## Lecture 12-graphs

1. Which data structure is used for implementing BFS and DFS, respectively?

a) Queue, Stack   
b) Stack, Queue  
c) Queue, Queue   
d) Stack, Stack  
**Answer:** a) Queue, Stack

1. **Which of the following is NOT a typical application of graphs?**  
   a) Social media follower relationships  
   b) Web page hyperlinks  
   c) Storing a list of student grades  
   d) Airline flight paths  
   **Answer:** c) Storing a list of student grades  
   *Explanation:* Storing grades is a linear data task, not requiring graph relationships.
2. **In a directed graph, the sum of all nodes' out-degrees equals:**  
   a) The number of nodes  
   b) The number of edges  
   c) Twice the number of edges  
   d) The number of cycles  
   **Answer:** b) The number of edges  
   *Explanation:* Each edge contributes exactly 1 to the out-degree of a node.
3. **An undirected graph is connected if:**  
   a) All nodes have even degrees  
   b) There exists a path between every pair of nodes  
   c) It contains no cycles  
   d) It uses an adjacency matrix  
   **Answer:** b) There exists a path between every pair of nodes
4. **Which graph representation has O(1) time complexity to check if an edge exists?**  
   a) Adjacency List  
   b) Adjacency Matrix  
   c) Hash Table  
   d) Linked List  
   **Answer:** b) Adjacency Matrix  
   *Explanation:* Matrix allows direct access to edge existence.
5. **A directed acyclic graph (DAG) can be topologically sorted because:**  
   a) It contains cycles  
   b) It has no undirected edges  
   c) It has no directed cycles  
   d) All nodes have equal in-degree and out-degree  
   **Answer:** c) It has no directed cycles  
   *Explanation:* Cycles prevent topological sorting.
6. **In BFS traversal, which data structure is used?**  
   a) Stack  
   b) Queue  
   c) Priority Queue  
   d) Tree  
   **Answer:** b) Queue  
   *Explanation:* BFS processes nodes layer-by-layer using a queue.
7. **Matrix multiplication of an adjacency matrix with itself helps identify:**  
   a) Node degrees  
   b) 2-hop neighbors  
   c) Cycle existence  
   d) Edge weights  
   **Answer:** b) 2-hop neighbors  
   *Explanation:* The resulting matrix entries indicate paths of length 2.
8. **Kahn's algorithm for topological sorting starts by enqueuing nodes with:**  
   a) Highest out-degree  
   b) In-degree of 0  
   c) Out-degree of 0  
   d) Highest edge weight  
   **Answer:** b) In-degree of 0  
   *Explanation:* Nodes with no dependencies are processed first.
9. **DFS post-order traversal of a graph is used to:**  
   a) Find the shortest path  
   b) Generate a topological sort (when reversed)  
   c) Calculate node degrees  
   d) Check graph connectivity  
   **Answer:** b) Generate a topological sort (when reversed)
10. **What is the space complexity of an adjacency list for a graph with |V| nodes and |E| edges?**  
    a) O(|V|)  
    b) O(|E|)  
    c) O(|V| + |E|)  
    d) O(|V|²)  
    **Answer:** c) O(|V| + |E|)
11. **A cycle in a graph is defined as:**  
    a) A path where all nodes have degree 2  
    b) A path starting and ending at the same node  
    c) A path with no repeated edges  
    d) A path with exactly three nodes  
    **Answer:** b) A path starting and ending at the same node
12. **Which traversal visits nodes in the order "node, left, right" for trees?**  
    a) Pre-order DFS  
    b) Post-order DFS  
    c) In-order DFS  
    d) BFS  
    **Answer:** a) Pre-order DFS
13. **In a directed graph with edges (A→B), (B→C), and (C→A), topological sorting:**  
    a) Is possible starting from A  
    b) Is possible using Kahn's algorithm  
    c) Is impossible due to a cycle  
    d) Results in [A, B, C]  
    **Answer:** c) Is impossible due to a cycle
14. **Which statement about edge weights is TRUE?**  
    a) They are only used in undirected graphs  
    b) They represent numerical labels on edges  
    c) They are unrelated to graph traversal  
    d) They replace the need for adjacency lists  
    **Answer:** b) They represent numerical labels on edges