# Lesson 2
# Topic: Intractability II Quiz

**Question1.**

Which of the following statements accurately describes the relationship between the classes NP-complete and NP-hard?

A) NP-complete problems are a subset of NP-hard problems.
B) NP-hard problems are a subset of NP-complete problems.
C) NP-complete and NP-hard problems are the same; the terms can be used interchangeably.
D) NP-complete and NP-hard problems have no relationship; they refer to different complexity classes.

Answer: A) NP-complete problems are a subset of NP-hard problems.

Explanation:
NP-complete problems are a subset of NP-hard problems. NP-hard problems are those that are at least as hard as the hardest problems in NP, and they can be more difficult than NP-complete problems. NP-complete problems, on the other hand, are specifically those problems in NP that are both in NP-hard and can be verified in polynomial time. So, every NP-complete problem is NP-hard, but not all NP-hard problems are necessarily NP-complete.

**Question 2.**

Which of the following statements about NP-complete problems is correct?

A) NP-complete problems are easier to solve than problems in P.
B) Every problem in NP can be efficiently reduced to an NP-complete problem.
C) NP-complete problems are solvable in exponential time.
D) NP-complete problems have efficient algorithms to solve them.

Answer: B) Every problem in NP can be efficiently reduced to an NP-complete problem.

Explanation:
An NP-complete problem is one to which any problem in NP can be polynomial-time reduced. This means that NP-complete problems are at least as hard as the hardest problems in NP, and finding a polynomial-time solution for any NP-complete problem would imply polynomial-time solutions for all problems in NP.

**Question 3:**

Which of the following problems is in the class NP-complete?

A) Sorting a list of numbers in ascending order
B) Finding the shortest path in a weighted graph
C) Determining whether a given graph has a Hamiltonian cycle
D) Multiplying two matrices

Answer: C) Determining whether a given graph has a Hamiltonian cycle

Explanation:
Determining whether a given graph has a Hamiltonian cycle (a cycle that visits every vertex exactly once) is an NP-complete problem. It's a classic example of an NP-complete problem within graph theory.

**Question 4:**

What does it mean for a problem to be NP-hard?

A) The problem is solvable in polynomial time.
B) The problem is in the class NP-complete.
C) The problem is at least as hard as the hardest problems in NP.
D) The problem is a special case of the Traveling Salesman Problem.

Answer: C) The problem is at least as hard as the hardest problems in NP.

Explanation:
An NP-hard problem is one that is at least as hard as the hardest problems in NP. It doesn't necessarily need to be in NP itself, but solving it efficiently would imply solving all problems in NP efficiently. NP-hard problems may not have polynomial-time solutions or efficient verification algorithms.