CSE 311: Foundations of Computing I

Section 2: Equivalences and Predicate Logic

1. Equivalences

Prove that each of the following pairs of propositional formulae are equivalent using propositional equivalences.

(a) $p \leftrightarrow q$ $\qquad\qquad$ $(p \wedge q) \vee (\neg p \wedge \neg q)$

(b) $\neg p \rightarrow (q \rightarrow r)$ $\qquad\qquad$ $q \rightarrow (p \vee r)$

2. Non-equivalence

Prove that the following pairs of propositional formulae are not equivalent by finding inputs they differ on.

(a) $p \rightarrow q$ $\qquad\qquad$ $q \rightarrow p$

(b) $p \rightarrow (q \wedge r)$ $\qquad\qquad$ $(p \rightarrow q) \wedge r$

3. Boolean Algebra

For each of the following parts, write the logical expression using boolean algebra operators. Then, simplify it using axioms and theorems of boolean algebra.

(a) $\neg p \vee (\neg q \vee (p \wedge q))$

(b) $\neg (p \vee (q \wedge p))$

4. Canonical Forms

Consider the boolean functions $F(A, B, C)$ and $G(A, B, C)$ specified by the following truth table:

A	B	C	$F(A,B,C)$	$G(A,B,C)$
1	1	1	1	0
1	1	0	1	1
1	0	1	0	0
1	0	0	0	0
0	1	1	1	1
0	1	0	1	0
0	0	1	0	1
0	0	0	1	0

(a) Write the DNF and CNF expressions for $F(A, B, C)$.

(b) Write the DNF and CNF expressions for $G(A, B, C)$.