

CS 540 HW4: Propositional Logic - Representation and Reasoning

Assigned: 4/21/08
Due: 4/28/08
Value: 50 points

1. Represent each of these sentences in propositional logic.
 - a. If I take History, I cannot take Economics.
 - b. I must take either Japanese or Italian but not both.
 - c. I must take at least two of cs520, cs552, and cs564.
2. For each of the following well-formed formulae, use truth tables to show whether it is *valid*, *satisfiable*, or *unsatisfiable*.

- a. $(P \rightarrow Q) \wedge (P \rightarrow \neg Q)$
- b. $(P \rightarrow Q) \wedge (P \rightarrow R) \wedge (\neg Q \wedge \neg R) \wedge P$
- c. $(P \rightarrow Q) \vee (Q \rightarrow P)$
- d. $((P \rightarrow Q) \rightarrow (Q \rightarrow R)) \leftrightarrow (P \rightarrow R)$

3. Using the inference rules of “natural deduction” presented in class,

- Given:
- 1) $P \wedge Q \rightarrow R$
 - 2) $\neg X \vee \neg Y \vee R$
 - 3) $Q \wedge Y \rightarrow W$
 - 4) Q
 - 5) $\neg(\neg X)$
 - 6) Y

Show: 7) $R \wedge W$

4. Put the following in *clausal form*.
 - a. $(P \rightarrow Q) \wedge (X \rightarrow Y)$
 - b. $(P \wedge Q \rightarrow Z) \vee (X \wedge Y)$
 - c. $((P \rightarrow Q) \rightarrow (X \rightarrow Y)) \leftrightarrow (A \wedge B)$
5. Using only the resolution inference rule, redo the *Given-Show* of Problem 3 via a proof by contradiction.