Question - 1: What is the primary aim of Knowledge Representation and Reasoning?

a. To enable computers to process vast amounts of data efficiently.
b. To develop advanced machine learning algorithms.
c. To understand the nature of intelligence and cognition to simulate human-like abilities in computers.
d. To create complex robotic systems for automation.

Question - 2: Which type of reasoning is described as "jumping to conclusions based on some default assumptions" when information is insufficient, potentially leading to unsound conclusions that may need to be withdrawn?

a. Deductive reasoning
b. Abductive reasoning
c. Epistemic reasoning
d. Default reasoning

Question - 3: In propositional logic, what is an "atom"?

a. A logical connective like 'and' or 'or'.
b. A formula composed of multiple propositions.
c. The smallest unit to which a truth value (true/false) can be assigned.
d. A symbol representing a numerical value.

Question - 4: Which of the following connectives is considered a unary propositional connective?

a. Conjunction ($\wedge$)
b. Implication ($\rightarrow$)
c. Disjunction ($\vee$)
d. Negation ($\neg$)

Question - 5: A propositional formula F is a tautology if:

a. At least one interpretation satisfies F.
b. F can be reduced to a Conjunctive Normal Form (CNF).
c. Every interpretation satisfies F.
d. Its negation ($\neg$F) is satisfiable.

Question - 6: What does it mean for a propositional formula F to be satisfiable?

a. F is true for all possible interpretations.
b. There exists at least one interpretation that satisfies F.

c. F contains no logical connectives.
d. F can be reduced to an empty clause.

Question - 7: Which of the following is equivalent to saying that F entails G (F ⊨ G)?

a. F ∧ G is a tautology.
b. F ↔ G is satisfiable.
c. (F ∧ ¬G) is unsatisfiable.
d. ¬F ∨ G is a contradiction.

Question - 8: What is the total number of sub formulas that can be formed for the propositional formula?

$$\neg(p \wedge q) \vee (r \rightarrow \neg p)$$

a. 8
b. 10
c. 7
d. 9

Question - 9: What is a key characteristic of a Herbrand interpretation for a given signature σ (containing at least one object constant)?

a. Its universe is any non-empty set of individuals.
b. Its universe is the set of all ground (variable-free) terms of σ, and every ground term is interpreted as itself.
c. It always makes all quantified formulas true.
d. It must contain at least one function constant of arity greater than 0.

Question - 10: Which of the following statements about SAT solvers is correct?

a. SAT solvers only accept formulas in Disjunctive Normal Form (DNF).
b. SAT solvers decide satisfiability of propositional formulas, often using DPLL.
c. SAT solvers can only handle problems with at most 100 variables.
d. SAT solvers are inefficient and rarely used in practice.

Question - 11: Every atom, ⊤, ⊥, and any recursive combination of formulas with connectives are considered valid formulas in propositional logic.

a. True
b. False

Question - 12: Which of the following statements is a tautology?

a. $(p \rightarrow q) \wedge (p \wedge \neg q)$
b. $(p \rightarrow q) \rightarrow (\neg p \vee q)$
c. $(p \rightarrow (q \rightarrow p))$
d. $\neg p \vee p$

Question - 13: Which of the following is a key limitation of propositional logic that First-Order Logic overcomes?

a. Inability to represent negation
b. Inability to express relations between individuals and relations
c. Inability to use logical connectives such as $\wedge$ and $\vee$
d. Inability to reason with truth values

Question - 14: Which of the following is a valid term in FOL?

a. $\forall x\, P(x)$
b. $P(x) \wedge Q(y)$
c. father(john)

Question - 15: What is the Herbrand Universe of a signature σ?

a. The set of all formulas in σ
b. The set of all predicates in σ.
c. The set of all ground terms of σ.
d. The set of all interpretations over σ

Question - 16: Which of the following is an example of a terminological axiom in FOL?

a. $\forall x\, (Teenager(x) \rightarrow \neg Adult(x))$
b. Child(John)
c. Affects(JRA, Mary)
d. ¬Affects(JRA, Mary)

Question - 17: What are some of the free occurrences of a variable in the below formula?

$$\forall x\, (P(x) \rightarrow Q(x, y)) \wedge \exists y\, R(y, z)$$

1 2 3 4 5 6 7

a. 4,7
b. 2,3
c. 1,6,7
d. None of the above