Unit I - Set Relation and Function & Group and Fields

Q: What is a power set?

A: The power set of a set is the set of all its subsets, including the empty set and the set itself. If a set has n elements, its power set will have 2^n elements. Power sets are useful in probability, logic, and algebra.

Q: Define Cartesian Product with example.

A: The Cartesian product of two sets A and B is the set of all ordered pairs (a, b) where a in A and b in B. For example, if A = {1, 2} and B = {x, y}, then AxB = {(1, x), (1, y), (2, x), (2, y)}.

Unit II - Mathematical Logic

Q: What is a tautology?

A: A tautology is a logical statement that is always true, regardless of the truth values of its individual components. For example, 'A or not A' is a tautology. Tautologies are used in proofs and logical deductions.

Q: Define Predicate Logic.

A: Predicate logic extends propositional logic with quantifiers and predicates. It expresses statements involving variables and allows us to reason about objects. Example: for allx (P(x) -> Q(x)) means for all x, if P(x) is true, then Q(x) is also true.

Unit III - Basic Concepts of Graph

Q: What is a bipartite graph?

A: A bipartite graph is a graph where vertices can be divided into two disjoint sets such that every edge connects a vertex from one set to another, not within the same set. There are no edges within a set.

Q: State Handshaking Lemma.

A: The Handshaking Lemma states that in any undirected graph, the sum of degrees of all vertices is twice the number of edges. It helps check graph validity and determine connectivity.

Unit IV - Eulerian and Hamiltonian Graphs

Q: What is Eulerian circuit?

A: An Eulerian circuit is a cycle that visits every edge of a graph exactly once and returns to the starting vertex. A connected graph has an Eulerian circuit if all its vertices have even degree.

Q: Define Hamiltonian graph.

A: A Hamiltonian graph contains a Hamiltonian cyclea cycle that visits every vertex exactly once. Unlike Eulerian circuits, the focus is on vertices, not edges. It has no simple necessary or sufficient conditions.

Unit V - Trees and Spanning Trees

Q: What is a spanning tree?

A: A spanning tree of a graph is a subgraph that includes all the vertices and is a tree (connected and acyclic). A graph can have multiple spanning trees. It is crucial in network design.

Q: State Kruskal's Algorithm.

A: Kruskal's Algorithm finds a minimum spanning tree by sorting all edges by weight and adding them one by one, avoiding cycles, until all vertices are connected. It's efficient for sparse graphs.