Eduardo Abreu – Logic Programming Worksheet I

Propositional Logic

1) Let p stand for the proposition "I bought a lottery ticket" and q for "I won the jackpot". Express the following as natural English sentences:
    a. I didn't buy a lottery ticket.
    b. I bought a lottery ticket or I won the jackpot.
    c. I bought a lottery ticket and I won the jackpot.
    d. If I bought the lottery ticket, then I won the jackpot.
    e. If I didn't buy the lottery ticket, then I didn't win the jackpot.
    f. I didn't buy a lottery ticket or I bought the lottery ticket, and I won the lottery.
2) Formalize the following in terms of atomic propositions r, b, and w, first making clear how they correspond to the English text.
    a. $b \wedge \neg r$
    b. $\neg r \wedge (w \wedge b)$
    c. $b \rightarrow (w \leftrightarrow \neg r)$
    d. $\neg w \wedge (\neg r \wedge b)$
    e. $\neg w \wedge \neg b \wedge \neg r$
    f. $(r \wedge b) \rightarrow \neg w$
3) Formalize these statements and determine (with truth tables or otherwise) whether they are consistent (i.e. if there are some assumptions on the atomic propositions that make it true): "The system is in a multiuser state if and only if it is operating normally. If the system is operating normally, the kernel is functioning. Either the kernel is not functioning or the system is in interrupt mode. If the system is not in multiuser state, then it is in interrupt mode. The system is not in interrupt mode."

$M \leftrightarrow N$	$N \rightarrow K$	$\neg K \vee I$	$\neg M \rightarrow I$	$\neg I$

4) A formula is **valid** if all interpretations make the formula true. It is **satisfiable** if it is possible to find an interpretation that makes the formula true.
5) What…
6) …
7) Formalize the following and, by writing truth tables for the premises and conclusion, determine whether the arguments are valid.
    a. $(\neg S \wedge L) \vee S$
       S
       $\therefore \neg L$
    b. $B \wedge C$
       $L \vee C$
       $\therefore L \vee \neg B$

Predicate Logic

1) Formalize the following statements in predicate logic, making clear what your atomic predicate symbols stand for and what the domains of any variables are.
    a. …
2) Translate the following into idiomatic English.
    a. …
3) State whether the following are true or false, where x, y and z range over the integers.
    a.