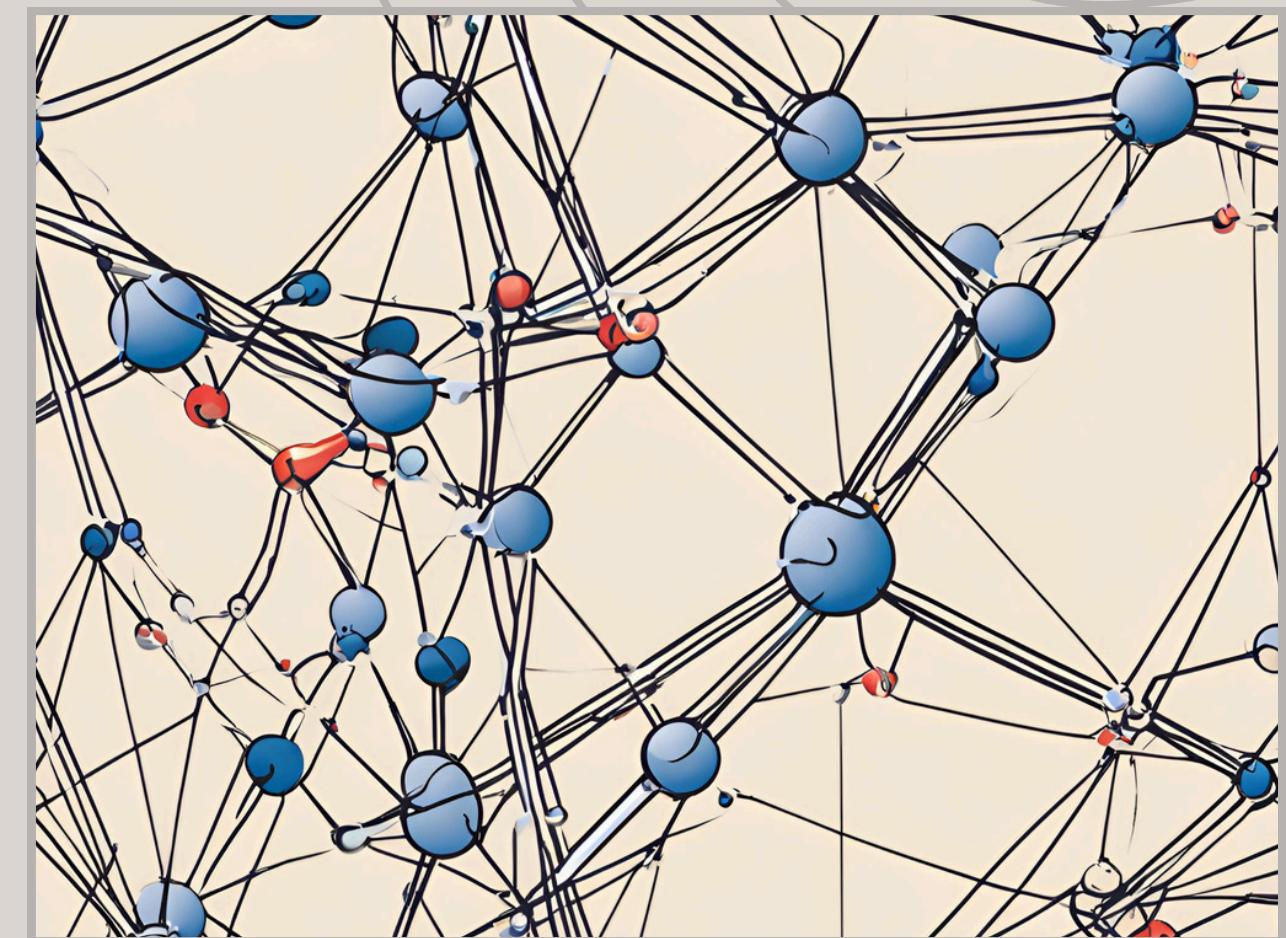


Graph Theory



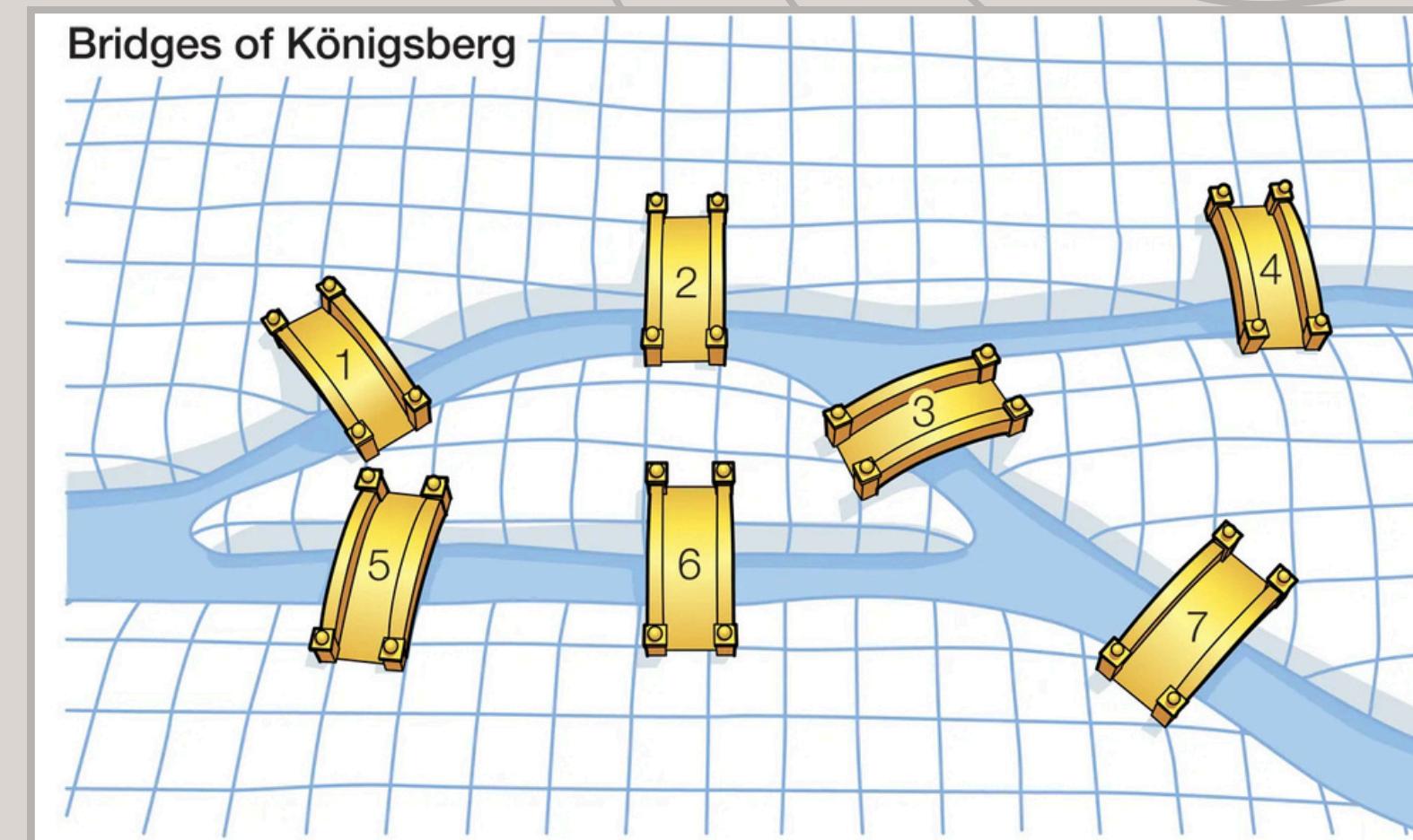
Introduction

- Graph theory is a fascinating branch of discrete mathematics that explores graphs' powerful structures designed to represent pairwise relationships between objects.



History of Graph Theory

- Graph theory began in 1736 with Leonhard Euler's solution to the Königsberg Bridge Problem.
- Find a walk through the city that would cross the bridges once and only once.
- Since then, it has expanded to solve problems in diverse fields like networking and optimization.



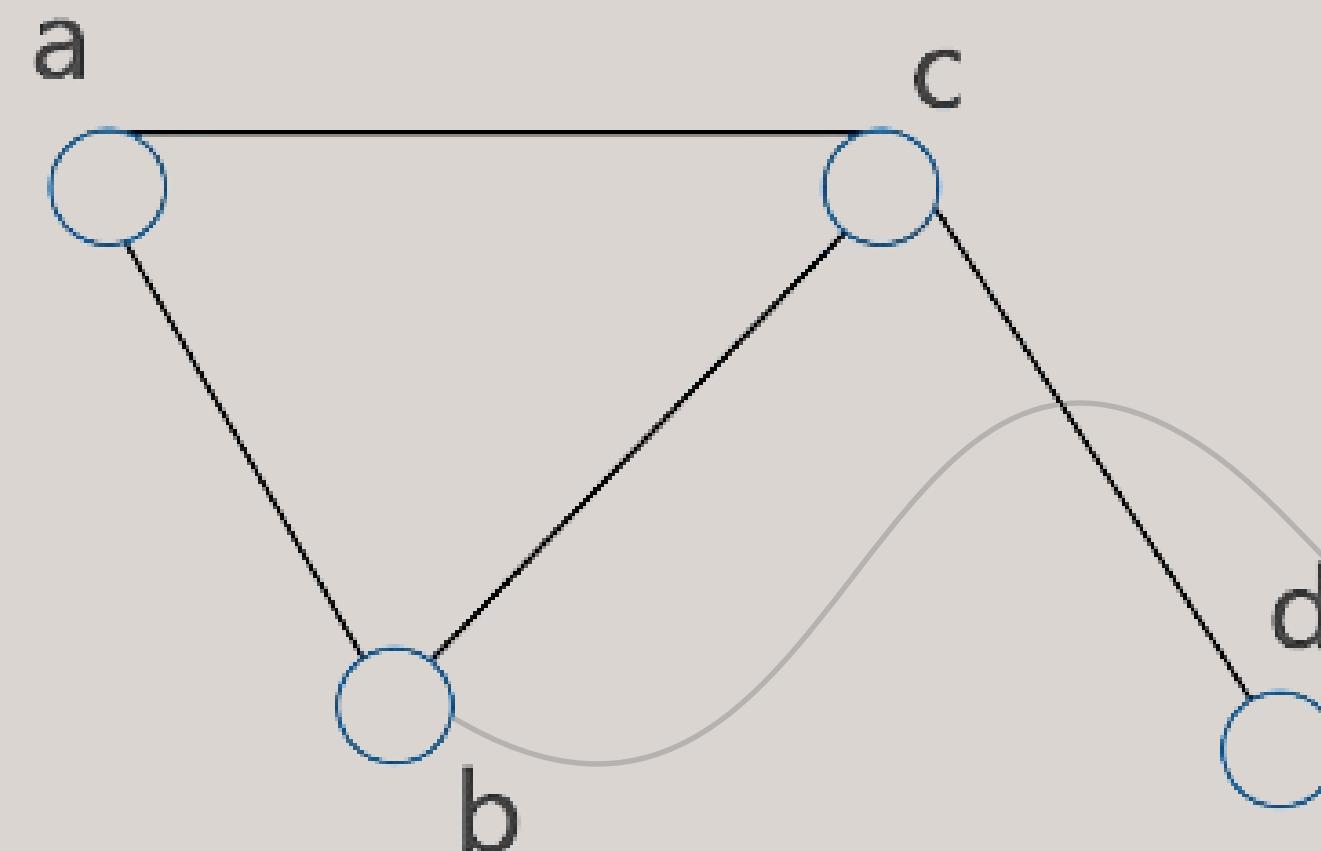
Graphs and Basic Terminologies

A Graph G is defined as a pair $G = (V, E)$, where:

- V is the set of vertices
- E is the set of edges, where each edge is a pair of vertices.

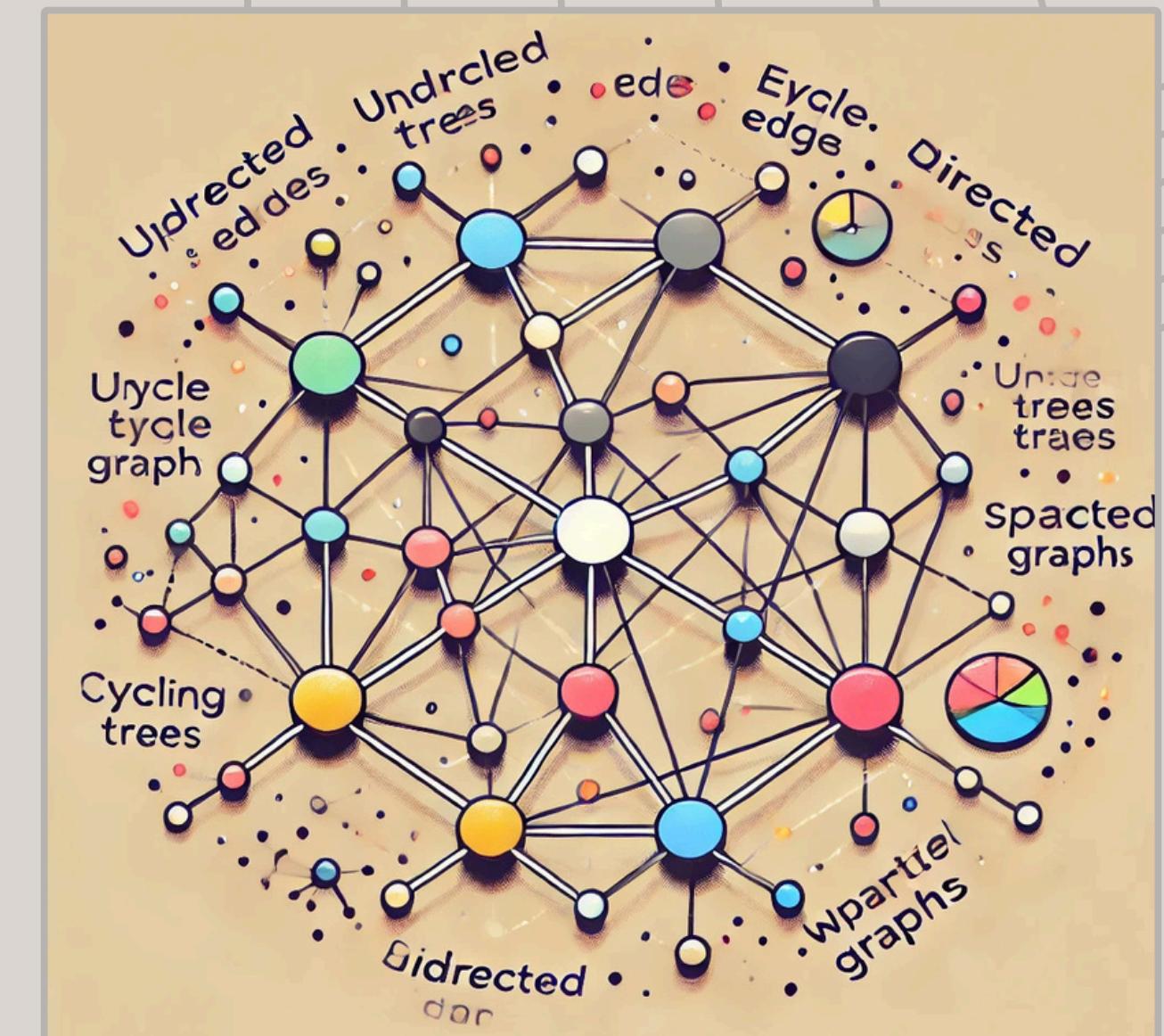
For example:

- Let us consider, a Graph is $G=(V, E)$ where:
- $V=\{a,b,c,d\}$
- $E=\{\{a,b\}, \{a,c\}, \{b,c\}, \{c,d\}\}$

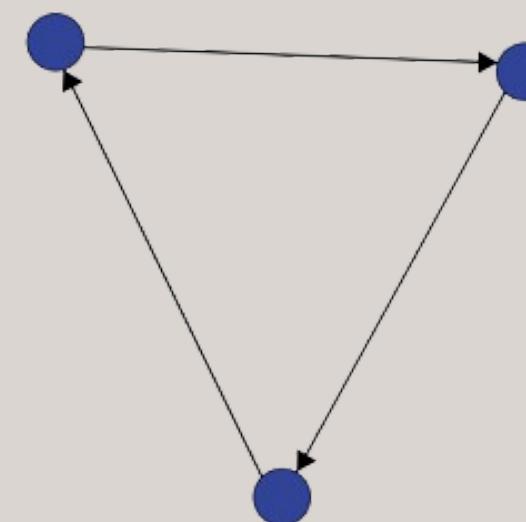


Types of Graphs

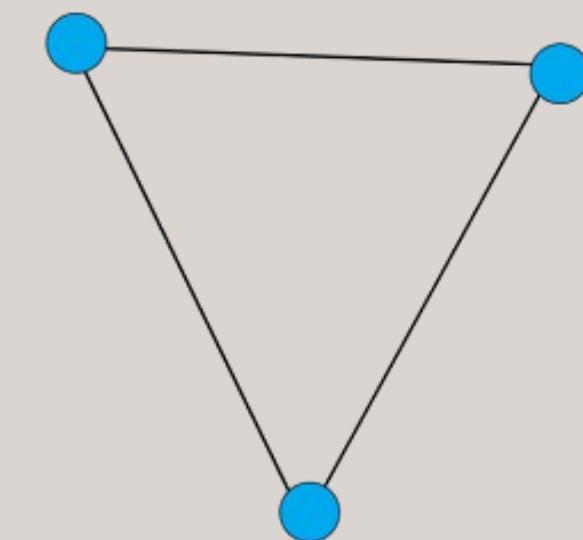
- **Directed graph:**
A graph where edges have no direction.
- **Undirected Graph:**
A graph where edges have direction.
- **Null Graph:**
A graph that contains no edges.
- **Cycle Graph:**
A graph that contains only one cycle.



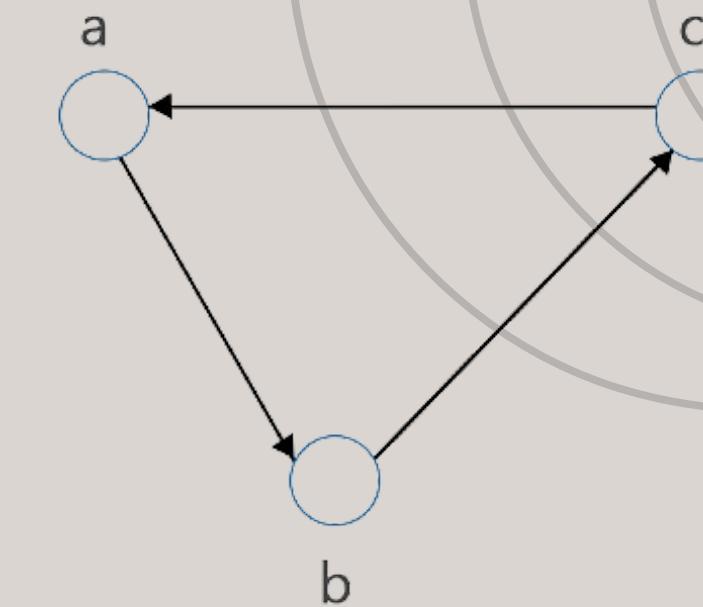
Examples of Graphs



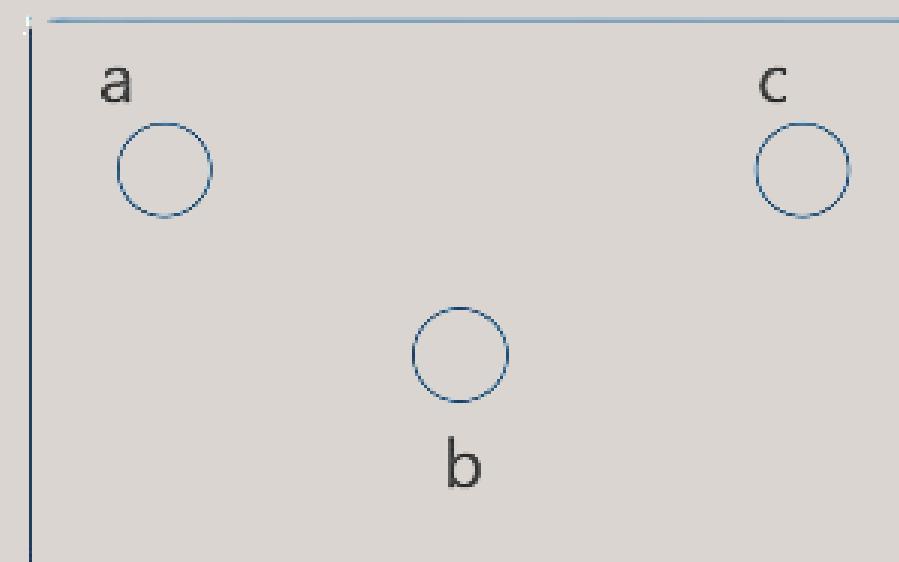
- **Directed Graph**



- **Undirected Graph**



- **Cycle Graph**



- **Null Graph**

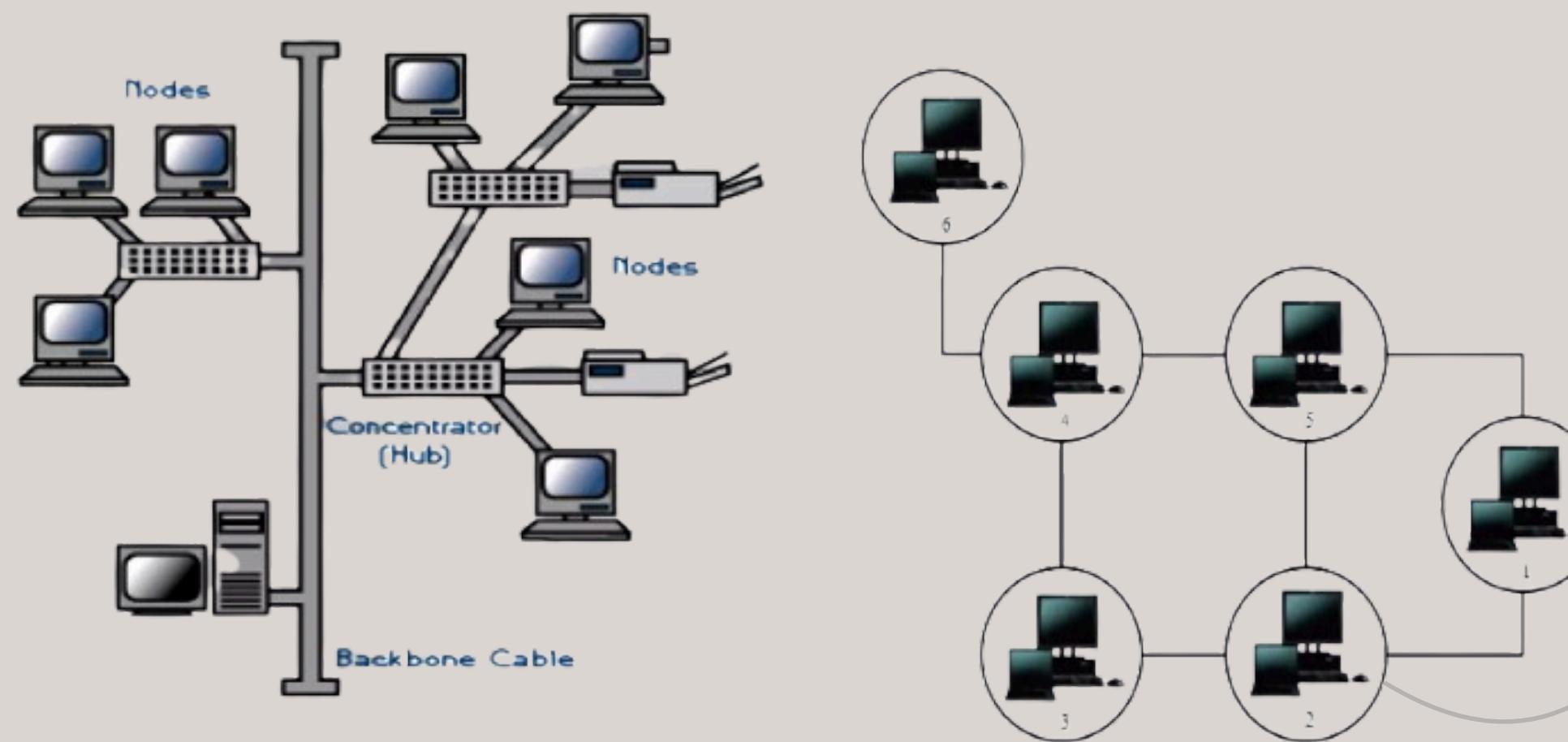
Applications of Graph theory

Graph theory finds its applications in diverse fields such as:

- **Computer Science**
- **Transportation and Logistics**
- **Biology and Chemistry**
- **Cryptography**
- **Entertainment and Gaming**

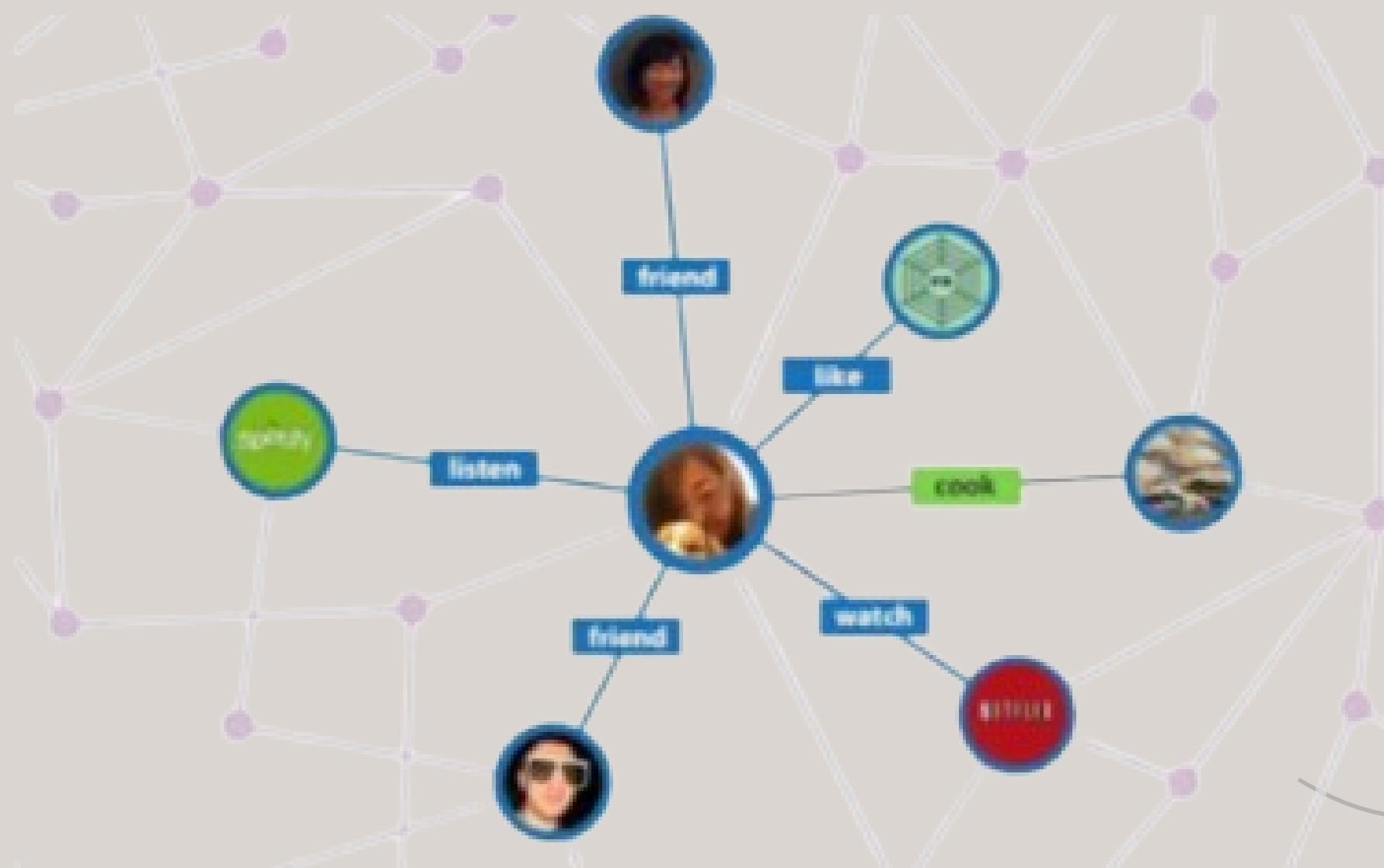
Computer Science

- **Network Analysis:**
Graph theory is fundamental in designing computer networks and developing efficient routing algorithms for data transmission.



Computer Science

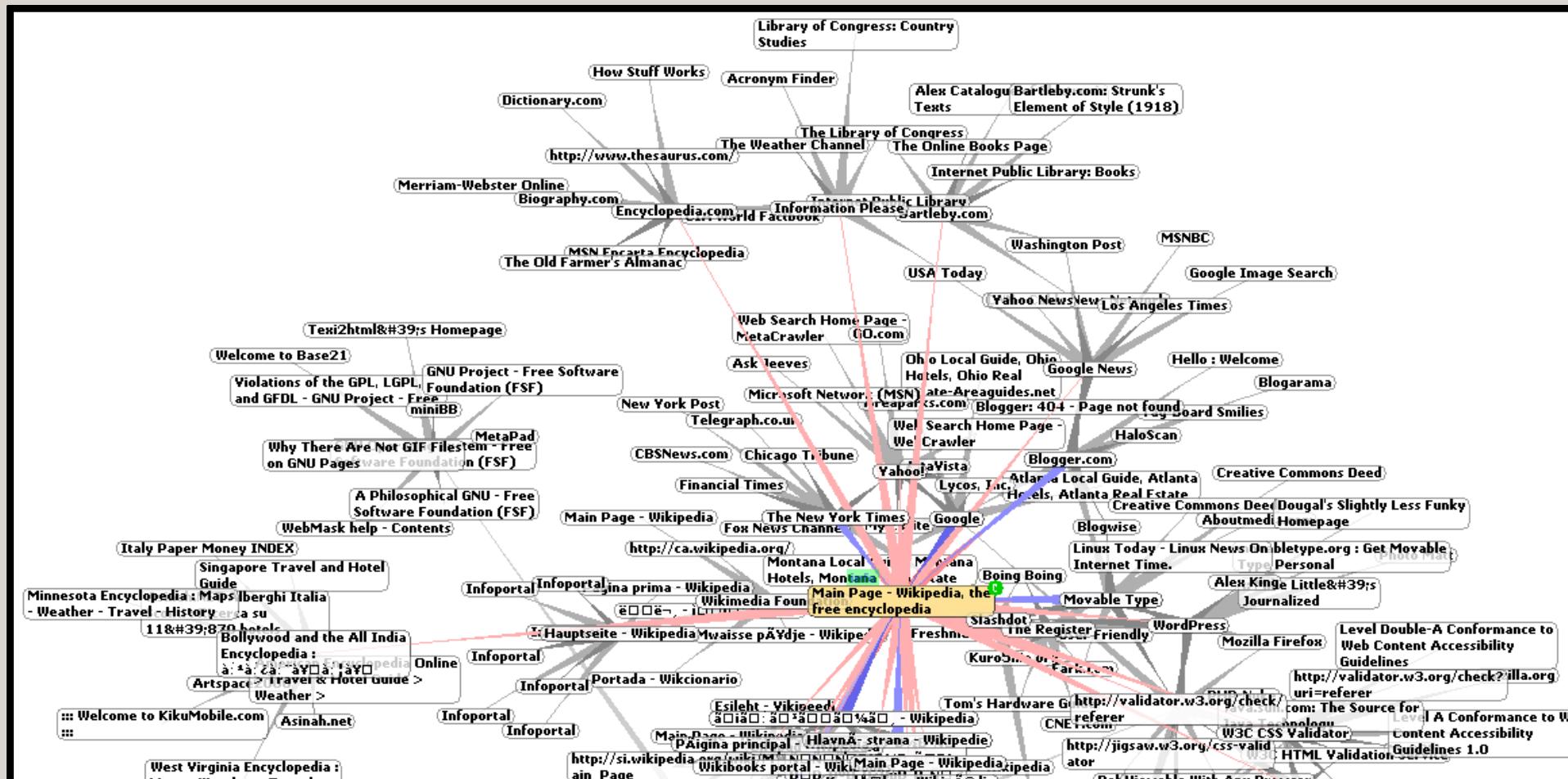
- **Social Networks:** Modeling relationships and interactions on platforms like Facebook, LinkedIn, or Twitter.



Computer Science

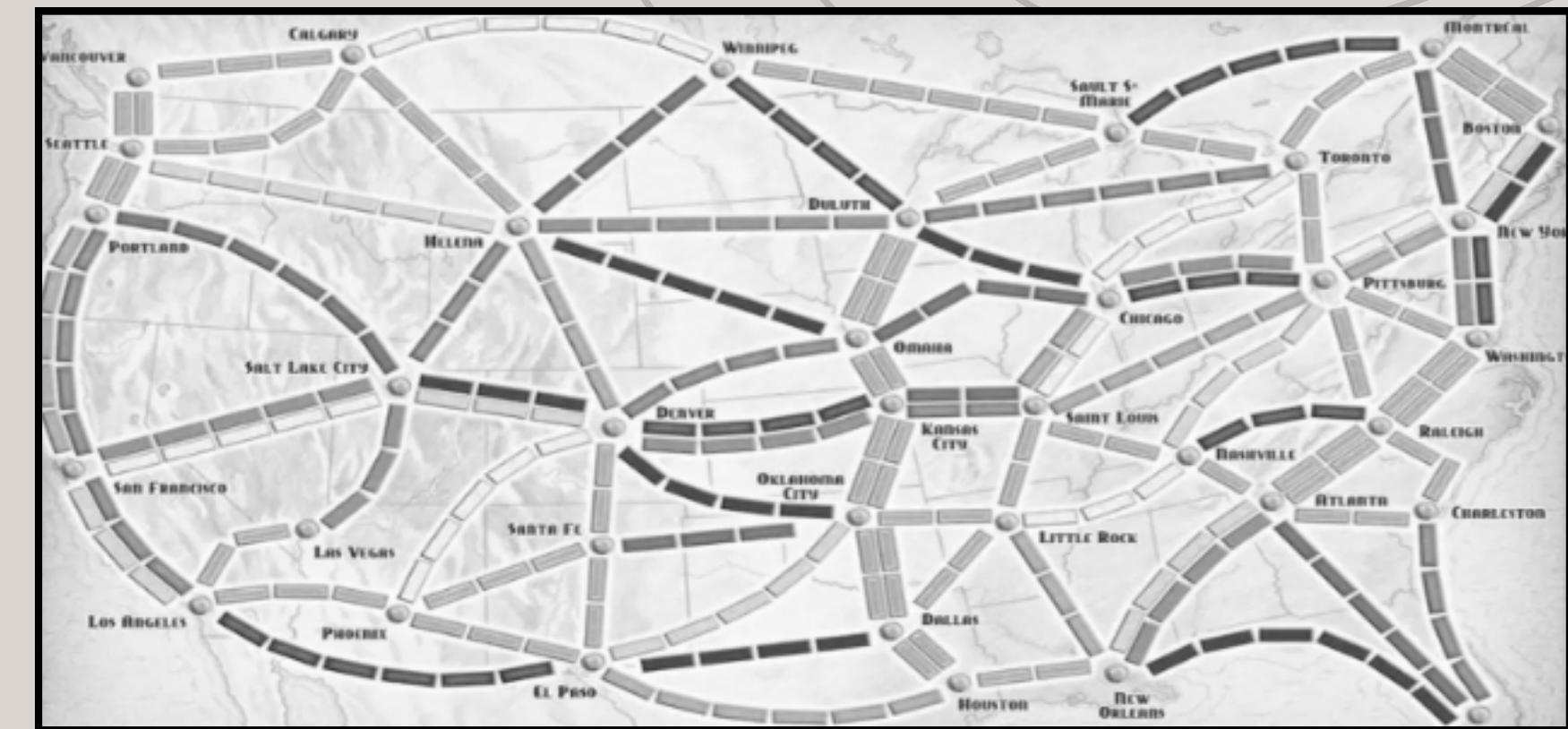
- **World Wide Web:**

The World Wide Web uses graph theory to model webpages as nodes and links as edges, enabling search engines, ranking, and web security.



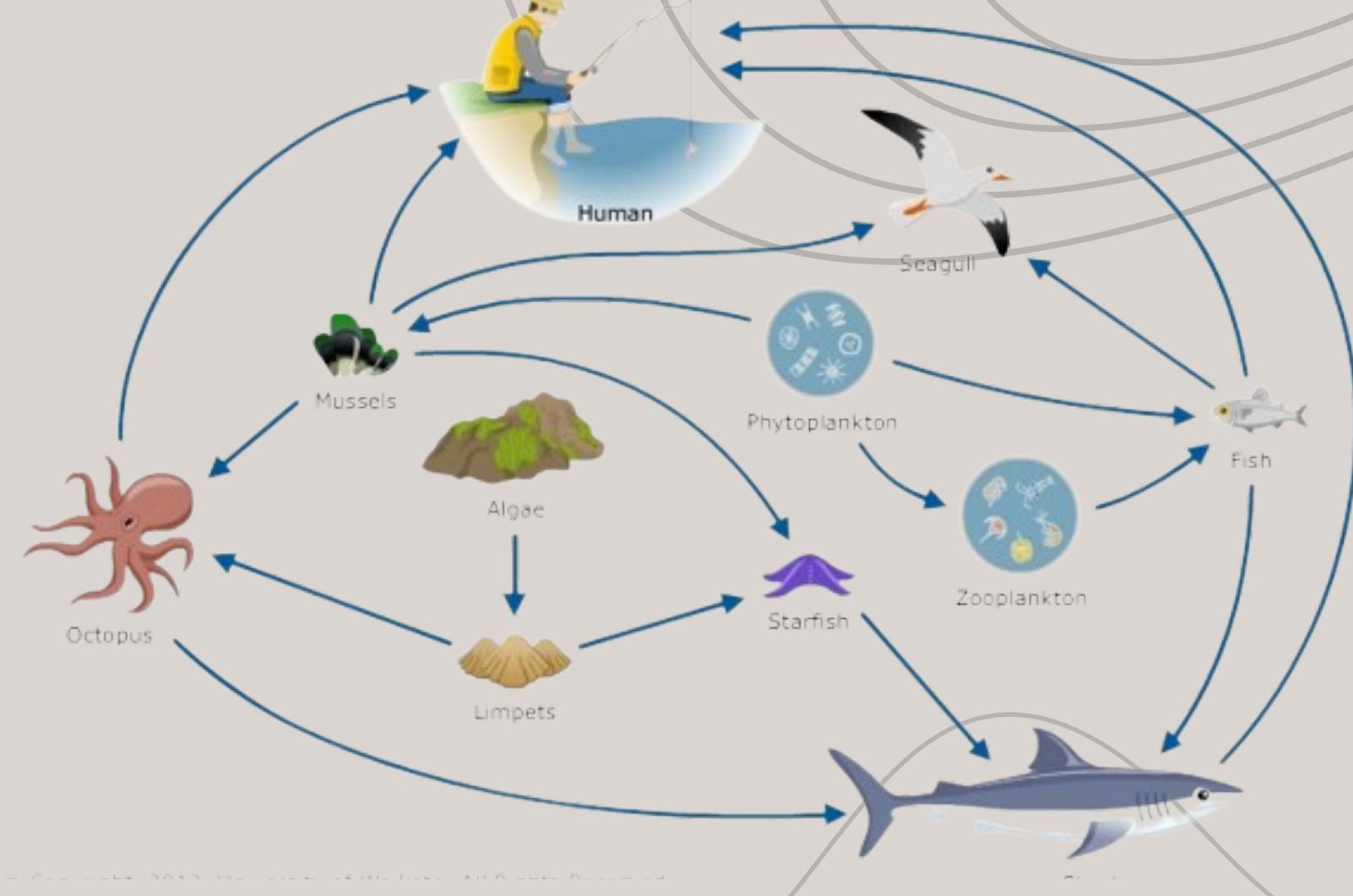
Transportation and Logistics

- Graph theory in transportation models locations as nodes and routes as edges to optimize paths, manage traffic, and plan logistics.
- It enhances efficiency in public transit, supply chains, and airline networks.



Biology and Chemistry

- In Biology and Chemistry, graph theory models protein interactions and analyzes ecosystems, such as:
- Food chains and webs to study molecular and ecological networks.



Cryptography

- In cryptography, graph theory enhances network security by supporting secure communication protocols.



Entertainment and Gaming

- **Game Development:**
Graph theory aids in character pathfinding in games by calculating optimal routes through the game world.
- **Recommendation Systems:**
Suggesting movies, books, or products using graph-based algorithms.



**Thank
You**