Homework #3: Chapters 7 and 8

The following exercises are due at the beginning of class on Tuesday, March 7.

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

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

   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 *P*? Use the definition of entailment to justify your answer.
   c. Does *KB* entail *R*? Use the definition of entailment to justify your answer.
   d. Does *KB* entail $R \Rightarrow P$? Extend the truth table and use the definition of entailment to justify your answer.

2. *[10 pts.]* In propositional logic, does an empty knowledge base (i.e. a knowledge base containing only the sentence *true*) entail anything? Explain your answer.

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

4. *[30 pts.]* For each of the following sentences, decide if the accompanying first-order logic sentence is a good translation. If it is not good, explain why and correct it.

   a. No two people have the same social security number

      $\forall x,y\ Person(x) \wedge Person(y) \Rightarrow \neg\exists n\ HasSSN(x,n) \wedge HasSSN(y,n)$

   b. John's social security number is the same as Mary's

      $\exists n\ HasSSN(John,n) \wedge HasSSN(Mary,n)$

   c. Everyone's social security number has nine digits.

      $\forall x,n\ Person(x) \Rightarrow (HasSSN(x,n) \wedge Digits(n,9))$

   d. Rewrite your answers to parts a–c using the **function** symbol *SSN* rather than the predicate symbol *HasSSN* (if the original sentence was good, rewrite the original).