

### Quiz:

Question 1: Which complexity class consists of decision problems that can be solved in polynomial time on a deterministic Turing machine?

- A) P
- B) NP
- C) NP-Hard
- D) NP-Complete

A) P

Explanation: Class P includes decision problems that can be solved in polynomial time, i.e., efficiently, on a deterministic Turing machine.

Question 2: A problem is in NP if:

- A) It can be solved in exponential time.
- B) It can be solved in polynomial time.
- C) A proposed solution can be verified in polynomial time.
- D) It is a non-deterministic problem.

Answer: C) A proposed solution can be verified in polynomial time.

Explanation: The class NP consists of problems for which a proposed solution can be verified in polynomial time, even though finding the solution itself might be difficult.

Question 3: Which of the following is an example of an NP-Hard problem?

- A) Travelling Salesman Problem (TSP)
- B) Sorting a list of integers
- C) Calculating the factorial of a number
- D) Finding the shortest path in a graph

Answer: A) Travelling Salesman Problem (TSP)

Explanation: The Travelling Salesman Problem is NP-Hard because it's at least as hard as the hardest problems in NP.

Question 4: An NP-Complete problem is one that is:

- A) The easiest problem in NP.
- B) Harder than any problem in NP.
- C) As hard as the hardest problems in NP.
- D) Solvable in constant time.

Answer: C) As hard as the hardest problems in NP.

Explanation: An NP-Complete problem is one that is at least as hard as the hardest problems in NP, and any problem in NP can be reduced to it in polynomial time.

Question 5: The Boolean Satisfiability Problem (SAT) is:

- A) In P
- B) In NP
- C) NP-Hard
- D) NP-Complete

Answer: D) NP-Complete

Explanation: SAT is NP-Complete, meaning it is both in NP and as hard as the hardest problems in NP.

Question 6: Which of the following is NOT a characteristic of NP problems?

- A) They can be solved efficiently in polynomial time.
- B) A proposed solution can be verified quickly.
- C) They are decision problems.
- D) They are related to problems involving "yes" or "no" answers.

Answer: A) They can be solved efficiently in polynomial time.

Explanation: NP problems are characterised by being quickly verifiable, but not necessarily quickly solvable.

Question 7: If  $P = NP$ , what would be the implication for solving NP-Complete problems?

- A) NP-Complete problems would become NP-Hard.
- B) NP-Complete problems would become P problems.
- C) NP-Complete problems would remain NP-Complete.
- D) NP-Complete problems would become NP problems.

Answer: B) NP-Complete problems would become P problems.

Explanation: If  $P = NP$ , it would imply that NP-Complete problems can be solved in polynomial time, making them P problems.

Question 8: The Halting Problem is an example of a problem that is:

- A) In P
- B) In NP
- C) NP-Hard
- D) Undecidable

Answer: D) Undecidable

Explanation: The Halting Problem is undecidable, meaning there is no algorithm that can solve it for all inputs.

Question 9: Which class of problems is the hardest among P, NP, NP-Hard, and NP-Complete?

- A) P
- B) NP
- C) NP-Hard

- D) NP-Complete

Answer:D) NP-Complete

Explanation: NP-Complete problems are the hardest class among the options because they are both in NP and as hard as the hardest problems in NP.

Question 10:\* Which of the following problems belongs to the class P?

- A) Travelling Salesman Problem (TSP)
- B) Integer Factorization
- C) Sorting a list of integers
- D) 3-SAT

Answer:C) Sorting a list of integers

Explanation: Sorting a list of integers can be done in polynomial time, making it a problem in class P.