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) $p \leftrightarrow q$ $(p \land q) \lor (\neg p \land \neg q)$
- (b) $\neg p \rightarrow (q \rightarrow r)$ $q \rightarrow (p \lor r)$

2. Non-equivalence

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

(a)
$$p \to q$$

(b) $p \to (q \land r)$
 $(p \to q) \land r$

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) $\neg p \lor (\neg q \lor (p \land q))$
- (b) $\neg (p \lor (q \land p))$

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).