

CSE 473: Artificial Intelligence
Assignment #3
April 24, 2005
Due: Monday, May 2

Reading Assignment: Chapter 11 and 13

Problems:

1. Chapter 7, exercise 7.4 a-c. Hint: Think about model sets.
2. Write axioms in first-order logic describing the following predicates: *GrandChild*, *Great-Grandparent*, *Brother*, *Aunt*, *SisterInLaw*, *FirstCousin*. You may assume that the predicates *ParentOf(x)*, *ChildOf(x)*, *Male(x)*, *Female(x)*, *Married(x, y)* are already defined.
3. Recall the nursery rhyme:

Fuzzy Wuzzy was a bear,
Fuzzy Wuzzy had no hair.
Was he fuzzy?

In this exercise you will prove that Fuzzy Wuzzy is indeed fuzzy. Fuzzy Wuzzy's universe is governed by the following six rules:

- 1) $\forall b \exists c \text{ Bear}(b) \Rightarrow \text{Coat}(c) \wedge \text{Has}(b, c)$
- 2) $\neg \exists c \text{ Raincoat}(c) \wedge \text{Furcoat}(c)$
- 3) $\forall c \text{ Coat}(c) \Rightarrow \text{Raincoat}(c) \vee \text{Furcoat}(c)$
- 4) $\forall x, c \text{ Has}(x, c) \wedge \text{Furcoat}(c) \Rightarrow \text{Fuzzy}(x)$
- 5) $\forall x \text{ HasHair}(x) \Rightarrow \text{Fuzzy}(x)$
- 6) $\neg \exists c \text{ Has}(\text{FuzzyWuzzy}, c) \wedge \text{Raincoat}(c)$

In addition, our knowledge base contains the following, thanks to the rhyme:

$\text{Bear}(\text{FuzzyWuzzy})$
 $\neg \text{HasHair}(\text{FuzzyWuzzy})$

- a) Write down the English-sentence equivalents of the six rules governing Fuzzy Wuzzy's universe.
- b) Convert each of the six rules into Clausal Normal Form (CNF). *Show your intermediate steps for each rule.*

c) Using resolution on your clauses from part b), prove that Fuzzy Wuzzy is fuzzy. Number the steps in your resolution so that steps 1 – n are the n CNF clauses from part b), and each subsequent clause is labeled with the numbers of the two clauses that you resolved to produce it. Also, if any unification was required for a particular step, write the substitution to the right of the resulting clause. For example:

- 1) $A(y) \vee B(y)$ Clause 1 from converted rules
- 2) $\neg B(bob)$ Clause 2 from KB
- 3) $\neg A(bob)$ Clause 3 (negated goal)
- 4) $A(bob)$ (1, 2) $\{y/bob\}$
- 5) $\{\}$ (3, 4)