Knowledge-Based AI Review

Artificial Intelligence

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

   Solution: An assertion about the world expressed in a **knowledge represeantation 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:

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

7. 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.

8. 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.

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

Solution: Model checking and theorem proving.

10. Define satisfiability.

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

11. 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.

12. Translate the following English sentence into first-order logic: "All that glitter is not gold."

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

13. Translate the following English sentence into first-order logic: "There's someone for everyone."

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

14. Express the following Engilsh sentence in a formal ontological knowledge representation language: "A hot dog is a sandwich."

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