

Knowledge-Based AI Study Guide

Artificial Intelligence

1 Logic

1. In the context of propositional logic, define sentence.

Solution: An assertion about the world expressed in a **knowledge representation language**, like propositional logic.

2. In the context of propositional logic, define knowledge base.

Solution: A set of sentences.

3. In the context of propositional logic, define axiom.

Solution: Sentences taken as given – not derived from other sentences, assumptions.

4. In the context of propositional logic, define inference.

Solution: Deriving new sentences from old sentences.

5. Define grounding.

Solution: Connection between logical reasoning and the real environment. How do we know that KB is true in the real world.

6. Define entailment.

Solution: Entailment: $\alpha \models \beta$: β follows logically from α . Formally:

$$\alpha \models \beta \text{ if and only if } M(\alpha) \subseteq M(\beta)$$

2 Logical Reasoning

1. In the context of logical reasoning, define model.

Solution: A model is a formal specification of a possible world, that is, a set of assignments of values to the variables in the sentences of a knowledge base.

2. In the context of logical reasoning, define model checking.

Solution: Model checking is enumerating all models and showing that a sentence is valid, that is, the sentence holds in all models.

3. List two methods of establishing the truth of a logical sentence.

Solution: Model checking and theorem proving.

4. Define satisfiability.

Solution: A sentence is ****satisfiable**** if it is true in, or satisfied by, ***some*** model

5. How does logical theorem proving work?

Solution: Applying rules of inference directly to the sentences in our knowledge base to construct a proof of the desired sentence without consulting models.

3 First-order Logic

1. Translate the following English sentence into first-order logic: “All that glitter is not gold.”

Solution: $\forall x, Glitters(x) \implies \neg Gold(x)$

2. Translate the following English sentence into first-order logic: “There’s someone for everyone.”

Solution: $\forall x, \exists y, IsFor(y, x)$

3. Express the following English sentence in a formal ontological knowledge representation language: “A hot dog is a sandwich.”

Solution: $Sandwich(HotDog)$, or $HotDog \in Sandwiches$.