

Homework #3: Chapters 7 and 8

The following exercises are due at the beginning of class on Tuesday, March 3.

1. [20 pts.] 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. [30 pts.] Consider the following statements:
- If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned.
- Using only four propositional symbols, express the above statements in propositional logic
 - Construct a truth table that shows the truth value of each sentence and indicate the models in which all of the sentences are true.
 - Using the definition of entailment, answer the question “Is the unicorn mythical?”
 - Using the definition of entailment, answer the question “Is the unicorn horned?”
3. [50 pts.] Do exercise 8.24 (a - j) from the book (p. 319). 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
- $Semester(x)$: x is a semester
- $Smart(x)$: x is smart
- $Student(x)$: x is a student
- $BornIn(x,c)$: 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 is the parent of 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
- $Score(x,c,s,n)$: student x received a score of n when taking course c in semester s .
- $Shaves(x,y)$: person x shaves person y
- $TakesCourse(x,c,s)$: student x takes course c in semester s