

1. What is the primary purpose of relational algebra?

- A) To perform calculations on relational data
- B) To manipulate graphical structures
- C) To analyze functions and their properties
- D) To model real-world networks

Answer: A) To perform calculations on relational data

Explanation: Relational algebra is primarily used for performing operations and calculations on relational databases.

2. Which operation in relational algebra is used to combine tuples from two relations based on a common attribute value?

- A) Intersection
- B) Union
- C) Join
- D) Projection

Answer: C) Join

Explanation: The join operation combines tuples from two relations based on a common attribute value.

3. What is the result of applying the Cartesian product in relational algebra?

- A) A set of tuples containing all possible combinations of tuples from two relations
- B) A set of tuples containing only unique values from both relations
- C) A set of tuples containing the union of two relations
- D) A set of tuples containing the intersection of two relations

Answer: A) A set of tuples containing all possible combinations of tuples from two relations

Explanation: The Cartesian product combines every tuple from one relation with every tuple from another relation, resulting in all possible combinations.

4. In relational algebra, what does the  $\sigma$  (selection) operation do?

- A) Projects specific attributes from a relation
- B) Adds new tuples to a relation
- C) Filters rows based on a condition
- D) Sorts the tuples in a relation

Answer: C) Filters rows based on a condition

Explanation: The  $\sigma$  (selection) operation filters rows from a relation based on a specified condition.

5. Which of the following statements is true about a function?

- A) A function can have multiple outputs for a given input.
- B) A function maps each input to exactly one output.
- C) A function cannot have inputs.
- D) A function always returns the same output regardless of the input.

Answer: B) A function maps each input to exactly one output.

Explanation: By definition, a function assigns exactly one output value to each input value.

6. In graph theory, what is the degree of a vertex?

- A) The number of edges incident to the vertex

- B) The number of vertices in the graph
- C) The weight assigned to the vertex
- D) The distance of the vertex from the origin

Answer: A) The number of edges incident to the vertex

Explanation: The degree of a vertex in a graph is the number of edges incident to that vertex.

7. Which of the following is NOT a type of graph?

- A) Directed graph
- B) Undirected graph
- C) Bipartite graph
- D) Cyclic graph

Answer: D) Cyclic graph

Explanation: A cyclic graph is not a distinct type of graph; rather, it is a property that some graphs may possess (having cycles).

8. What is a path in a graph?

- A) A cycle that starts and ends at the same vertex
- B) A sequence of edges connecting two vertices
- C) A vertex with no incident edges
- D) A disconnected component of the graph

Answer: B) A sequence of edges connecting two vertices

Explanation: A path in a graph is a sequence of edges that connect two vertices without

revisiting any vertex.

9. What is the complement of a graph?

- A) A graph with all possible edges
- B) A graph with no edges
- C) A graph with the same vertices but no edges that were in the original graph
- D) A graph with the same edges but different vertices

Answer: C) A graph with the same vertices but no edges that were in the original graph

Explanation: The complement of a graph has the same vertices but contains edges that were not present in the original graph.

10. In relational algebra, which operation is used to remove duplicate tuples from a relation?

- A) Union
- B) Intersection
- C) Difference
- D) Projection

Answer: D) Projection

Explanation: Projection in relational algebra projects only the distinct tuples of a relation, effectively removing duplicates.

11. What is the range of a function?

- A) The set of all possible inputs
- B) The set of all possible outputs
- C) The set of ordered pairs representing the function

D) The set of all possible domains

Answer: B) The set of all possible outputs

Explanation: The range of a function is the set of all possible output values it can produce.

12. Which of the following is an example of a bipartite graph?

- A) Complete graph
- B) Cycle graph
- C) Star graph
- D) Complete bipartite graph

Answer: D) Complete bipartite graph

Explanation: A complete bipartite graph is an example of a bipartite graph where the vertices can be partitioned into two sets, and edges only connect vertices from different sets.

13. What is the Eulerian path in a graph?

- A) A path that visits every vertex exactly once and ends at the same vertex where it started
- B) A path that visits every edge exactly once and ends at the same vertex where it started
- C) A path that visits every vertex exactly once
- D) A path that visits every edge exactly once

Answer: D) A path that visits every edge exactly once

Explanation: An Eulerian path in a graph is a path that traverses every edge of the graph exactly once.

14. Which operation in relational algebra is used to combine tuples from two relations without removing duplicates?

- A) Union
- B) Intersection
- C) Cartesian product
- D) Difference

Answer: A) Union

Explanation: The union operation in relational algebra combines tuples from two relations, including duplicates.

15. What does the composition of functions represent?

- A) The inverse of a function
- B) The combination of two functions to produce a new function
- C) The domain of a function
- D) The range of a function

Answer: B) The combination of two functions to produce a new function

Explanation: The composition of functions represents applying one function to the output of another, producing a new function.

16. In graph theory, what is a spanning tree?

- A) A tree with the minimum number of vertices
- B) A tree that includes all vertices of the original graph
- C) A tree with the maximum number of edges
- D) A tree with no cycles

Answer: B) A tree that includes all vertices of the original graph

Explanation: A spanning tree of a graph is a subgraph that is a tree containing all the vertices of the original graph.

17. What is the characteristic of a surjective function?

- A) It maps each input to exactly one output.
- B) It is a one-to-one function.
- C) It covers the entire range of the function.
- D) It has no inverse.

Answer: C) It covers the entire range of the function.

Explanation: A surjective function covers the entire range of the function, meaning every possible output value is attained.

18. Which of the following is NOT a property of a relation in relational algebra?

- A) Reflexivity
- B) Symmetry
- C) Transitivity
- D) Completeness

Answer: D) Completeness

Explanation: Completeness is not a property typically associated with relations in relational algebra.

19. In graph theory, what does the term "connected graph" mean?

- A) A graph with no cycles
- B) A graph with every vertex having the same degree
- C) A graph in which every pair of vertices is connected by a path
- D) A graph with no edges

Answer: C) A graph in which every pair of vertices is connected by a path

Explanation: A connected graph is one in which there is a path between every pair of vertices.

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