Subject 24.241. Logic I. Homework due Thursday, September 29.

1.   For this problem, let N be the set of natural numbers (nonnegative integers), let E be the set of even natural numbers, let P be the set of primes (integers > 1 that aren't divisible by any numbers other than themselves and one), and let S be the set of integers greater than 1 and less than 10.

   a) List the members of $S \sim P$.
   b) List the members of $S \sim (P \cup E)$
   c) List the members of $P \cap E$.
   d) List the members of $(S \sim P) \sim E$.
   e) List the members of $S \sim (P \sim E)$.

2.   For this problem, let I be {Mercury, Venus, Earth, Mars}, and let C = {Spock, McCoy}.

   a) List the functions from I to C, indicating which are one-one and which are onto.
   b) How many functions are there from I to I. of these how many are one-one? Onto? Both?

3.   Use the method of truth table to identify each of the following sentences as valid, inconsistent, or neither.

   a) $((P \leftrightarrow (Q \leftrightarrow R)) \leftrightarrow ((P \leftrightarrow Q) \leftrightarrow \neg R))$.
   b) $(((P \rightarrow Q) \rightarrow R) \rightarrow ((P \rightarrow R) \rightarrow R))$
   c) $((P \rightarrow (Q \lor R)) \lor ((P \rightarrow Q) \lor R))$

4.   For each of the following categories, either give an example or explain why there can't be any example:

   a) A tautological conditional whose antecedent is tautological.
   b) An inconsistent conditional whose antecedent is inconsistent.
   c) A tautological disjunction neither of whose disjuncts are tautological.
   d) A tautological conjunction neither of whose conjuncts are tautological.
   e) An inconsistent sentence with no negation signs.