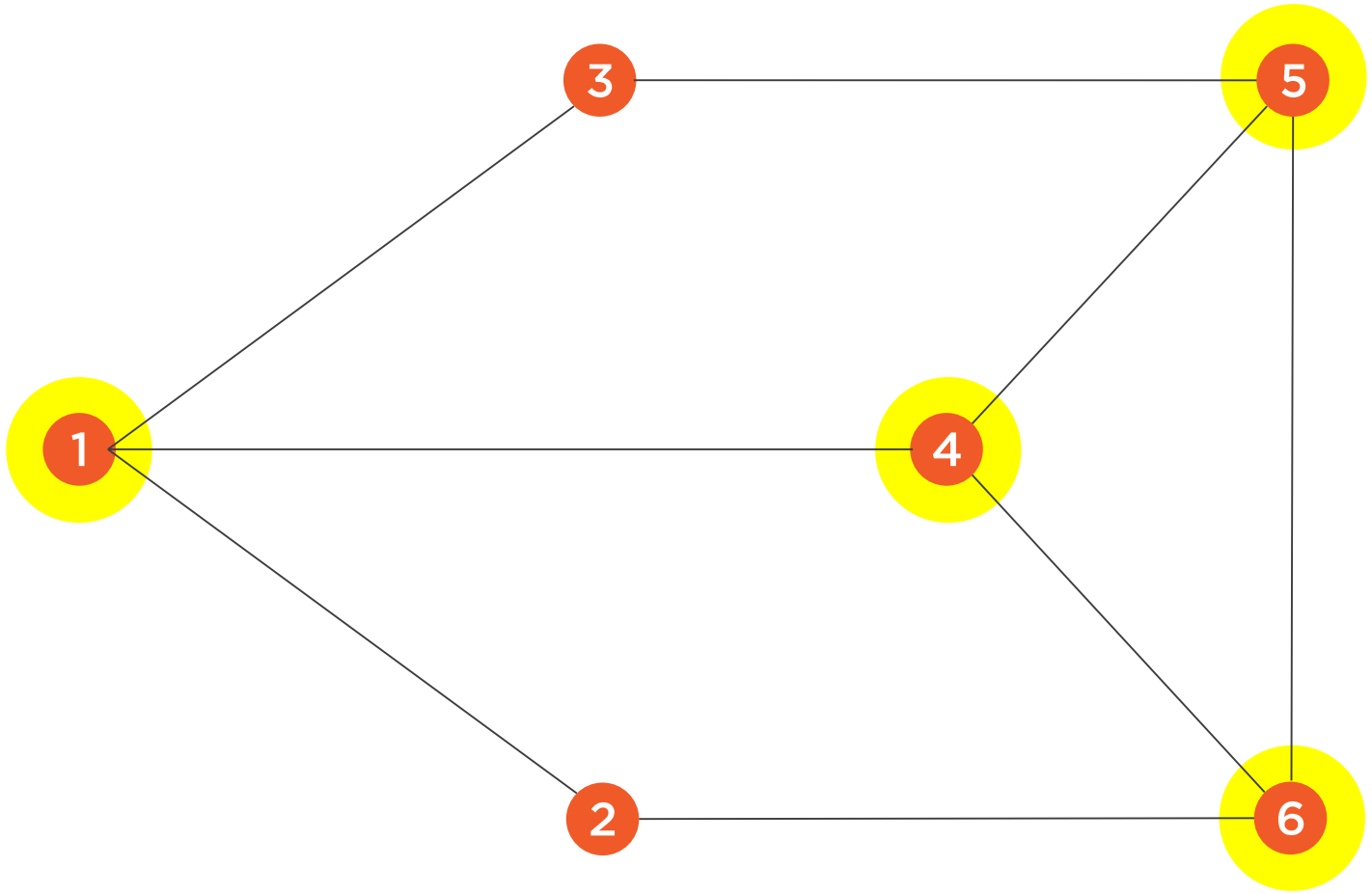
Neighborhood



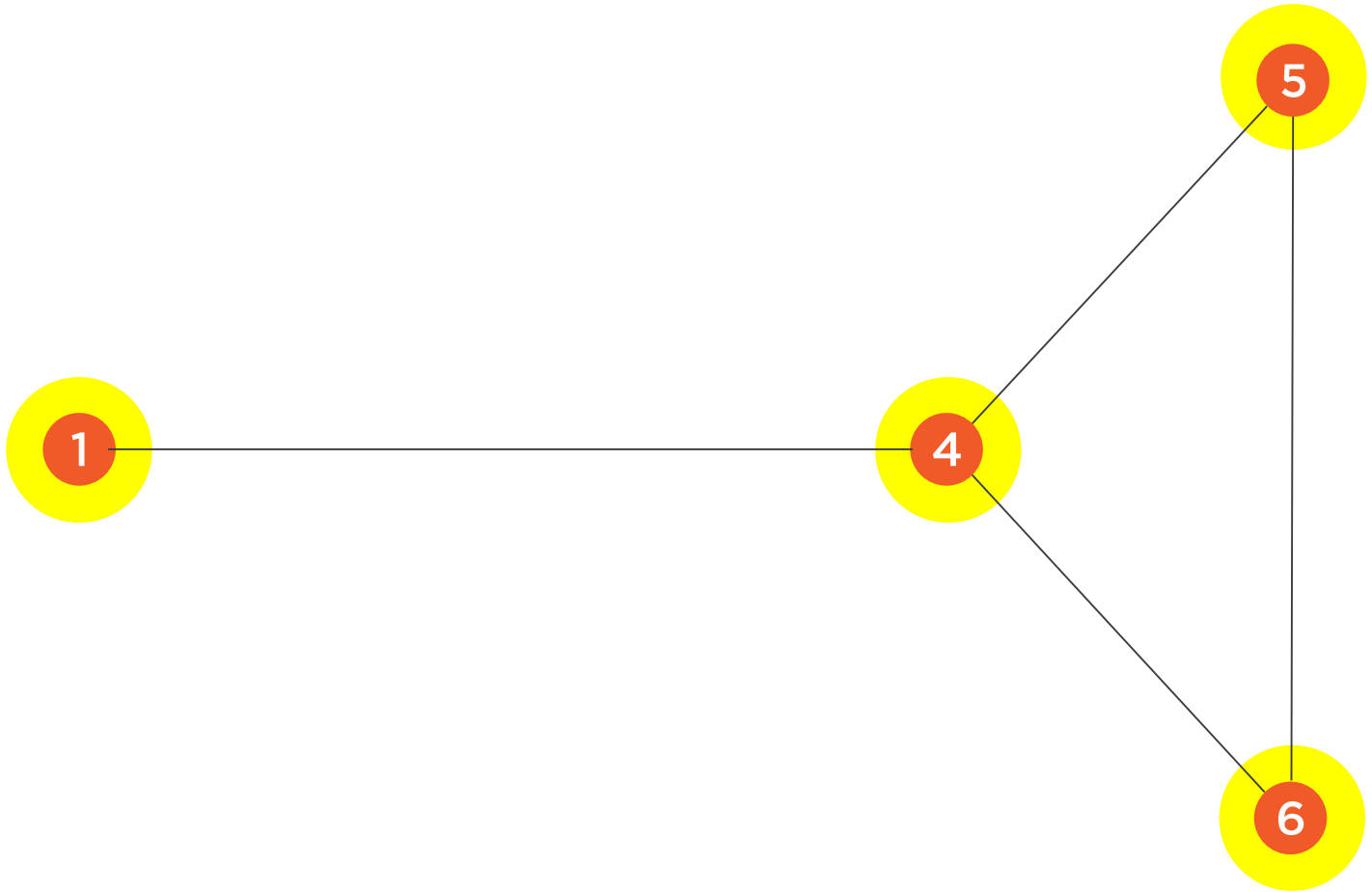
Neighborhood



Neighborhood



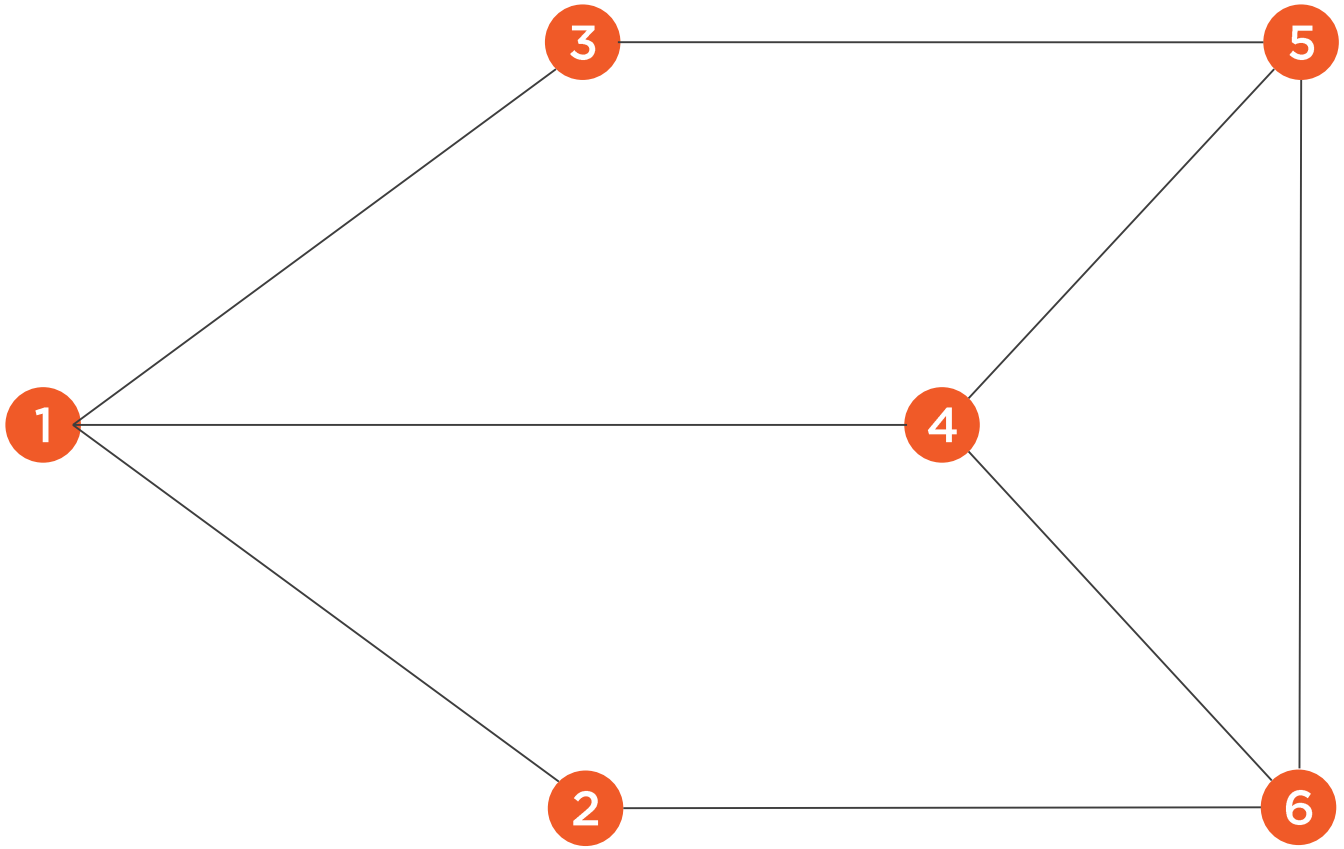
Neighborhood Subgraph



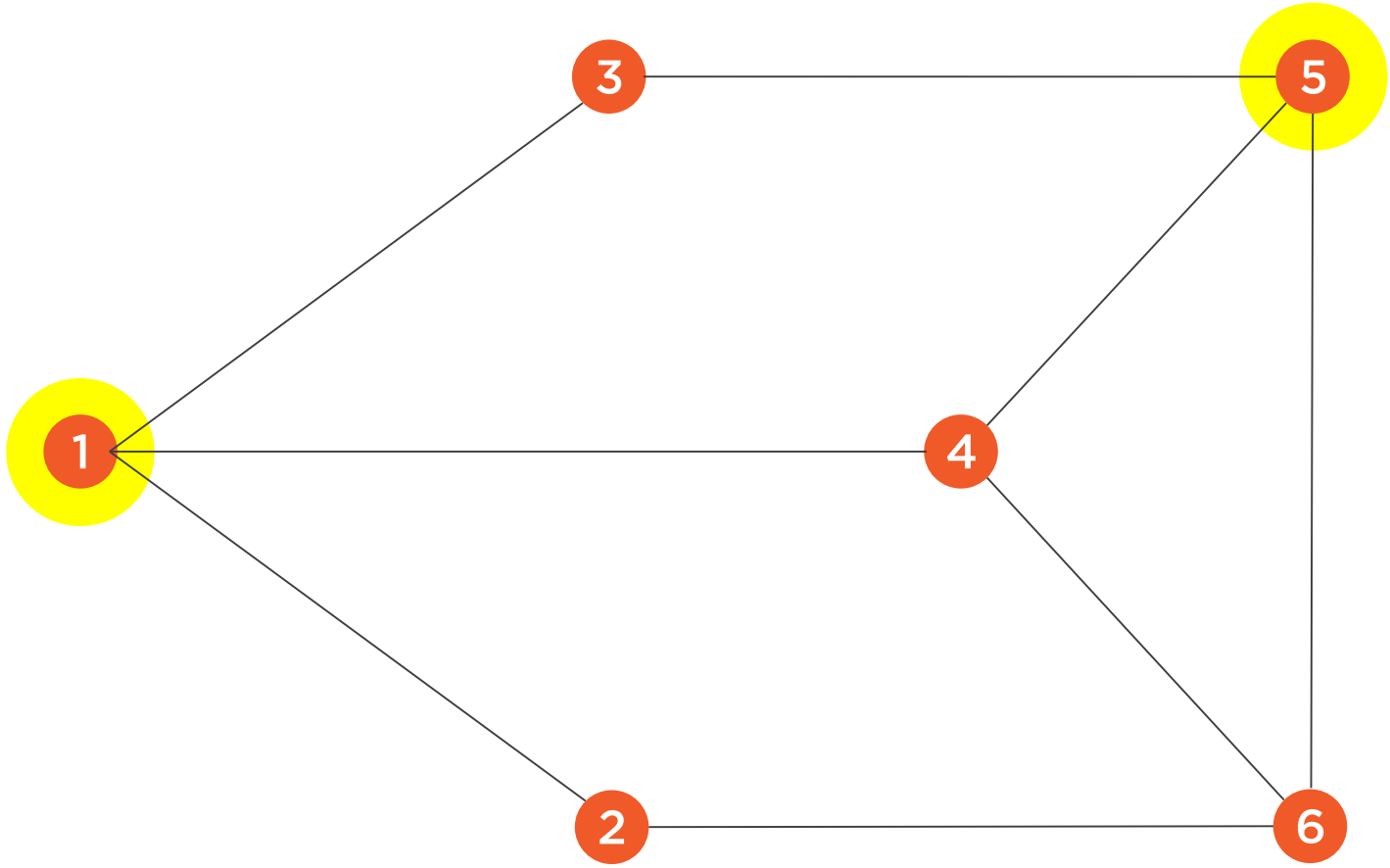
Path / Shortest Path

A sequence of edges or connections which join nodes within a network graph.

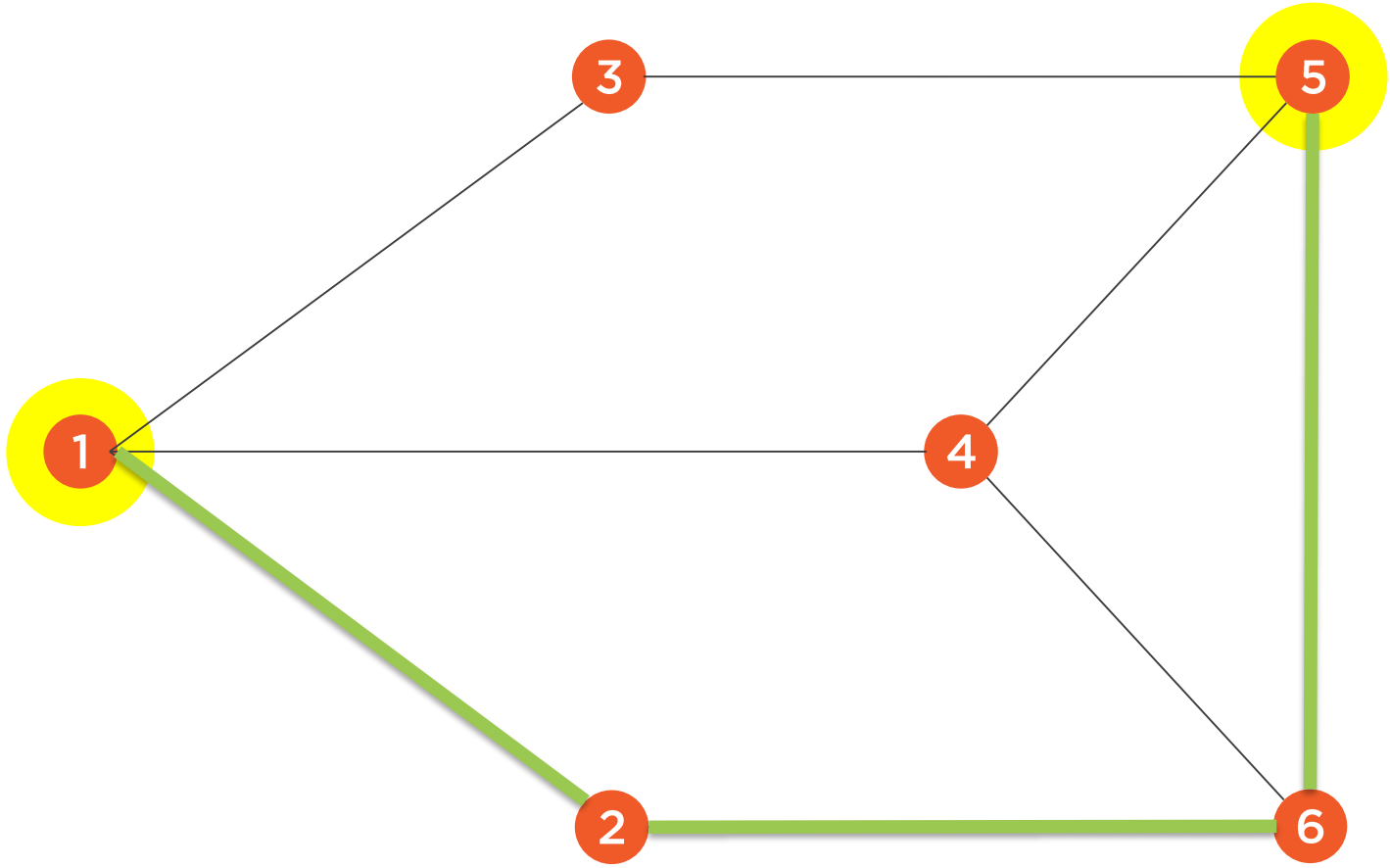
Shortest Path



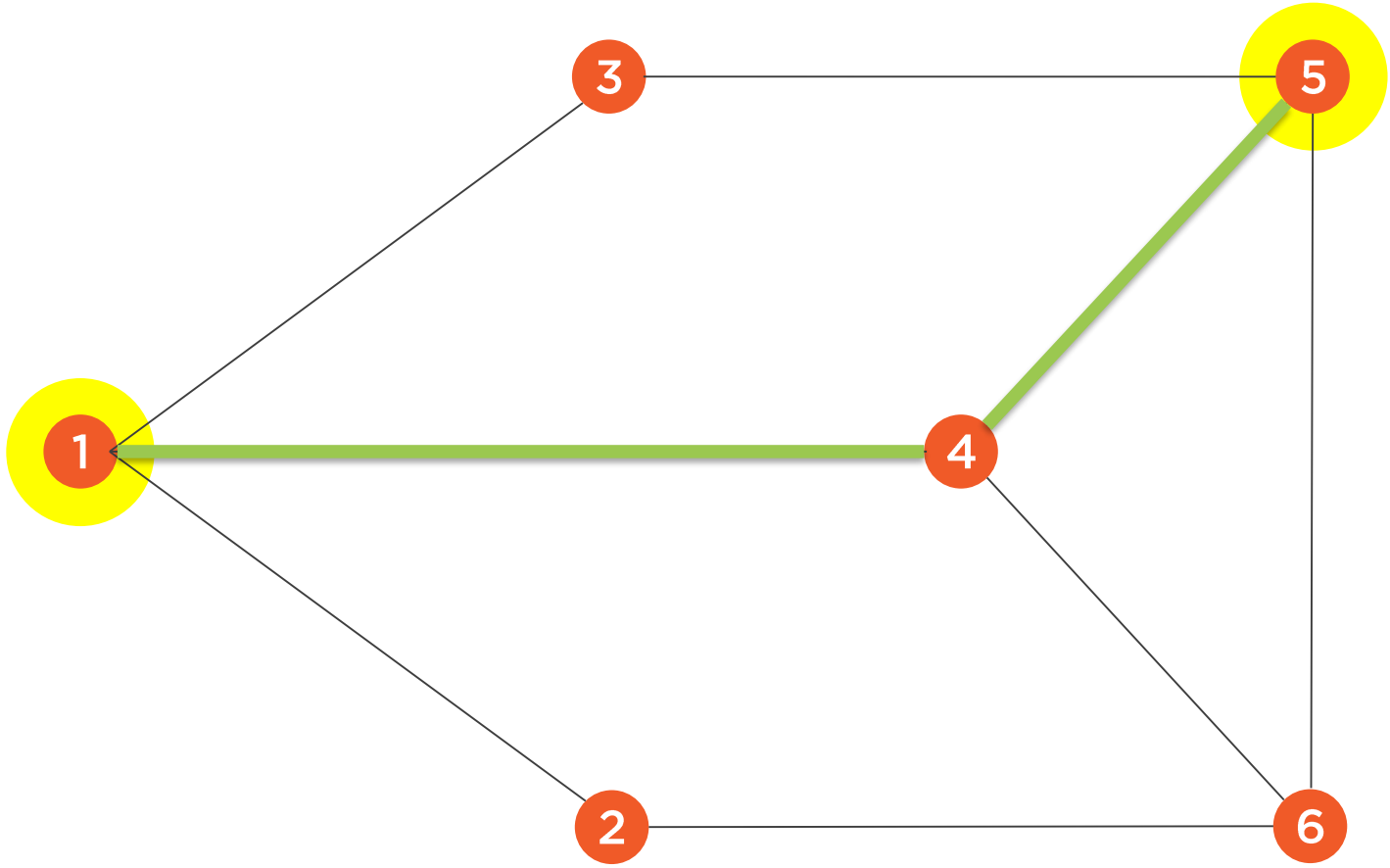
Shortest Path



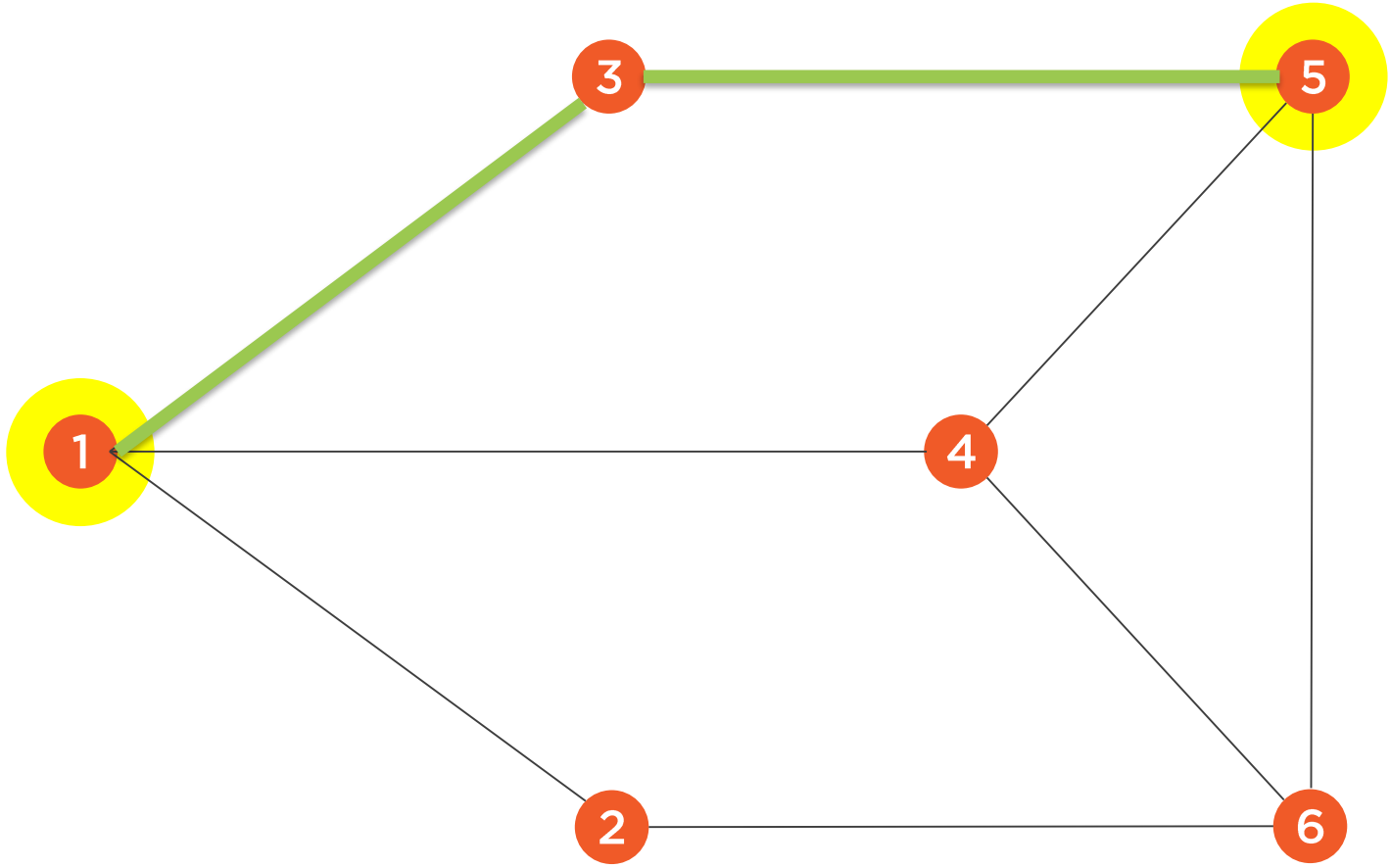
Path



Shortest Path



Shortest Path



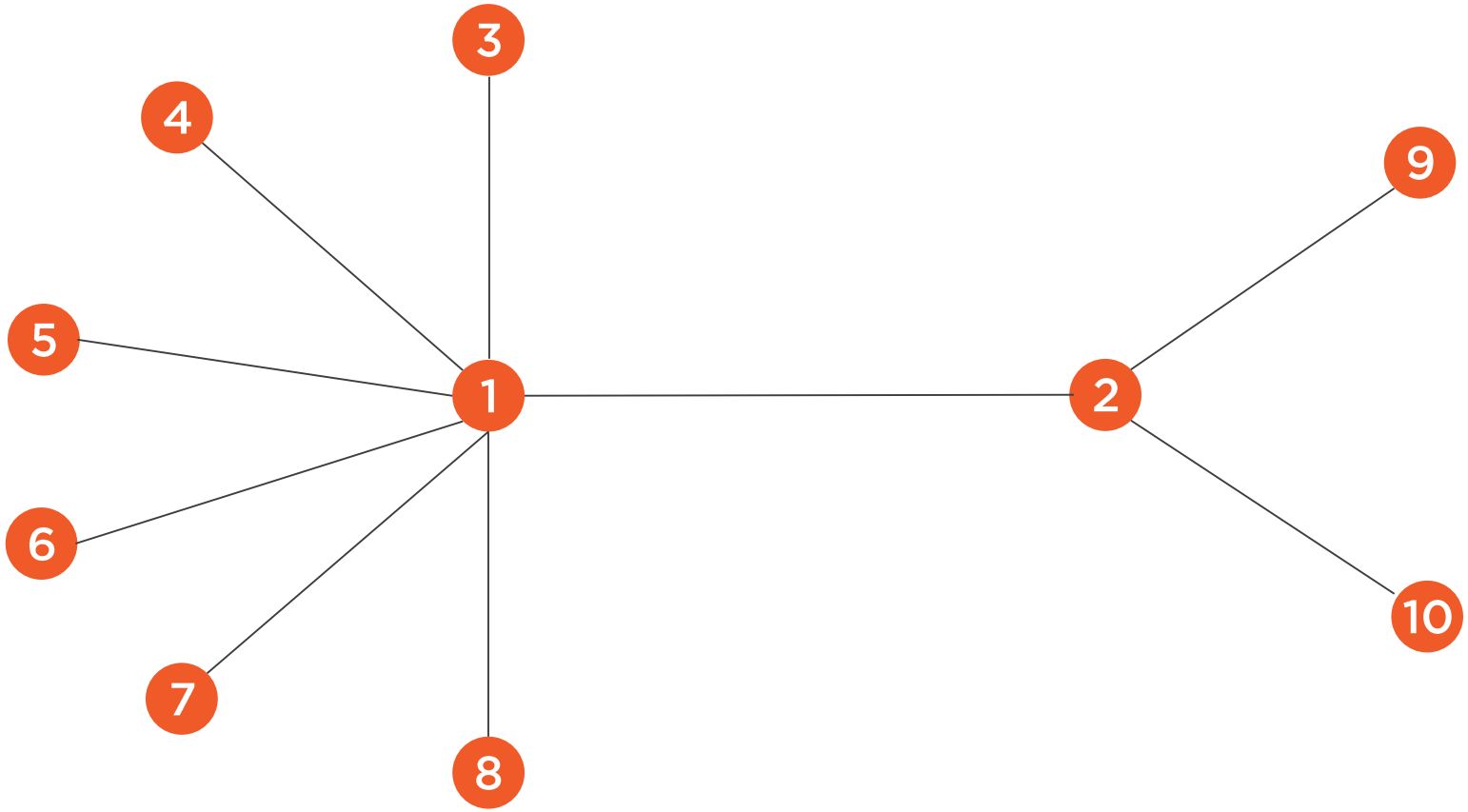
Implementing Neighborhoods and Shortest Paths

Understanding Network Centrality

Centrality

A metric to identify which nodes are most important within a network.

Centrality

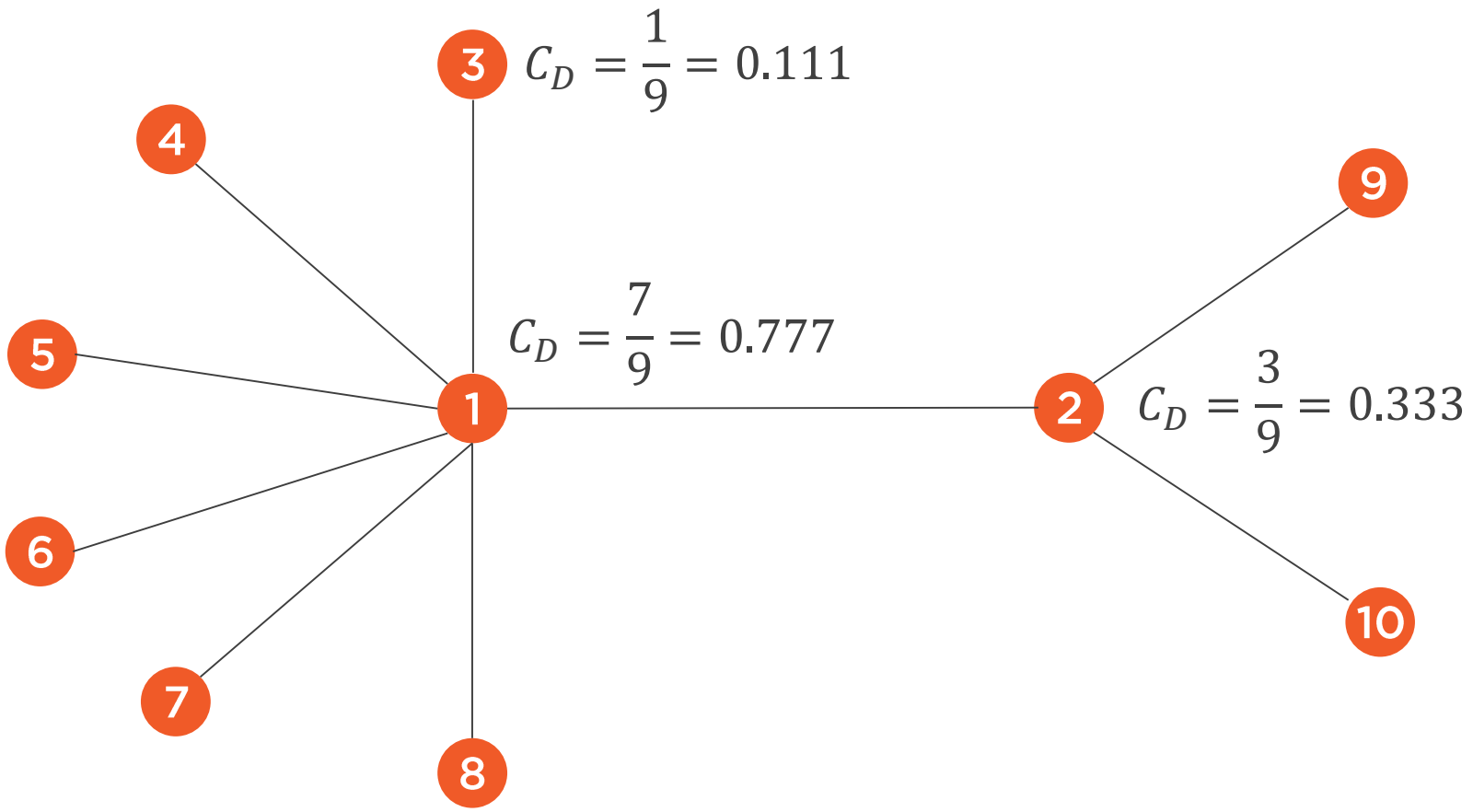


Degree Centrality

Indicates how many edges or connections a specific node has.

$$C_D = \frac{number\ of\ connections}{number\ of\ possible\ connections}$$

Degree Centrality



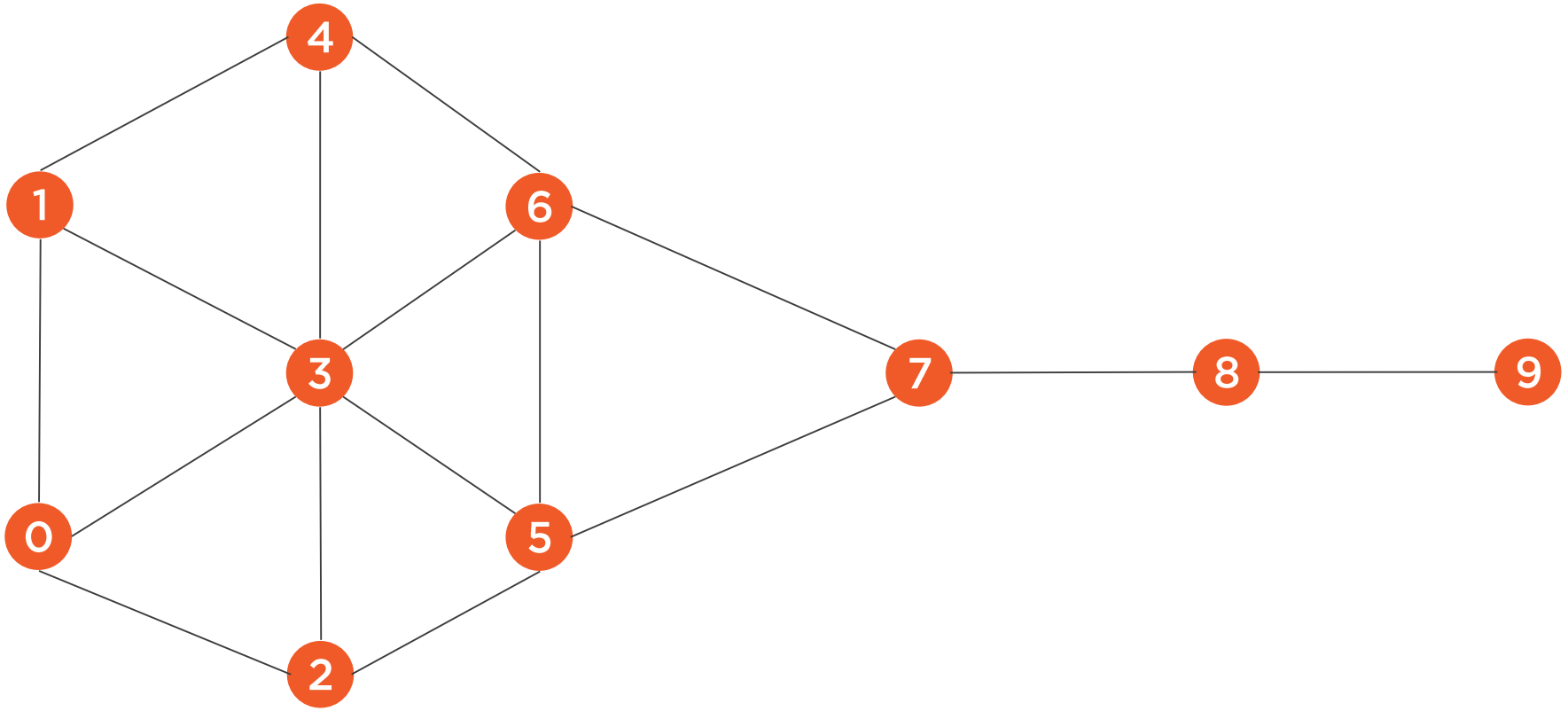
Betweenness Centrality

Indicates the number of times a node acts as a bridge along the shortest path between two other nodes.

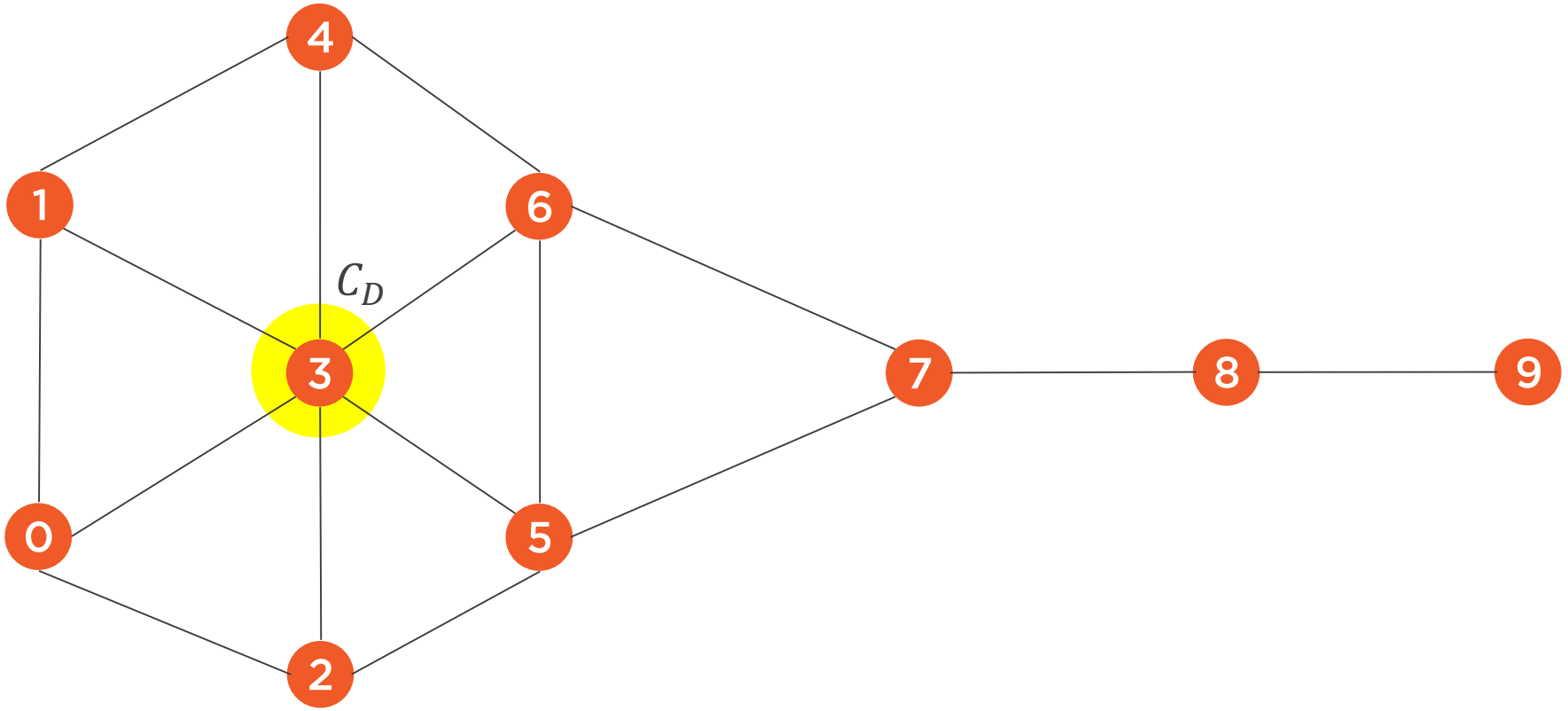
Closeness Centrality

Indicates the average length of the shortest path between a specific node and all other nodes.

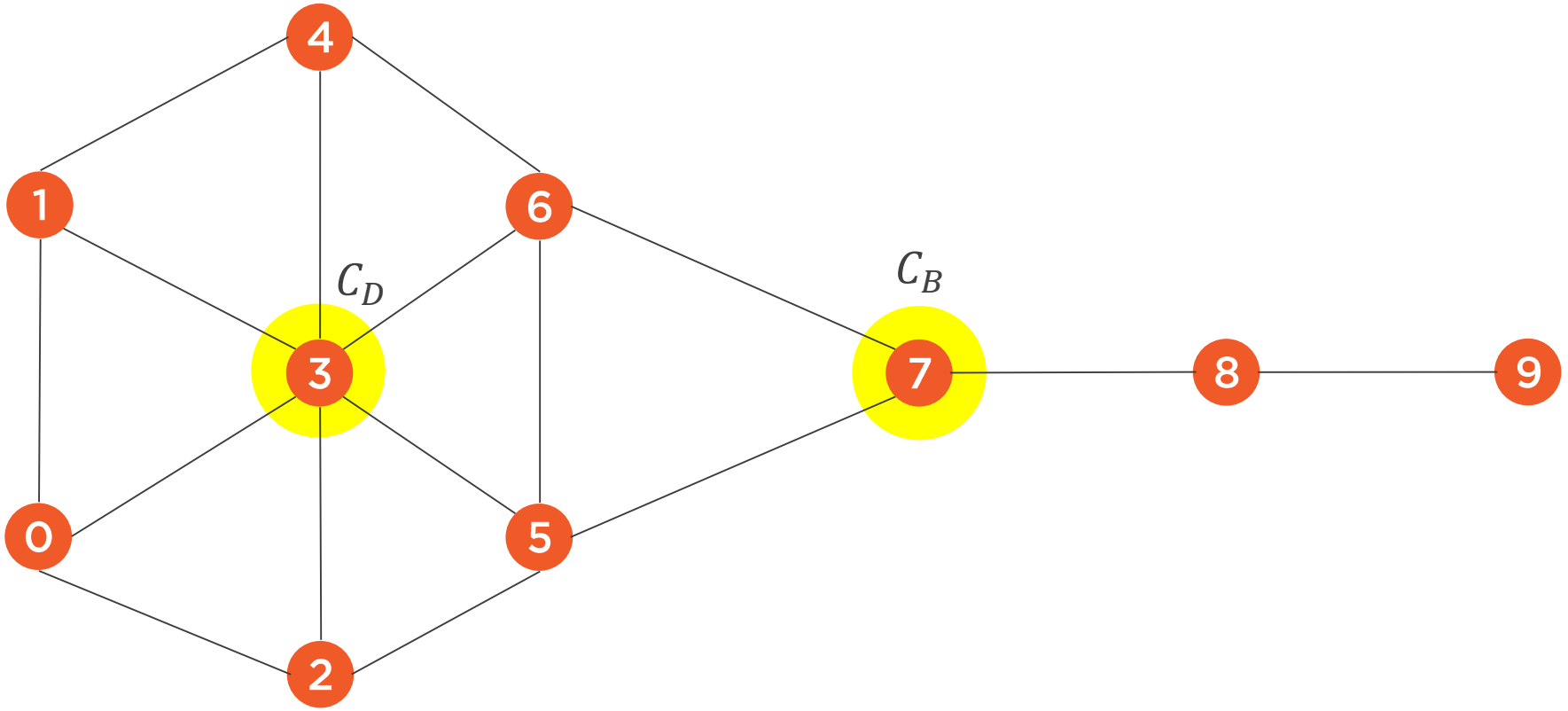
Centrality



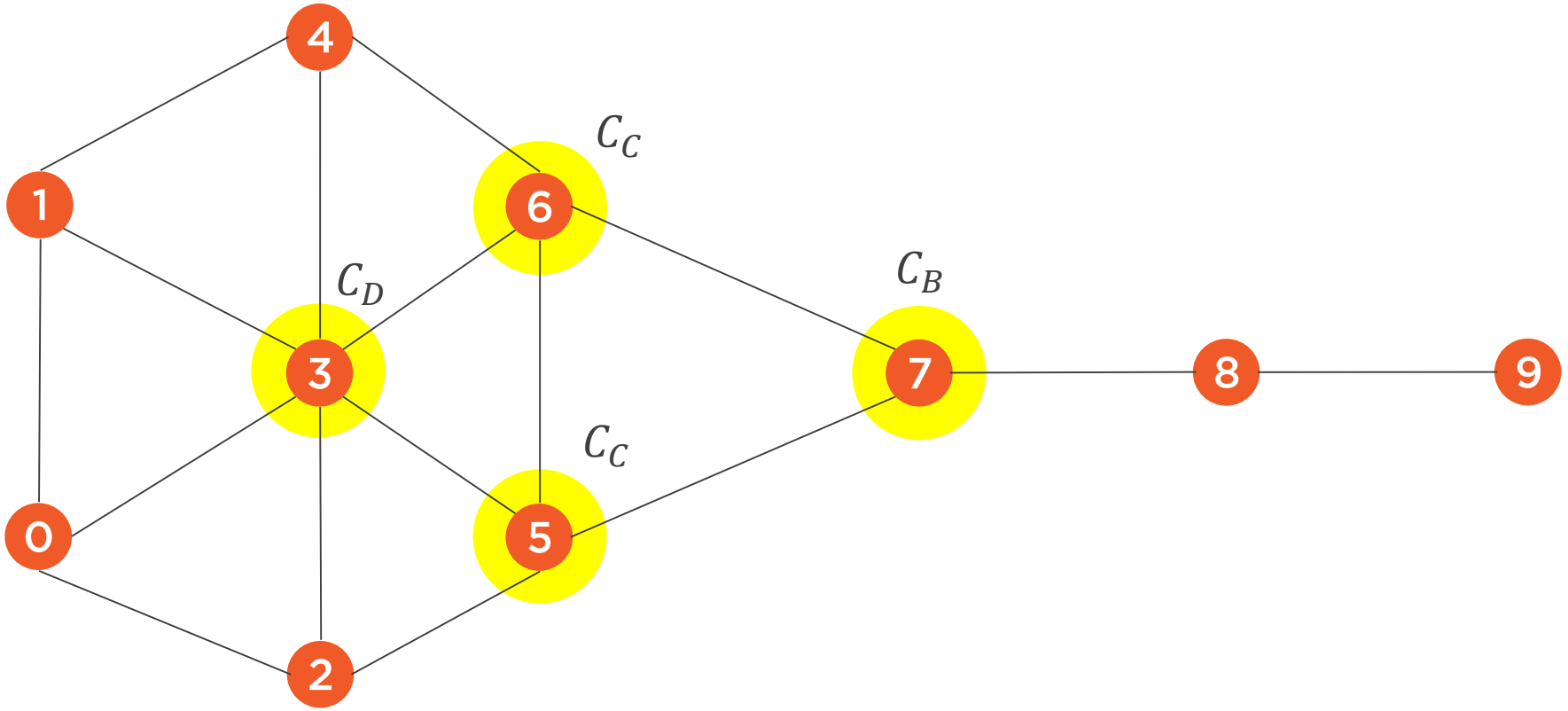
Centrality



Centrality



Centrality



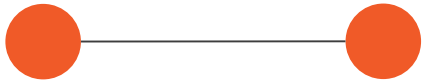
Implementing Network Centrality

Understanding Cliques and Clusters

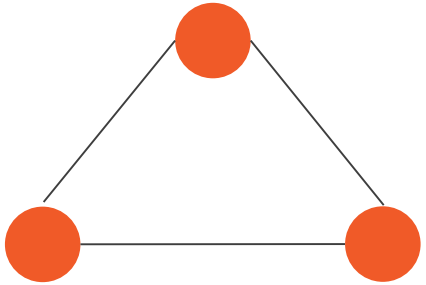
Clique

A subset of nodes such that every two nodes in the clique are connected. A complete subgraph.

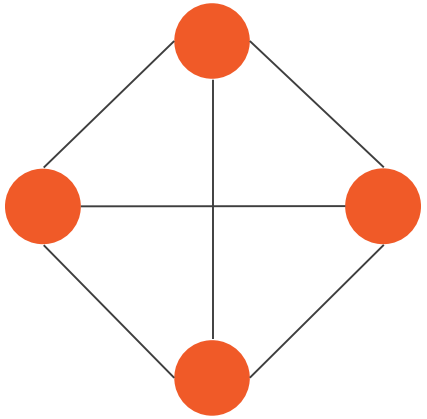
Cliques



2-Clique

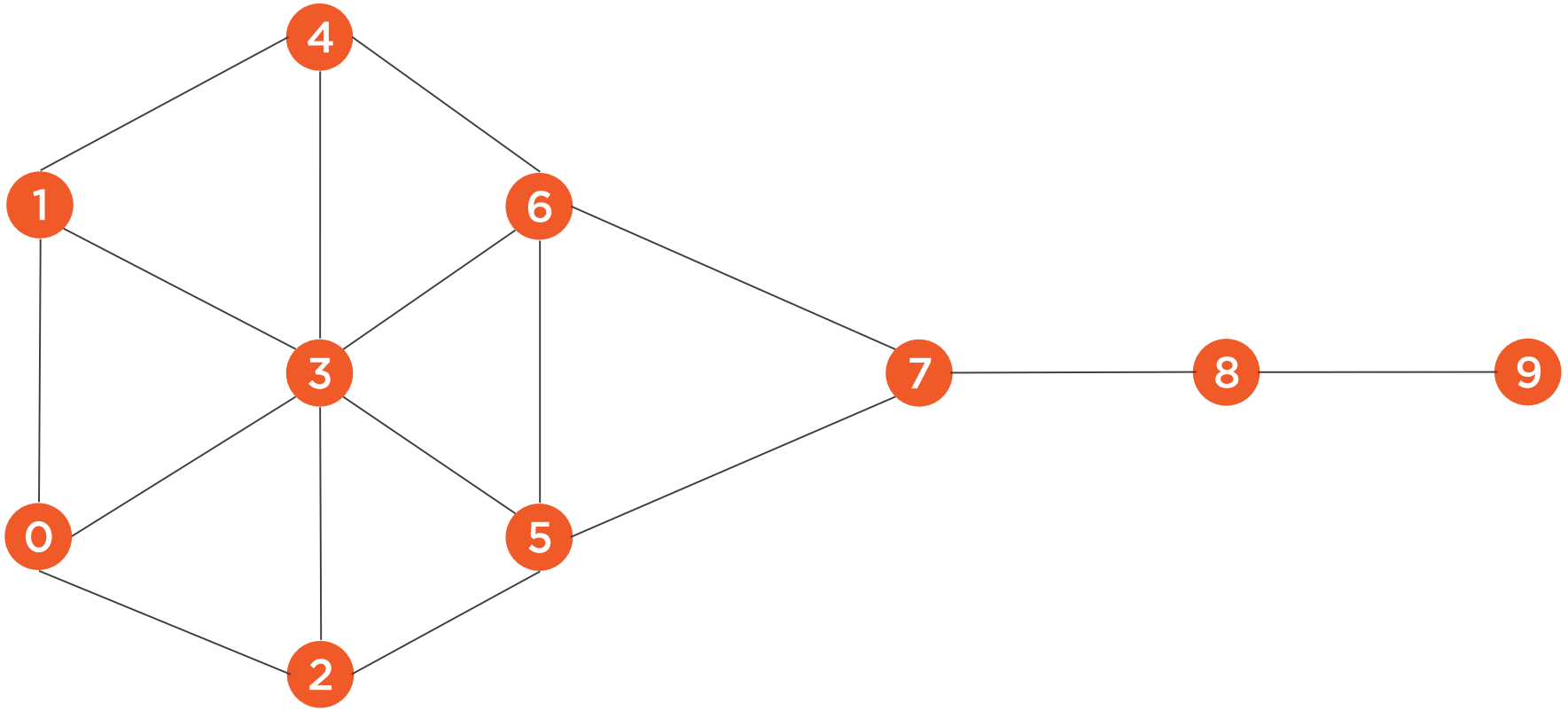


3-Clique

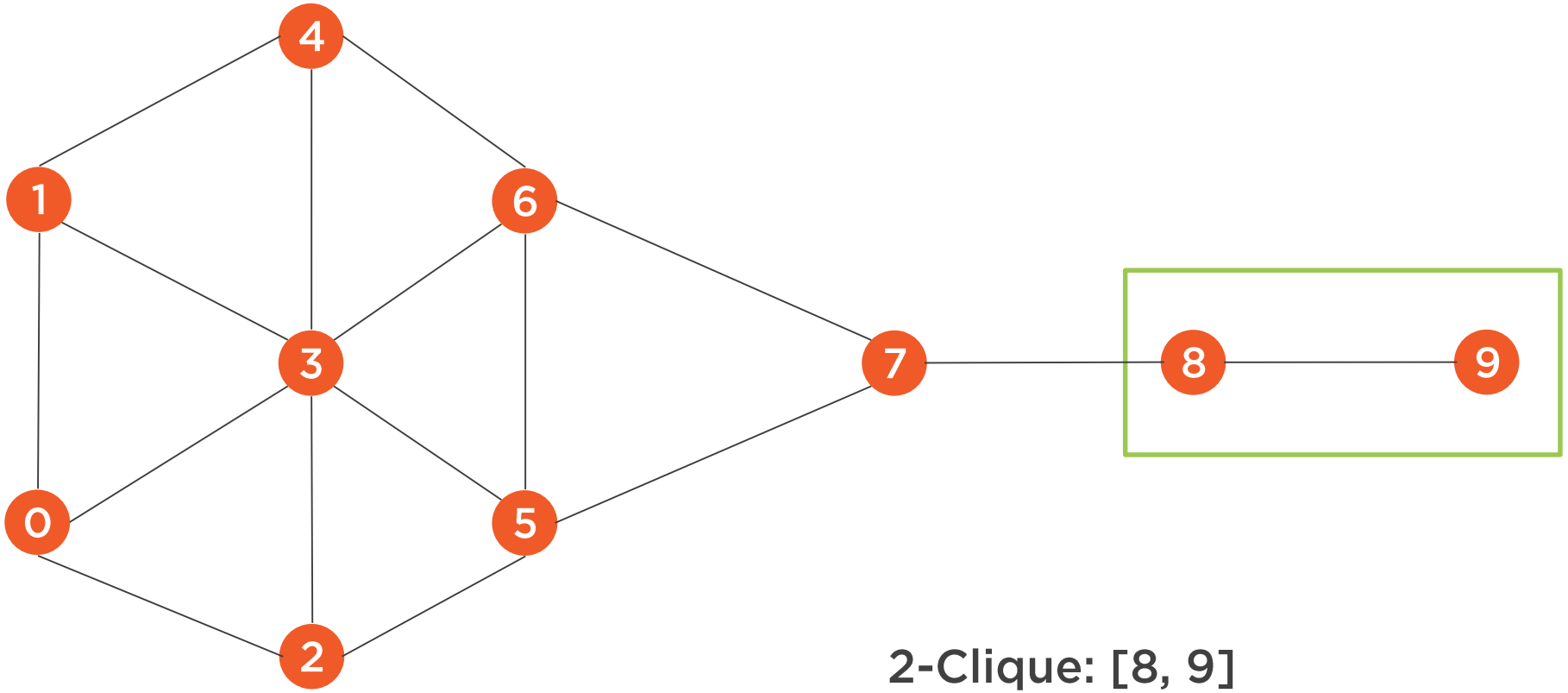


4-Clique

Cliques

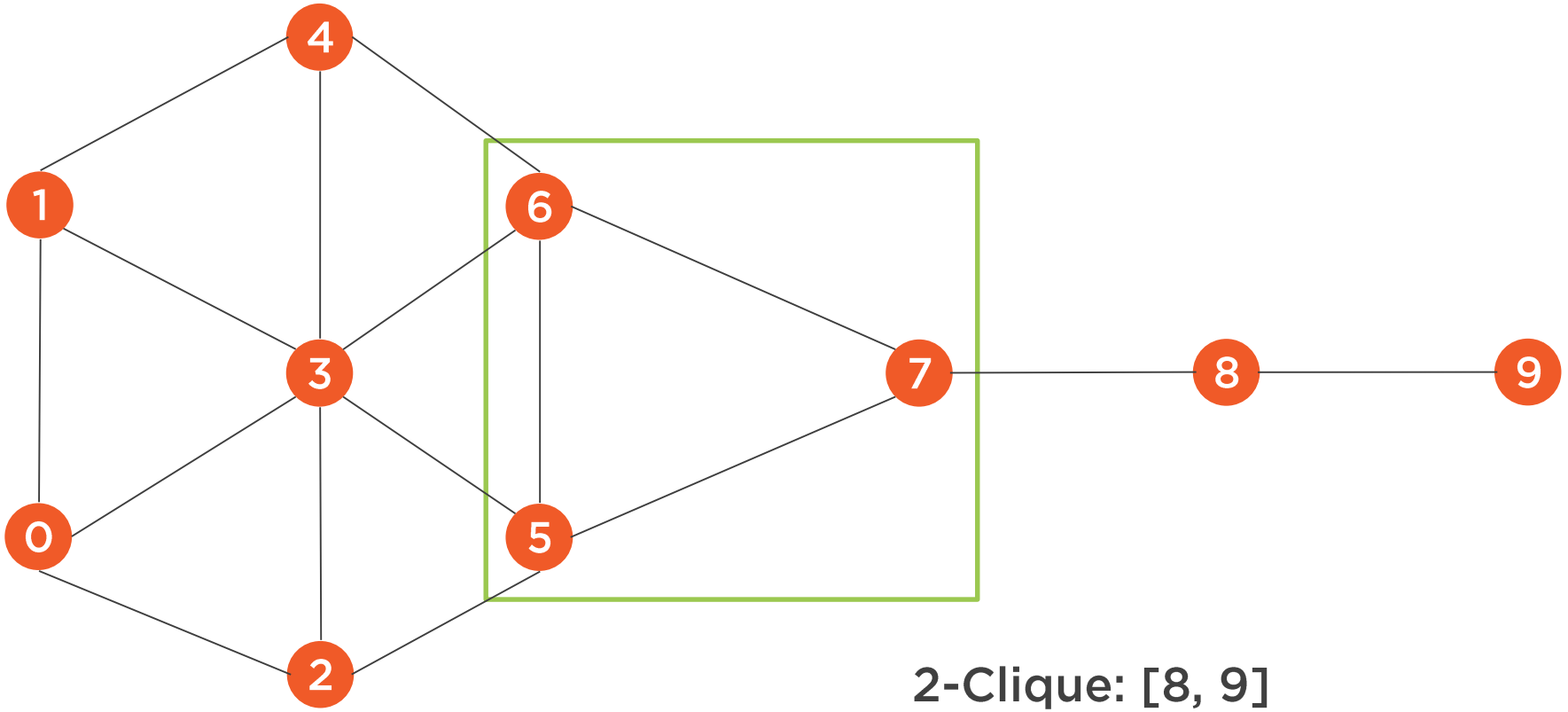


Cliques



2-Clique: [8, 9]

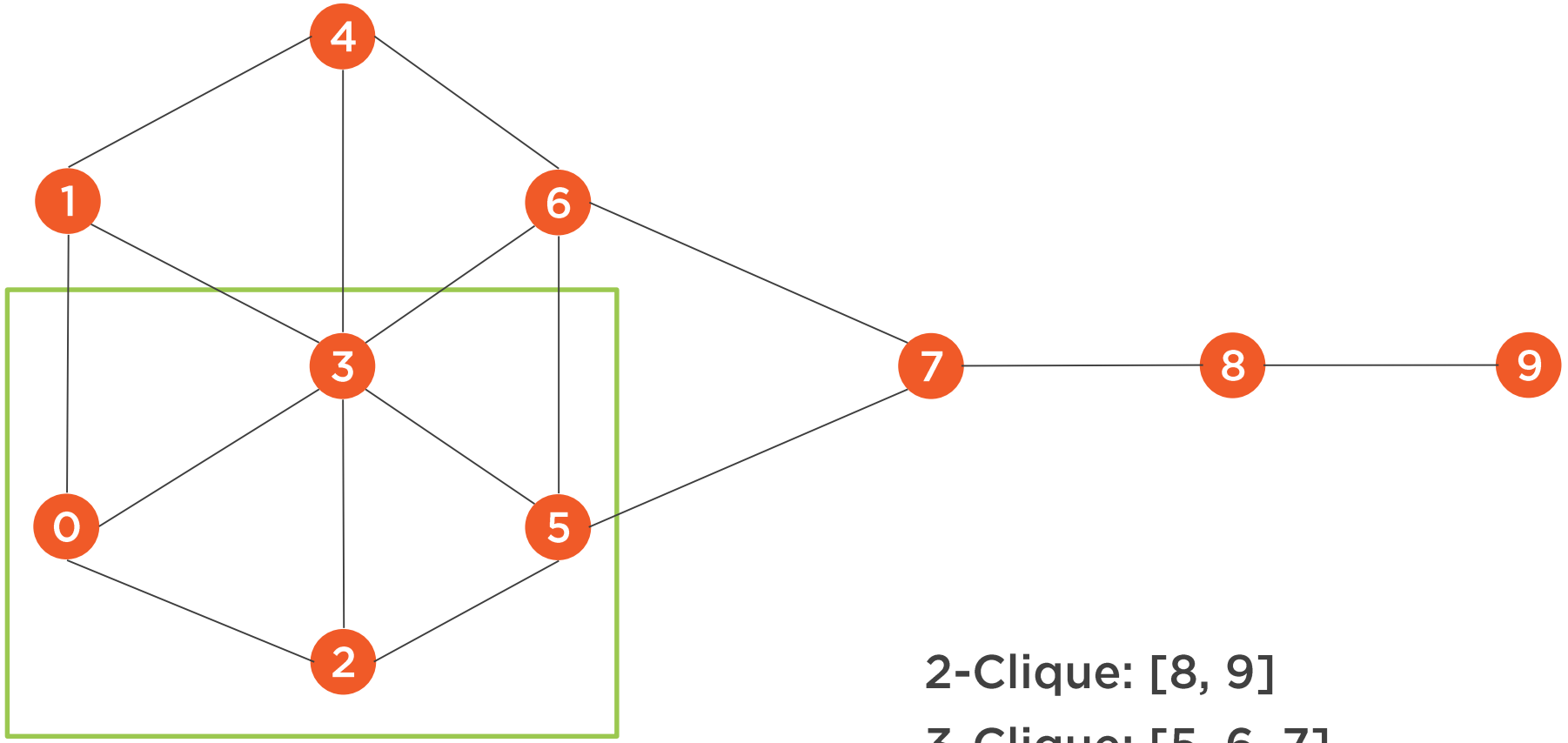
Cliques



2-Clique: [8, 9]

3-Clique: [5, 6, 7]

Cliques



2-Clique: [8, 9]

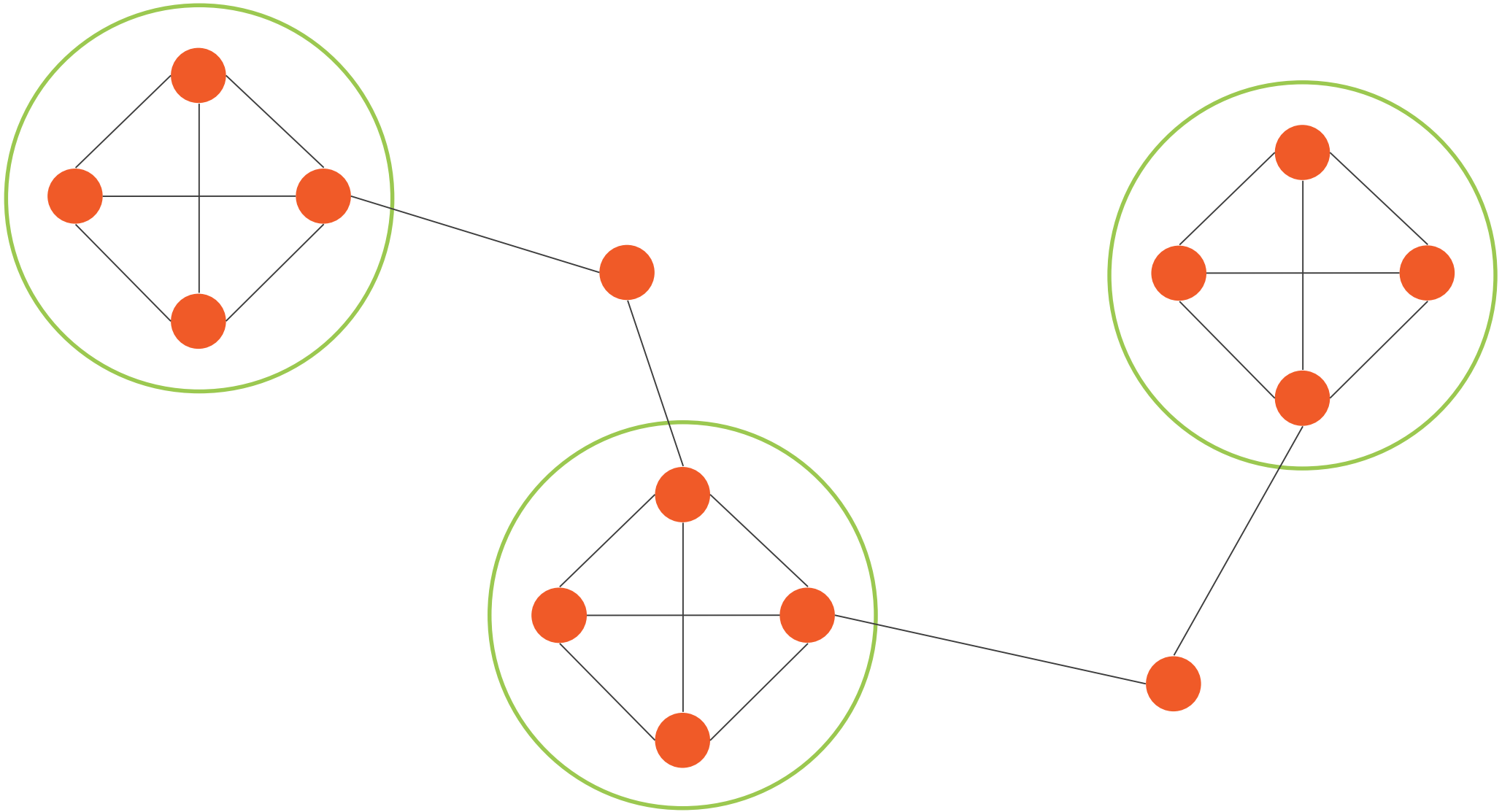
3-Clique: [5, 6, 7]

4-Clique: [0, 2, 3, 5]

Community

A set of nodes is densely connected internally.

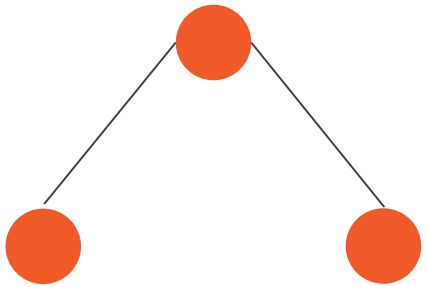
Communities



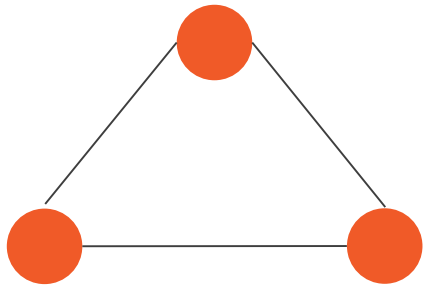
Cluster Coefficient

A measure of the degree to which nodes in a graph tend to cluster together.

Clusters



Open Triplet



Closed Triplet

Implementing Cliques and Clusters

Summary

- Introduced and understood shortest paths and neighborhoods
- Implemented neighborhoods and shortest paths methods
- Introduced and understood centrality
- Implemented centrality using NetworkX
- Introduced and understood cliques and clusters
- Implement cliques and clusters