CSE 311 Quiz Section 2: Apr 10, 2014

1 Student Questions

2 Problem 8 from Homework #1

42. Suppose that a truth table in n propositional variables is specified. Show that a compound proposition
with this truth table can be formed by taking the disjunction of conjunctions of the variables or their
negations, with one conjunction included for each combination of values for which the compound proposition
is true. The resulting compound proposition is said to be in disjunctive normal form.

3 Practice Problems

1. How many different Boolean functions on n variables are possible? (A “Boolean function on n variables”
is specified by a truth table with n + 1 columns, one for each variable and one for the value of the
resulting function. There are as many Boolean functions as there are distinct truth tables.)

2. Logical equivalence with quantifiers


Determine whether the following are logically equivalent:

(a) \( \forall x(P(x) \rightarrow Q(x)) \) and \( \forall xP(x) \rightarrow \forall xQ(x) \)

(b) \( \exists x(P(x) \lor Q(x)) \) and \( \exists xP(x) \lor \exists xQ(x) \)

3. Translate English to logical expressions with nested quantifiers.

Both editions: 1.5: 9

Let \( L(x,y) \) be the statement "x loves y"

(a) There is somebody whom everybody loves (c)

(b) Nobody loves everybody (d)

(c) There is exactly one person whom everybody loves. (g)

(d) Everyone loves himself or herself. (i)

(e) There is someone who loves no one besides himself or herself. (j)

4. (Section 2.22, Exercise 12-13, 7th Edition) Prove the following (these are called absorption laws):

(a) \( A \cup (A \cap B) = A \)

(b) \( A \cap (A \cup B) = A \)

5. (Section 2.1, Exercise 9, 7th Edition, modified slightly) Determine which of these statements are true
and which false

(a) \( 0 \in \emptyset \)

(b) \( \emptyset \in \{0\} \)

(c) \( \{0\} \subseteq \emptyset \)

(d) \( \emptyset \subseteq \{0\} \)

(e) \( \{0\} \in \{0\} \)

(f) \( \{0\} \subseteq \{0\} \)

(g) \( \{\emptyset\} \subseteq \{\emptyset\} \)