

Homework 1

1. Show that S can be proved from the following premises using the set of propositional logic inference rules from the lecture notes. Show the rules used at each step.
 - a. $A \wedge B \Rightarrow C$
 - b. $\neg C \wedge A$
 - c. $\neg S \Rightarrow B$
2. How would an AI figure out what order to use the rules in question 1?
3. Translate these First Order Logic assertions into English (no x 's or y 's):
 - a. $\forall x, y, z : \text{SpeaksLanguage}(x, z) \wedge \text{SpeaksLanguage}(y, z) \Rightarrow \text{UnderstandsTheOther}(x, y) \wedge \text{UnderstandsTheOther}(y, x)$
 - b. $\forall x \exists y : \text{Language}(x) \wedge \text{Person}(y) \wedge \text{SpeaksLanguage}(y, x)$
 - c. $\forall x, y : \text{Student}(x) \wedge \text{French}(y) \wedge \text{Take}(x, y) \Rightarrow \text{Pass}(x, y)$
 - d. $\exists x \forall y : \text{Student}(x) \wedge \text{Take}(x, y) \Rightarrow \text{Likes}(x, y)$
4. Consider a vocabulary with the following symbols:
Customer($p1, p2$): Person $p1$ is a customer of person $p2$
Boss($p1, p2$): Person $p1$ is a boss of person $p2$
Doctor(p), Surgeon(p), Lawyer(p), Actor(p): Denote occupation
Emily(p), Joe(p): Denote name, assume only one person has this name
Use these symbols to write the following assertions in first-order logic:
 - a. Emily is either a surgeon or a lawyer
 - b. All surgeons are doctors
 - c. Joe does not have a lawyer (i.e. is not the customer of a lawyer)
 - d. Emily has a boss who is a lawyer
 - e. There is some lawyer who only has customers that are doctors
 - f. Every surgeon has a lawyer
5. Provide two possible instantiations of each sentence.
Objects in the KB: {dog, cat, turtle, Pam, Jim, Angela}
 - a. $\forall x, y : (\text{IsPerson}(x) \wedge \text{IsAnimal}(y) \wedge \text{OwnsPet}(x, y)) \Rightarrow \text{Loves}(x, y)$
 - b. $\forall x, y, z : (\text{IsPet}(x) \wedge \text{IsPet}(y) \wedge \text{Loves}(x, y) \wedge \text{IsPerson}(z)) \Rightarrow \text{Loves}(z, x)$
6. What condition would an AI place on an instantiation before adding it to its KB?