1. What does the complexity class P represent? (Easy)**

- A) Problems verifiable in polynomial time
- B) Problems solvable in polynomial time
- C) Problems solvable in exponential time
- D) Undecidable problems

Answer: B) Problems solvable in polynomial time

2. To prove a problem is NP-Complete, which two conditions must be met? (Medium)**

- A) It is in P and NP-Hard
- B) It is in NP and verifiable in polynomial time
- C) It is in NP and NP-Hard
- D) It reduces to SAT and is in P

Answer: C) It is in NP and NP-Hard

3. When reducing Hamiltonian Cycle to Hamiltonian Path, how is the original graph modified? (Med

- A) A random edge is removed
- B) A vertex is split into two connected nodes
- C) All cycles are removed
- D) Edge weights are inverted

Answer: B) A vertex is split into two connected nodes

4. If problem A is reducible to problem B (A \leq B) and B \in P, what can be concluded about A? (Easy

- A) A is NP-Hard
- B) A is in P
- C) A is harder than B
- D) A is undecidable

Answer: B) A is in P

5. Which problem is reduced to prove Independent Set is NP-Hard? (Medium)**

- A) Hamiltonian Path
- **B) 3-SAT**
- C) Clique
- D) Vertex Cover

Answer: C) Clique

6. What is verified to show Hamiltonian Path is in NP? (Medium)**

- A) The path has the shortest length
- B) The path visits every vertex exactly once and uses valid edges
- C) The path starts and ends at the same vertex
- D) The path is computed in polynomial time

Answer: B) The path visits every vertex exactly once and uses valid edges

7. In reducing Clique to Independent Set, how is the transformed graph constructed? (Hard)**

- A) By reversing all edge directions
- B) By replacing edges with non-edges and vice versa
- C) By splitting vertices into pairs
- D) By adding dummy nodes
- **Answer:** B) By replacing edges with non-edges and vice versa

8. In the reduction from 3DM to 4-Partition, why are numbers created in a large base \(r \)? (Hard)**

- A) To ensure digit positions enforce element matching in triples
- B) To simplify arithmetic operations
- C) To minimize the target sum
- D) To guarantee unique permutations
- **Answer:** A) To ensure digit positions enforce element matching in triples

9. In the Max2SAT reduction for Clique, clauses for non-edges enforce which condition? (Hard)**

- A) At most one endpoint is selected
- B) Both endpoints must be selected
- C) At least one endpoint is excluded
- D) Literals must alternate assignments
- **Answer:** C) At least one endpoint is excluded

10. How is Vertex Cover transformed into Set Cover? (Medium)**

- A) Edges become elements, and vertices become sets covering their incident edges
- B) Vertices become elements, and edges become sets
- C) Sets are mapped to cliques
- D) Elements are replaced with dummy variables
- **Answer:** A) Edges become elements, and vertices become sets covering their incident edges
