

[illegible]

Choose the most appropriate answer for each of the following questions.

1. Which of the following best characterizes a **knowledge-based system**?
 - A. A system that uses fast algorithms
 - B. A system that stores large datasets
 - C. A system whose behavior depends on reasoning over explicitly represented knowledge
 - D. A system implemented in Prolog
2. Which design choice most clearly indicates a **knowledge-based approach**?
 - A. Writing many if-else statements
 - B. Encoding facts and general rules separately
 - C. Using object-oriented programming
 - D. Storing values in arrays
3. Given the rule:
 $\text{Allergic}(x, \text{Penicillin}) \rightarrow \text{Avoid}(x, \text{Penicillin})$
 and the fact: $\text{Allergic}(\text{Ahmed}, \text{Penicillin})$
 The statement $\text{Avoid}(\text{Ahmed}, \text{Penicillin})$ is:
 - A. Explicit knowledge
 - B. Data
 - C. Implicit knowledge derived by reasoning
 - D. Hard-coded output
4. Which of the following best describes **entailment**?
 - A. A likely conclusion
 - B. A conclusion that must be true if premises are true
 - C. A stored fact
 - D. A random assumption
5. In knowledge representation, **syntax** primarily ensures:
 - A. Truth of statements
 - B. Correct interpretation
 - C. Well-formed structure
 - D. Logical consequence
6. **Semantics** in First-Order Logic defines:
 - A. How symbols are written
 - B. How inference rules operate
 - C. What expressions mean in a world
 - D. How many predicates exist
7. An interpretation in FOL consists of:
 - A. Syntax rules and inference rules
 - B. A domain and an interpretation mapping
 - C. Only a truth assignment
 - D. Only predicates and constants
8. The statement $S \models \alpha$ means:
 - A. α is true in every interpretation where S is true
 - B. α can be syntactically derived from S
 - C. α is true in some interpretations of S
 - D. α is explicitly written in S
9. Which of the following correctly expresses “All robots handle some part”?
 - A. $\forall x \forall y \text{ Handles}(x, y)$
 - B. $\exists x \forall y \text{ Handles}(x, y)$
 - C. $\forall x \exists y \text{ Handles}(x, y)$
 - D. $\exists y \forall x \text{ Handles}(x, y)$
10. Which of the following expresses “There is one robot that handles all parts”?
 - A. $\forall x \exists y \text{ Handles}(x, y)$
 - B. $\exists x \forall y \text{ Handles}(x, y)$
 - C. $\forall x \forall y \text{ Handles}(x, y)$
 - D. $\exists y \exists x \text{ Handles}(x, y)$

Question 2: Points: 10		CLO #2
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Part A: Points 5

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| <p>11. In First-Order Logic, the statement:
 $\text{Vehicle}(\text{car1})$ represents:
 A. A function returning a vehicle
 B. A proposition asserting car1 is a vehicle
 C. A variable declaration
 D. An existential claim?</p> <p>12. Which expression represents an existential statement?
 A. $\forall x (\text{Vehicle}(x) \rightarrow \text{HasEngine}(x))$
 B. $\exists x (\text{Vehicle}(x) \wedge \text{Electric}(x))$
 C. $\text{Vehicle}(\text{car1})$
 D. $\neg \text{Vehicle}(\text{car1})$</p> <p>13. Which of the following is a function (not a predicate)?
 A. $\text{Pedestrian}(x)$
 B. $\text{MarriedTo}(x, y)$</p> | <p>C. $\text{MustStop}(x)$
 D. $\text{ceoOf}(x)$</p> <p>14. The statement: $\forall x (\text{Surgeon}(x) \rightarrow \text{Doctor}(x))$ represents:
 A. Subtype relationship
 B. Disjointness
 C. Symmetry
 D. Closure assumption</p> <p>15. In a hospital robot system, we declare:
 $\forall x (\text{Robot}(x) \rightarrow \neg \text{Human}(x))$
 This represents:
 A. Disjointness
 B. Subtype relationship
 C. Symmetry
 D. Closure assumption</p> |
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Part B: Points 5

Use only the predicates, constants, and logical symbols provided below. - Do not introduce new predicate names. - Use standard First-Order Logic notation with quantifiers ($\forall$, $\exists$), implication ($\rightarrow$), negation ($\neg$), and conjunction ($\wedge$).	
Constant: R5 Predicates: $\text{Robot}(x)$ $\text{PassedInspection}(x)$ $\text{FailedInspection}(x)$ $\text{AllowedToOperate}(x)$ A. In an automated factory: - Every robot that is allowed to operate must have passed inspection. $\forall x ((\text{Robot}(x) \wedge \text{AllowedToOperate}(x)) \rightarrow \text{PassedInspection}(x))$ - Any robot that fails inspection is not allowed to operate. $\forall x (\text{FailedInspection}(x) \rightarrow \neg \text{AllowedToOperate}(x))$ - R5 failed inspection. $\text{FailedInspection}(\text{R5})$	Constant: DrAli Predicates: $\text{LicensedDoctor}(x)$ $\text{Cardiologist}(x)$ $\text{MayPrescribe}(x)$ B. In a hospital: - Every cardiologist is a licensed doctor. $\forall x (\text{Cardiologist}(x) \rightarrow \text{LicensedDoctor}(x))$ - Only licensed doctors may prescribe medication. $\forall x (\text{MayPrescribe}(x) \rightarrow \text{LicensedDoctor}(x))$ - DrAli is a cardiologist. $\text{Cardiologist}(\text{DrAli})$

Best Wishes

A handwritten signature in blue ink, appearing to read 'M. Elhosseini', with a horizontal line drawn underneath the signature.

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