

UNIVERSITY OF WESTERN ONTARIO

Computer Science 2209b, Winter 2013-2014
Applied Logic for Computer Science

ASSIGNMENT 2

Given: Monday, February 3, Due: Monday February 10, 5:00pm

- 1). Use the laws of propositional calculus to find a formula in disjunctive normal form tautologically equivalent to the formula:

$$(p \rightarrow q \wedge \neg r) \rightarrow (p \vee r \rightarrow \neg q \wedge r)$$

State all laws of propositional calculus that you use. Simplify your result as much as possible.

- 2). Use the laws of propositional calculus to find a formula in conjunctive normal form tautologically equivalent to the formula:

$$((\neg A \leftrightarrow B) \vee C) \wedge (\neg B \wedge C)$$

State all laws of propositional calculus that you use. Simplify your result as much as possible.

- 3). Use the truth table method to find the disjunctive normal form of the formula in 1), and the conjunctive normal form of the formula in 2). How do the resulting formulas compare to the ones you obtained in 1) and 2)? Justify your answers.

- 4). (a) Show that the set of connectives $\{ \wedge, \leftrightarrow, \oplus \}$ is adequate, where \oplus is defined by the truth table:

p	q	$p \oplus q$
1	1	0
1	0	1
0	1	1
0	0	0

- (b) Show that the set of connectives $\{ \wedge, \leftrightarrow \}$ is not adequate.

5. Give formal proofs that the following arguments are valid using only the 11 rules of formal deduction and the theorems proved in class. State each rule you use.

Argument a)

1. $(A \vee B) \wedge \neg C$
2. $\neg C \rightarrow (D \wedge \neg A)$
3. $B \rightarrow (A \vee E)$

Concl. $E \vee F$

Argument b)

1. $(O \wedge G) \rightarrow V$
2. $V \rightarrow \neg M$
3. $\neg J \rightarrow M$

Concl. $G \rightarrow (O \rightarrow J)$