University of Washington, Bothell

CSS 342: Data Structures, Algorithms, and Discrete Mathematics

Fall 2014

Propositions Problem Examples

Some practice problems to help with learning propositions, quantifiers, and logical operators

1) Use Boolean algebra simplify the left hand side to establish whether the following are tautologies:

   $(a \wedge b \rightarrow a) \leftrightarrow T$

   $\neg(\neg(a \vee b) \rightarrow \neg a) \leftrightarrow F$

   $(a \rightarrow b) \wedge (\neg a \rightarrow b) \wedge (\neg a \rightarrow a) \leftrightarrow a$

2) Simplify the following propositional form:

   $((a \rightarrow b) \vee (a \rightarrow d)) \rightarrow (b \vee d)$

3) Find the truth table for the following propositions:

   $(a \rightarrow b) \vee (a \rightarrow b \rightarrow c) \wedge \neg(b \vee b \vee a)$

   $\neg(\neg(a \vee b) \rightarrow \neg a) \rightarrow b$

4) Let the domain of discourse for x and y be the set of married persons. Determine if the following are true of false.

   $\forall x \exists y$ (x is married to y)

   $\exists x \forall y$ (x is married to y)

   $\exists x \exists y$ (x is married to y)

5) Let P(x, y) be the propositional function $x^2 + y^2 = 20$. The domain of discourse is the set for all integers. Determine whether each proposition below is true or false.

$\forall x \forall y\ P(x, y)$

$\forall x \exists y\ P(x, y)$

$\exists x \forall y\ P(x, y)$

$\exists x \exists y\ P(x, y)$