Homework #3: Chapters 7 and 8

The following exercises are due at the beginning of class on Monday, February 27.

1. *[20 pts.]* Consider a knowledge base *KB* that contains the following propositional logic sentences:

$$P \vee R \Rightarrow Q$$
$$\neg P \Rightarrow R$$
$$Q \vee R$$

   a) Construct a truth table that shows the truth value of each sentence in *KB* and indicate the models in which the *KB* is true.
   b) Does *KB* entail *R*? Use the definition of entailment to justify your answer.
   c) Does *KB* entail $P \wedge Q$? Use the definition of entailment to justify your answer.
   d) Does *KB* entail $\neg Q \Rightarrow P$? Extend the truth table and use the definition of entailment to justify your answer.

2. *[35 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.

   a) Using only four propositional symbols, express the above statements in propositional logic
   b) Construct a truth table that shows the truth value of each sentence and indicate the models in which all of the sentences are true.
   c) Using the definition of entailment, answer the question "Is the unicorn mythical?"
   d) Using the definition of entailment, answer the question "Is the unicorn horned?"

3. *[35 pts.]* Do exercise 8.10 from the book (p. 317).

4. *[10 pts.]* Write down a first-order logic sentence such that every world in which it is true contains exactly one object in its domain.