--Question Starting--

Match the following graph algorithms with their primary operational mechanism:

1. Algorithm Characteristic

I. Breadth-First Search (BFS) A. Relies on repeatedly selecting augmenting paths to increase flow

II. Depth-First Search (DFS) B. Explores neighbors level by level, ensuring shortest path in unweighted graphs

III. Shortest Paths C. Uses a queue to traverse nodes in layers

IV. Maximum Flow D. Utilizes recursion or stack to explore as deep as possible before backtracking

Choose the correct answer from the options given below:

(1) I-C, II-D, III-B, IV-A

(2) I-B, II-C, III-D, IV-A

(3) I-C, II-D, III-A, IV-B

(4) I-A, II-B, III-C, IV-D

Answer Key: 2

Solution:

? Breadth-First Search (BFS): It employs a queue to traverse the graph level by level, which guarantees shortest path in unweighted graphs, making it fundamentally a layer-by-layer exploration.

? Depth-First Search (DFS): It uses recursion or a stack to explore as deep as possible along each branch before backtracking, emphasizing depth.

? Shortest Paths (e.g., Dijkstra's algorithm): It systematically explores nodes based on current shortest distances, often using a priority queue.

? Maximum Flow (e.g., Ford-Fulkerson): It relies on repeatedly finding augmenting paths using techniques like DFS or BFS to increase flow until no more augmenting paths exist.

Hence, Option (2) is the right answer.

--Question Starting--

3. Match the following distributed system design issues with their corresponding challenges:

1. Design Issue Challenge

I. Communication Protocols A. Ensuring message order and reliability across unreliable networks

II. File System Consistency B. Handling concurrent access without conflicts

III. Failure Tolerance C. Detecting and recovering from node or link failures

IV. Network Structure D. Managing heterogeneity in hardware and software components

Choose the correct answer from the options given below:

(1) I-A, II-B, III-C, IV-D

(2) I-B, II-A, III-D, IV-C

(3) I-A, II-D, III-C, IV-B

(4) I-C, II-B, III-A, IV-D

Answer Key: 3

Solution:

? Communication Protocols: The challenge is to guarantee reliable and ordered message delivery over unreliable or asynchronous networks, which is critical for consistency and coordination.

? File System Consistency: Ensuring data remains consistent despite concurrent accesses and failures is a major challenge in distributed file systems.

? Failure Tolerance: Designing systems that can detect failures and recover gracefully is key to robustness in distributed environments.

? Network Structure: Managing heterogeneity involves accommodating different hardware, network types, and protocols to ensure interoperability.

Hence, Option (3) is the right answer.