

Course/ Batch: BTech/ SCSET
Course Code: CSET244
Semester: Even
Session: 2024-2025

Course Type: Core
Course Name: Design and Analysis of Algorithms

Tutorial Assignment: Week 13

Tutorial title: NP Complete, NP Hard

CO Mapping

Question no	CO1	CO2	CO3
Q1	✓	✓	
Q2	✓	✓	
Q3	✓	✓	
Q4	✓	✓	

Q1. Ram and Shyam have been asked to show that a certain problem Π is NP-complete. Ram shows a polynomial time reduction from the 3-SAT problem to Π , and Shyam shows a polynomial time reduction from Π to 3-SAT. Which of the following can be inferred from these reductions ?

- A. Π is NP-hard but not NP complete
- B. Π is in NP, but is not NP-complete
- C. Π is NP-complete
- D. Π is neither NP-hard, nor in NP complete

Q2. The problems are 3-SAT and 3SAT are

- A. Both in P
- B. Both NP complete
- C. NP-complete and in P respective
- D. Undecidable and NP complete Respective

Q3. The subset-sum problem is defined as follows:

Given a set S of n positive integers and a positive integer W , determine whether there is a subset of S whose elements sum to W . An algorithm Q solves this problem in $O(nW)$ time. Which of the following statements is false?

- A. Q solves the subset-sum problem in polynomial time when the input is encoded in Unary
- B. Q solves the subset-sum problem in polynomial time when the input is encoded in binary
- C. The subset sum problem belongs to the class NP
- D. The subset problem is NP hard

Q4. Let $SHAM_3$ be the problem of finding a Hamiltonian cycle in a graph $G = (V, E)$ with $|V|$ divisible by 3 and $DHAM_3$ be the problem of determining if a Hamiltonian cycle exists in such graphs. Which one of the following is true?

- A. Both $SHAM_3$ and $DHAM_3$ are NP hard
- B. $SHAM_3$ is NP hard, $DHAM_3$ but is not
- C. $DHAM_3$ is NP hard, $SHAM_3$ but is not
- D. Neither $SHAM_3$ Nor $DHAM_3$ is NP hard