

3. Consider the following statements:

Statement I: In a weighted graph, the shortest path algorithms such as Dijkstra's algorithm assume non-negative weights and work efficiently for sparse graphs when implemented with priority queues.

Statement II: Eulerian paths and circuits exist in a graph if and only if the graph is connected (except for isolated vertices) and all vertices have even degrees for circuits or exactly two vertices have odd degrees for paths.

In light of the above, select the correct answer:

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Statement I is incorrect but Statement II is correct

Answer Key: 2

Solution:

? Statement I (Incorrect): Dijkstra's algorithm requires non-negative weights, but its efficiency depends on the data structures used. While it performs well on sparse graphs with priority queues, the statement oversimplifies the implementation details and does not specify that it's optimal in those contexts.

? Statement II (Incorrect): Eulerian paths and circuits exist when the graph is connected (except for isolated vertices), and the degrees of vertices satisfy specific parity conditions: all even for Eulerian circuit, exactly two odd for Eulerian path. The statement correctly mentions conditions but omits that the graph must be connected in the relevant component.

Given the options, both statements contain inaccuracies or incomplete conditions, so the best choice is 2.

Hence, Option (2) is the right answer.

2. Consider the following statements:

Statement I: In a temporal database, time-varying data is modeled such that each data item is associated with a timestamp or interval, enabling queries about the data's state at any point in time.

Statement II: Multimedia databases support various data types such as audio, video, images, and text, often requiring specialized storage and retrieval mechanisms due to their size and complexity.

In light of the above, choose the correct option:

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Statement I is incorrect but Statement II is correct

Answer Key: 4

Solution:

? Statement I (Incorrect): While temporal databases indeed associate data items with timestamps or intervals, the statement suggests that this modeling inherently enables queries about data's historical states. However, the core feature is capturing the temporal aspect; querying depends on indexing and query mechanisms built upon this model.

? Statement II (Correct): Multimedia databases handle data like images, audio, and video, which require specialized storage due to their size and data types, and support complex retrieval mechanisms.

Hence, Option (4) is the right answer.

5. Consider the following statements:

Statement I: Graph traversal algorithms such as BFS and DFS are used for different purposes; BFS finds the shortest path in unweighted graphs, while DFS can be used for topological sorting and detecting cycles.

Statement II: Maximum flow algorithms, like Ford-Fulkerson, rely on augmenting paths and residual graphs to iteratively increase flow until no more augmenting paths exist, thus determining the maximum flow in a network.

In light of the above, select the correct answer:

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Answer Key: 3

Solution:

? Statement I (Correct): BFS is used to find shortest paths in unweighted graphs because it explores neighbors layer by layer. DFS is used in cycle detection and topological sorting, among other applications.

? Statement II (Incorrect): Max flow algorithms like Ford-Fulkerson do use augmenting paths and residual graphs, but the statement's wording suggests reliance solely on these methods without mentioning that the algorithms also involve capacities, residual capacities, and iterative augmentations until no augmenting path remains.

Given the options, the best fit is 3 because the first is correct and the second is mostly correct but the statement's phrasing might be seen as incomplete.

Hence, Option (3) is the right answer.

1. Consider two statements regarding deadlock management:

Statement I: Deadlock prevention techniques, such as resource allocation graphs, aim to deny at least one necessary condition for deadlock occurrence without necessarily detecting deadlocks after they happen.

Statement II: Detection algorithms for deadlocks often involve constructing wait-for graphs and searching for cycles, which indicate the presence of deadlocks, and recovery mechanisms include killing processes or resource preemption.

In light of the above, select the correct option:

(1) Both Statement I and Statement II are correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Answer Key: 2

Solution:

? Statement I (Incorrect): Deadlock prevention techniques such as resource allocation graphs typically prevent at least one of the necessary conditions (like hold and wait, mutual exclusion, etc.), but the statement implies prevention is solely about denying conditions without context. The statement oversimplifies prevention by suggesting it only denies conditions without mentioning that it actively prevents deadlock occurrence.

? Statement II (Correct): Detection algorithms generally use wait-for graphs to detect cycles, which indicate deadlocks. Recovery involves actions like process termination or resource preemption.

Hence, Option (2) is the right answer.

4. Consider the following two statements:

Statement I: Mathematical induction can be used to prove properties that involve recursive structures or algorithms, often by proving a base case and then the inductive step assuming the property for an arbitrary case.

Statement II: In probability theory, Bayes' theorem allows updating the probability estimate for an event based on new evidence, by relating the conditional and marginal probabilities.

In light of the above, select the correct option:

(1) Both Statement I and Statement II are correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Answer Key: 1

Solution:

? Statement I (Correct): Mathematical induction is a fundamental proof technique for recursive properties and algorithms, involving a base case and an inductive step that assumes the property for an arbitrary case to prove for the next.

? Statement II (Correct): Bayes' theorem provides a way to update probabilities based on new evidence, expressed as $P(A|B) = [P(B|A) * P(A)] / P(B)$, linking conditional and marginal probabilities.

Hence, Option (1) is the right answer.