

# Homework #3: Chapters 7 and 8

The following exercises are due at the beginning of class on Monday, March 1.

1. [25 pts. total] Consider a knowledge base  $KB$  that contains the following propositional logic sentences:

$$\begin{aligned} P \vee R &\Rightarrow Q \\ \neg P &\Rightarrow R \\ Q \vee R & \end{aligned}$$

- Construct a truth table that shows the truth value of each sentence in  $KB$  and indicate the models in which the  $KB$  is true.
  - Does  $KB$  entail  $Q$ ? Use the definition of entailment to justify your answer.
  - Does  $KB$  entail  $R \Rightarrow P$ ? Use the definition of entailment to justify your answer.
  - Does  $KB$  entail  $P \vee Q$ ? Extend the truth table and use the definition of entailment to justify your answer.
2. [10 pts.] Prove each of the following assertions regarding propositional logic:
- $\alpha \models \beta$  if and only if the sentence  $(\alpha \Rightarrow \beta)$  is valid.
  - $\alpha \models \beta$  if and only if the sentence  $(\alpha \wedge \neg\beta)$  is unsatisfiable.
3. [50 pts.] Do exercise 8.6 (a - j) from the book (p. 268). Use the following constants and predicates (and no others):

- $F$ : a constant representing French
- $G$ : a constant representing Greek
- $S$ : a constant representing Spring 2001
- $UK$ : a constant representing the U.K.
- $Agent(x)$ :  $x$  is an agent
- $Barber(x)$ :  $x$  is a barber
- $Expensive(x)$ :  $x$  is expensive
- $Insured(x)$ :  $x$  is insured
- $LocalMan(x)$ :  $x$  is a man living in the town
- $Person(x)$ :  $x$  is a person
- $Policy(x)$ :  $x$  is a policy
- $Smart(x)$ :  $x$  is smart
- $Student(x)$ :  $x$  is a student
- $Score(c,s)$ :  $s$  is a score for course  $c$
- $BornIn(x,c)$ : person  $x$  is born in country  $c$
- $Buys(x,y)$ : person  $x$  buys item  $y$
- $CitizenByBirth(x,c)$ : person  $x$  is a citizen by birth in country  $c$
- $CitizenByDescent(x,c)$ : person  $x$  is a citizen by descent in country  $c$
- $CitizenOf(x,c)$ : person  $x$  is a citizen of country  $c$
- $GreaterThan(x,y)$ :  $x > y$ . You may assume that the standard mathematical semantics apply to this predicate.
- $Parent(x,y)$ : person  $x$  has parent  $y$
- $Passes(x,c)$ : student  $x$  passes course  $c$
- $ResidentOf(x,c)$ : person  $x$  is a resident of country  $c$
- $Sells(s,x,b)$ : person  $s$  sells item  $x$  to person  $b$
- $Shaves(x,y)$ : person  $x$  shaves person  $y$
- $TakesCourse(x,c,s)$ : student  $x$  takes course  $c$  in semester  $s$

4. [15 pts.] Do exercise 8.16 from the book (p. 270). Your axioms should be consistent with those defined on pages 258-260. You may also use any predicates already defined for the Wumpus world.