COMP 2711 Discrete Mathematical Tools for Computer Science
2022 Fall Semester - Tutorial 1

Question 1: Let p, q, and r be the propositions

p: You get an A in the final exam.
q: You do every exercise in this book.
r: You get an A in the class.

Write these propositions using p, q, and r and the Boolean connectives

(a) You get an A in this class, but you do not do every exercise in the book

(b) You get an A in the final, you do every exercise in this book, and you get an A in this class

(c) Getting an A in the final and doing every exercise in this book is sufficient for getting an A in this class.

(d) You get an A in this class if and only if you either do every exercise in this book or you get an A in the final.

Using p, q, r above express each of the following as an English sentence

(e) $p \leftrightarrow r$

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

Question 2: (Distributive "Laws")

(a) Is $w \wedge (w \oplus v)$ equivalent to $(w \wedge w) \oplus (w \wedge v)$?

(b) Is $w \vee (u \oplus v)$ equivalent to $(w \vee u) \oplus (w \vee v)$? (Noted. $a \oplus b$ evaluates F if and only if a and b are the same.)

Question 3: Let p and q be statements, prove each of the following compound statement is always true. (such statement is called "Tautology")

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

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

Question 4: For each of the following pairs of logic statements, either prove that the two statements are logically equivalent, or give a counterexample. In your proof, you may use either a truth table or logic laws. A counterexample should consist of a truth setting of the variables and the truth values of the statements under the setting.

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

(b) $(p \wedge q) \rightarrow r$ and $\neg r \rightarrow (p \rightarrow \neg q)$

(c) $(p \rightarrow r) \wedge (q \rightarrow r)$ and $(p \wedge q) \rightarrow r$

(d) $(p \wedge \neg q) \rightarrow (r \wedge \neg r)$ and $p \rightarrow q$

Question 5: (a) Given the statement $(a \vee b) \wedge (\neg b \vee c)$. Express its equivalent statement using only *NOT* ($\neg$) and *Implication* ($\rightarrow$).

(b) Given $\neg a \vee (b \rightarrow \neg c)$. Express its equivalent statements using only:

(i) *NOT* ($\neg$) and *Implication* ($\rightarrow$).

(ii) *NOT* ($\neg$) and *OR* ($\vee$).

(iii) *NOT* ($\neg$) and *AND* ($\wedge$).