1 **What is a knowledge base in a knowledge-based agent?**
a) A database containing all possible actions
b) A set of representations of facts and rules about the world
c) A mechanism for perceiving the environment
d) A storage system for raw data

- **Answer:** b

2 **What is the primary goal of a knowledge-based agent in the Wumpus World?**
a) To find the shortest path to gold
b) To escape the cave as quickly as possible
c) To collect the gold and return safely to the starting square
d) To kill the Wumpus without using the arrow

- **Answer:** c

3 **Which logical connector has the highest priority in propositional logic?**
a) Conjunction ($\wedge$)
b) Negation ($\neg$)
c) Disjunction ($\vee$)
d) Implication ($\rightarrow$)

- **Answer:** b

4 **In the Wumpus World, what does a "breeze" indicate?**
a) Presence of the Wumpus in an adjacent room
b) Presence of a pit in an adjacent room
c) Presence of gold in the current room
d) Presence of a wall nearby

- **Answer:** b

5 **What is the resolution rule in propositional logic?**
a) Combining two premises to eliminate a common literal
b) Breaking a complex sentence into atomic sentences
c) Assigning truth values to propositional symbols
d) Deriving new sentences using universal quantifiers

- **Answer:** a

6 **What does "satisfiability" mean in logical reasoning?**
a) A sentence is true in all possible interpretations
b) A sentence is false in all possible interpretations
c) A sentence is true in at least one interpretation
d) A sentence is equivalent to a contradiction

- **Answer:** c

7 **Which of the following is NOT a step in converting a sentence to CNF?**
a) Eliminating implications
b) Applying De Morgan's laws
c) Converting to Horn form
d) Distributing conjunctions over disjunctions

- **Answer:** c

8 **In predicate logic, what does the statement $\forall x\ (P(x) \rightarrow Q(x))$ imply?**
a) P(x) is true for all x
b) Q(x) is true for all x
c) If P(x) is true, then Q(x) must also be true for all x
d) Q(x) is false if P(x) is true for all x

- **Answer:** c

9 **What does the existential quantifier ($\exists$) signify in predicate logic?**
a) The sentence is true for all objects
b) The sentence is true for at least one object
c) The sentence is always false
d) The sentence applies to no objects

- **Answer:** b

10 **What is the main advantage of representing knowledge in CNF?**
a) It simplifies inference using resolution
b) It minimizes the number of literals
c) It ensures completeness of the inference procedure
d) Both a and c

- **Answer:** d

11 **What is a propositional symbol in propositional logic?**
a) A sentence with multiple literals
b) An atomic symbol representing a proposition
c) A logical connective
d) A quantifier

- **Answer:** b

12 **What is logical entailment in propositional logic?**
a) Deriving new facts from unrelated sentences
b) A relationship where one sentence follows logically from another
c) Converting a sentence into clausal form
d) Assigning truth values to propositional symbols

- **Answer:** b

13 **What is the significance of the Deduction Theorem in logical reasoning?**
a) It simplifies propositional logic statements
b) It establishes the connection between validity and inference
c) It converts statements into CNF
d) It determines the truth value of atomic sentences

- **Answer:** b

14 **Which of the following statements about Horn form is true?**
a) It is less powerful than CNF for inference
b) It allows polynomial-time inference
c) It cannot represent disjunctions of literals
d) It is always more compact than CNF

- **Answer:** b

15 **In the Wumpus World, what happens when the agent hears a scream?**
a) It indicates the Wumpus has been killed
b) It signifies a pit is nearby
c) It means gold has been collected
d) It suggests the agent is in danger

- **Answer:** a

16 **Which of the following is an example of a valid sentence?**
a) Water boils at 100°C
b) Human beings can have three legs
c) $x > 4$ or $x \leq 4$
d) Books can have infinite pages

- **Answer:** c

17 **What is the main difference between propositional and predicate logic?**
a) Predicate logic does not use quantifiers
b) Propositional logic represents relationships among objects
c) Predicate logic is more expressive due to the use of variables and quantifiers
d) Propositional logic can represent infinite models

- **Answer:** c

18 **What is the rule of Modus Ponens in propositional logic?**
a) $\neg P \rightarrow Q, P \vdash Q$
b) $P \rightarrow Q, \neg Q \vdash \neg P$

c) $P \rightarrow Q, P \vdash Q$
d) $P \rightarrow Q, Q \vdash P$

- **Answer:** c

19 **In predicate logic, what does $\forall x (P(x) \land Q(x))$ mean?**
a) P(x) or Q(x) is true for all x
b) Both P(x) and Q(x) are true for all x
c) At least one of P(x) or Q(x) is true for some x
d) P(x) and Q(x) are unrelated

- **Answer:** b

20 **What is a "ground term" in predicate logic?**
a) A term that contains no variables
b) A term that contains only constants
c) A term that contains a function
d) A term that refers to multiple objects

- **Answer:** a

21 **Which of the following is an example of a clause in Conjunctive Normal Form (CNF)?**
a) $(A \lor B) \land (C \land D)$
b) $(A \land B) \lor C$
c) $(\neg A \lor B) \land (C \lor D)$
d) $\neg(A \lor B)$

- **Answer:** c

22 **In the Wumpus World, how does the agent deduce the location of the Wumpus?**
a) By identifying a square with both a breeze and a stench
b) By observing a stench in adjacent rooms and using logical reasoning
c) By perceiving glitter in a room
d) By randomly moving to unexplored squares

- **Answer:** b

23 **What is the primary use of the resolution rule in logical reasoning?**
a) To verify the truth of atomic sentences
b) To derive conclusions from a set of clauses
c) To combine multiple quantifiers into a single form
d) To determine the equivalence of two logical statements

- **Answer:** b

24 **Which of the following is true about sound inference procedures?**
a) They guarantee deriving all possible conclusions
b) They derive only conclusions that are logically entailed by the knowledge base
c) They are less efficient than unsound procedures
d) They can handle incomplete knowledge bases

- **Answer:** b

25 **Which of the following is NOT a property of predicate logic?**
a) It includes quantifiers for variables
b) It allows relationships between objects
c) It has limited expressive power
d) It uses terms like constants and functions

Answer: c

26 **What does it mean if a sentence in propositional logic is "unsatisfiable"?**
a) It is true in all interpretations
b) It is false in all interpretations
c) It is true in at least one interpretation
d) It cannot be expressed in CNF

- **Answer:** b

27 **What does the formula $\exists x (P(x) \land \neg Q(x))$ represent?**

a) For all x, P(x) and ¬Q(x) are true
b) There exists an x for which both P(x) and ¬Q(x) are true
c) P(x) and ¬Q(x) are always true
d) P(x) or ¬Q(x) is true for some x

- **Answer:** b

28 **Which of the following steps is required to convert a formula to CNF?**
a) Eliminate disjunctions
b) Remove quantifiers
c) Eliminate implications and bi-conditionals
d) Simplify all conjunctions into disjunctions

- **Answer:** c

29 **What is the primary goal of "normalizing" a logical formula?**
a) To remove redundant literals
b) To convert it into a standardized form like CNF or DNF
c) To minimize the number of clauses
d) To determine its satisfiability

- **Answer:** b

30 **What is the relationship between universal and existential quantifiers?**
a) They are independent and unrelated
b) They can always be replaced by each other without changing meaning
c) They are connected through negation and obey De Morgan's laws
d) They both represent disjunctions

Answer: c

31 **What does the sentence ∀x (¬P(x) ∨ Q(x)) imply in predicate logic?**
a) P(x) is true for all x
b) Q(x) is true whenever P(x) is true
c) ¬P(x) is false for all x
d) Both P(x) and Q(x) are true for some x

- **Answer:** b

32 **Which of the following statements about propositional logic is correct?**
a) It can represent infinite models effectively
b) It uses quantifiers to describe properties of objects
c) It has limited expressive power compared to predicate logic
d) It allows reasoning about relationships between objects

- **Answer:** c

33 **What is the role of the "sensors" in the Wumpus World?**
a) To detect the agent's position in the world
b) To identify the location of gold directly
c) To perceive environmental clues like stench, breeze, and glitter
d) To control the agent's movements

- **Answer:** c

34 **What is the logical equivalence of ¬(P ∧ Q)?**
a) ¬P ∨ ¬Q
b) ¬P ∧ ¬Q
c) P ∨ Q
d) P ∧ ¬Q

- **Answer:** a

35 **Which of the following is a limitation of propositional logic?**
a) It cannot handle finite sentences
b) It cannot represent individual objects or their relationships
c) It cannot be expressed in CNF
d) It does not use logical connectors

- **Answer:** b

36 **What does it mean for an inference procedure to be "complete"?**
a) It can derive any conclusion from any knowledge base

b) It can derive all sentences entailed by the knowledge base
c) It guarantees the fastest possible inference
d) It ensures that the knowledge base is consistent

- **Answer:** b

37 **Which of the following sentences uses a nested quantifier?**
a) $\exists x\,(P(x) \land Q(x))$
b) $\forall x\ \exists y\,(P(x) \rightarrow Q(y))$
c) $\exists x\,(P(x) \lor \neg Q(x))$
d) $\forall x\,(P(x) \land Q(x))$

- **Answer:** b

38 **What does the term "atomic sentence" refer to in predicate logic?**
a) A sentence that contains no logical connectors
b) A sentence formed by combining multiple predicates
c) A basic statement consisting of a predicate and its arguments
d) A sentence that represents a universal truth

- **Answer:** c

39 **What is the purpose of Horn clauses in logical reasoning?**
a) To simplify complex sentences into disjunctions
b) To allow efficient inference using polynomial-time algorithms
c) To replace propositional logic entirely
d) To eliminate the need for CNF conversion

- **Answer:** b

40 **Which of the following is an example of a sentence in Disjunctive Normal Form (DNF)?**
a) $(A \land B) \lor (C \land D)$
b) $(A \lor B) \land (C \lor D)$
c) $(\neg A \land B) \land (C \lor D)$
d) $(A \lor \neg B) \land (\neg C \land D)$

- **Answer:** a

41 **What does the formula $\neg\forall x\,(P(x))$ imply in predicate logic?**
a) P(x) is false for all x
b) There exists an x for which P(x) is false
c) P(x) is true for some x
d) P(x) is true for all x

- **Answer:** b

42 **What is the main advantage of predicate logic over propositional logic?**
a) It is faster for inference
b) It allows representation of individual objects and their relationships
c) It eliminates the need for logical connectors
d) It uses truth tables for all inference tasks

- **Answer:** b

43 **What happens if the agent in the Wumpus World walks into a wall?**
a) The game ends immediately
b) The agent perceives a "bump"
c) The agent moves back to the previous square
d) The agent perceives a "scream"

- **Answer:** b

44 **What is the logical equivalence of $\neg(P \lor Q)$?**
a) $\neg P \lor Q$
b) $\neg P \land \neg Q$
c) $P \land \neg Q$
d) $P \land Q$

- **Answer:** b

45 **What does it mean for a sentence to be "tautology"?**
a) It is true in some interpretations
b) It is false in all interpretations
c) It is true in all interpretations
d) It is neither true nor false

- **Answer:** c

46 **Which of the following is an example of a universally quantified sentence?**
a) $\exists x\ (P(x) \land Q(x))$
b) $\forall x\ (P(x) \rightarrow Q(x))$
c) $P(x) \land Q(x)$
d) $P(x) \rightarrow Q(x)$

- **Answer:** b

47 **Which of the following best describes the Wumpus World?**
a) Fully observable, deterministic, and episodic
b) Partially observable, deterministic, and sequential
c) Fully observable, stochastic, and static
d) Partially observable, stochastic, and dynamic

- **Answer:** b

48 **In predicate logic, what does the statement $\forall x\ \exists y\ (R(x, y))$ mean?**
a) There exists a y such that R(x, y) is true for all x
b) For all x, there exists a y such that R(x, y) is true
c) R(x, y) is true for some x and y
d) R(x, y) is true for all pairs of x and y

- **Answer:** b

49 **What does the resolution method rely on when applied to propositional logic?**
a) Converting all sentences into CNF
b) Identifying contradictions in predicate logic
c) Using quantifiers to derive new conclusions
d) Transforming logical sentences into Horn clauses

- **Answer:** a

50 **What does the formula $\exists x\ \forall y\ (P(x, y))$ imply?**
a) For all x and y, P(x, y) is true
b) There exists an x such that P(x, y) is true for all y
c) P(x, y) is true for some x and y
d) P(x, y) is false for all x and y

- **Answer:** b

51 **Which of the following statements about Conjunctive Normal Form (CNF) is correct?**
a) CNF consists of a disjunction of literals
b) CNF consists of a conjunction of disjunctions of literals
c) CNF eliminates the need for quantifiers in predicate logic
d) CNF uses bi-conditionals as its primary connective

- **Answer:** b

52 **In the Wumpus World, what does glitter indicate?**
a) Presence of a pit in the adjacent room
b) Presence of gold in the current room
c) Presence of the Wumpus nearby
d) A safe square for the agent to explore

- **Answer:** b

53 **What does the formula $\neg \exists x\ (P(x))$ mean in predicate logic?**
a) P(x) is false for all x
b) P(x) is true for at least one x
c) P(x) is true for all x
d) P(x) is false for some x

- **Answer:** a

54 **What is the role of semantics in knowledge representation?**
a) Defining the grammar of sentences
b) Ensuring every sentence ends with a period
c) Determining the meaning of sentences in the real world
d) Representing sentences as binary sequences

- **Answer:** c

55 **Which of the following best describes logical equivalence?**
a) Two sentences have the same syntax
b) Two sentences have the same truth value in all possible worlds
c) Two sentences can be derived from each other
d) Two sentences represent the same objects

- **Answer:** b

56 **What is the main connective typically used with the existential quantifier (∃)?**
a) Implication (→)
b) Conjunction (∧)
c) Disjunction (∨)
d) Bi-implication (↔)

- **Answer:** b

57 **What is the inference procedure used to prove Wumpus is in room (1,3)?**
a) Truth table analysis
b) Resolution using propositional rules
c) Conversion to Disjunctive Normal Form
d) Direct application of CNF

- **Answer:** b

58 **What is the significance of an "empty clause" in resolution?**
a) It indicates the knowledge base is inconsistent
b) It confirms the completeness of the knowledge base
c) It simplifies the inference process
d) It proves the validity of a sentence

- **Answer:** a

59 **Which of the following is an example of a quantified sentence that is dual to ∀x (P(x))?**
a) ¬∀x (P(x))
b) ∃x (¬P(x))
c) ¬∃x (¬P(x))
d) ∃x (P(x))

- **Answer:** c

60 **What is the De Morgan's law equivalence for ¬(P(x) ∨ Q(x))?**
a) ¬P(x) ∧ ¬Q(x)
b) ¬P(x) ∨ Q(x)
c) ¬P(x) ∧ Q(x)
d) P(x) ∨ Q(x)

Answer: a

61 **Which of the following best describes the universal quantifier (∀)?**
a) It applies to a subset of elements in the universe
b) It applies to all elements in the universe
c) It applies only to elements that satisfy a specific predicate
d) It applies to at least one element in the universe

- **Answer:** b

62 **In the Wumpus World, what does the "breeze" percept imply?**
a) A pit is present in the current room
b) A pit is in an adjacent room
c) The Wumpus is in an adjacent room
d) Gold is present in the current room

- **Answer:** b

63 **What is the logical equivalence of ¬∀x (P(x))?**
a) ∃x (¬P(x))
b) ∀x (¬P(x))
c) ¬∃x (P(x))
d) ∃x (P(x))

- **Answer:** a

64 **What does the term "syntax" refer to in knowledge representation?**
a) The rules governing the grammar of sentences
b) The interpretation of sentences in the real world
c) The semantic meaning of binary sequences
d) The process of deriving conclusions from sentences

- **Answer:** a

65 **Which of the following is a property of a sound inference procedure?**
a) It can derive conclusions that are not entailed by the knowledge base
b) It ensures that all derived conclusions are logically valid
c) It guarantees efficiency in deriving conclusions
d) It eliminates the need for a knowledge base

- **Answer:** b

66 **What does the formula ∀x (P(x) → Q(x)) ∧ ∃x (P(x)) imply?**
a) P(x) is true for all x
b) Q(x) is true for all x
c) There exists an x where Q(x) is true and P(x) is true
d) For some x, P(x) implies Q(x)

- **Answer:** c

67 **Which of the following steps is NOT part of converting a sentence to CNF?**
a) Eliminating implications
b) Applying De Morgan's laws
c) Moving quantifiers to the end of the formula
d) Distributing disjunctions over conjunctions

- **Answer:** c

68 **What does a model represent in logical reasoning?**
a) A valid sentence in CNF
b) A set of interpretations where a sentence is true
c) A formula that includes quantifiers
d) A proof of soundness for an inference procedure

- **Answer:** b

69 **What is the logical equivalence of ∃x ∀y (P(x, y))?**
a) ∀x ∃y (P(x, y))
b) ∃x ∀y (¬P(x, y))
c) There exists an x such that P(x, y) is true for all y
d) For all x, there exists a y such that P(x, y) is true

- **Answer:** c

70 **What is the purpose of the resolution method in propositional logic?**
a) To check satisfiability of a sentence
b) To convert all sentences into DNF
c) To derive new clauses by eliminating complementary literals
d) To simplify conjunctions of disjunctions

- **Answer:** c

71 **Which of the following is true about entailment in logical reasoning?**
a) It shows a syntactic relationship between sentences
b) It proves that a conclusion is true in

all models of the knowledge base
c) It is a process of converting sentences to CNF
d) It involves assigning truth values to literals

- **Answer:** b

72 **In the Wumpus World, how does the agent infer the presence of a pit?**
a) By perceiving a stench in adjacent rooms
b) By perceiving a breeze in the current room
c) By observing glitter in adjacent rooms
d) By perceiving a scream after shooting

- **Answer:** b

73 **What does the formula ∀x (P(x) ∧ Q(x)) represent?**
a) There exists an x such that P(x) and Q(x) are true
b) P(x) and Q(x) are true for all x
c) P(x) or Q(x) is true for some x
d) Both P(x) and Q(x) are false for all x

- **Answer:** b

74 **What is the relationship between satisfiability and validity?**
a) A valid sentence is satisfiable in at least one interpretation
b) A satisfiable sentence is true in all possible interpretations
c) A valid sentence is true in all possible interpretations
d) Validity and satisfiability are unrelated concepts

- **Answer:** c

75 **What is the purpose of Modus Ponens in logical reasoning?**
a) To eliminate negations in a sentence
b) To derive a conclusion from an implication and its antecedent
c) To convert sentences to clausal form
d) To test the validity of a sentence

- **Answer:** b

76 **Which of the following represents a sound inference procedure?**
a) It derives true conclusions that are entailed by the knowledge base
b) It generates conclusions based on random interpretations
c) It ensures completeness without considering logical entailment
d) It eliminates contradictions by ignoring unsound clauses

- **Answer:** a

77 **What is the duality property of quantifiers?**
a) $\forall x\ P(x) \equiv \neg \exists x\ \neg P(x)$
b) $\exists x\ P(x) \equiv \neg \forall x\ \neg P(x)$
c) Both a and b
d) None of the above

- **Answer:** c

78 **What does it mean for a sentence to be in Horn form?**
a) It is expressed as a conjunction of disjunctions of literals
b) It contains at most one positive literal per clause
c) It uses only existential quantifiers
d) It eliminates the need for CNF

- **Answer:** b

79 **Which of the following statements is true about predicate logic?**
a) It cannot represent relationships between objects
b) It extends propositional logic with quantifiers and variables
c) It eliminates the need for logical connectives
d) It is less expressive than propositional logic

- **Answer:** b

80 **In logical reasoning, what does a contradiction signify?**
a) A sentence is valid in all interpretations
b) A sentence is true in at least one interpretation
c) A sentence is false in all interpretations
d) A sentence cannot be expressed in CNF

- **Answer:** c

81 **What does the formula ∃x ∀y (P(x) → Q(y)) mean?**
a) For all x and y, P(x) implies Q(y)
b) There exists an x such that P(x) implies Q(y) for all y
c) For some y, P(x) and Q(y) are both true
d) P(x) is false for all x

- **Answer:** b

82 **Which of the following is a limitation of propositional logic?**
a) It allows the use of quantifiers
b) It cannot represent generalizations about objects
c) It uses only conjunctions and disjunctions
d) It is always less efficient than predicate logic

- **Answer:** b

83 **In the Wumpus World, what happens when the agent perceives a stench?**
a) The agent identifies the location of a pit
b) The agent concludes that gold is nearby
c) The agent infers that the Wumpus is in an adjacent room
d) The agent terminates its exploration

- **Answer:** c

84 **Which of the following is true about the resolution method?**
a) It is unsound but complete
b) It can only be applied to sentences in Disjunctive Normal Form (DNF)
c) It relies on eliminating complementary literals to derive new clauses
d) It cannot handle clauses with quantifiers

- **Answer:** c

85 **What is the logical equivalence of ¬(P(x) ∧ Q(x))?**
a) ¬P(x) ∨ ¬Q(x)
b) ¬P(x) ∧ ¬Q(x)
c) P(x) ∧ ¬Q(x)
d) P(x) ∨ Q(x)

- **Answer:** a

86 **What is the role of a predicate in predicate logic?**
a) To denote individual objects
b) To establish relationships or properties of objects
c) To connect sentences logically
d) To eliminate the need for quantifiers

- **Answer:** b

87 **What does the formula ∀x (P(x) → ∃y Q(y)) imply?**
a) For all x, there exists a y such that P(x) and Q(y) are true
b) If P(x) is true for all x, then Q(y) is true for all y
c) For all x, if P(x) is true, then there exists a y for which Q(y) is true
d) There exists an x and y such that both P(x) and Q(y) are true

- **Answer:** c

88 **Which of the following is a property of conjunctive normal form (CNF)?**

a) It simplifies sentences into a single disjunction
b) It allows direct inference without logical connectives
c) It is a conjunction of disjunctions of literals
d) It eliminates the need for truth tables

- **Answer:** c

89 **What is the purpose of the knowledge base in a knowledge-based agent?**
a) To store raw percepts
b) To represent facts and rules for reasoning
c) To control the agent's actuators
d) To optimize the agent's performance

- **Answer:** b

90 **Which of the following is an example of a quantified formula with nested quantifiers?**
a) $\exists x\ (P(x) \land Q(x))$
b) $\forall x\ \exists y\ (P(x) \rightarrow Q(y))$
c) $P(x) \rightarrow Q(x)$
d) $\forall x\ (P(x) \land Q(x))$

- **Answer:** b

91 **What does the formula $\exists x\ \forall y$ (R(x, y)) imply in predicate logic?**
a) There exists an x such that R(x, y) is true for all y
b) For all x, there exists a y such that R(x, y) is true
c) R(x, y) is true for some x and y
d) R(x, y) is true for all pairs of x and y

- **Answer:** a

92 **Which of the following is a step in converting a formula to CNF?**
a) Eliminating negations using truth tables
b) Converting quantifiers into predicates
c) Applying distributive laws to simplify disjunctions and conjunctions
d) Replacing predicates with constants

- **Answer:** c

93 **What does the inference rule "And-Elimination" state?**
a) If $(P \land Q)$ is true, then either P or Q must be true
b) If $P \rightarrow Q$ is true, and Q is true, then P must be true
c) If $(P \land Q)$ is true, then P is true and Q is true
d) If P is true, then $(P \land Q)$ must be true

- **Answer:** c

94 **Which of the following is NOT true about predicate logic?**
a) It can represent generalizations like "All men are mortal"
b) It can handle relationships between objects
c) It eliminates the need for propositional logic
d) It uses quantifiers like $\forall$ and $\exists$

- **Answer:** c

95 **What does the formula $\neg \exists x$ (P(x)) mean in predicate logic?**
a) There exists an x such that P(x) is true
b) P(x) is true for all x
c) P(x) is false for all x
d) P(x) is true for some x

- **Answer:** c

96 **In the Wumpus World, what is the agent's goal?**
a) To avoid pits and kill the Wumpus
b) To explore all rooms without being killed
c) To grab the gold and return safely to the starting square
d) To minimize penalties for incorrect moves

- **Answer:** c

97 **What is the primary advantage of using resolution in logical reasoning?**
a) It eliminates the need for converting to CNF
b) It ensures completeness in deriving conclusions
c) It simplifies the inference process by ignoring contradictions
d) It works directly with quantified sentences

- **Answer:** b

98 **Which of the following statements describes a "valid" sentence?**
a) It is true in at least one interpretation
b) It is true in all possible interpretations
c) It is neither true nor false
d) It is false in all possible interpretations

- **Answer:** b

99 **Which of the following is an example of a Horn clause?**
a) $(A \lor B) \land (\neg C \lor D)$
b) $(\neg A \lor B) \land (\neg C)$
c) $A \land B \rightarrow C$
d) $(\neg A \lor \neg B \lor C)$

- **Answer:** d

100 **What is the purpose of De Morgan's laws in logical reasoning?**
a) To simplify conjunctions into disjunctions
b) To negate sentences systematically
c) To transform quantified formulas into CNF
d) To establish equivalence between logical expressions

- **Answer:** d