University of Toronto at Scarborough
CSC A67/MAT A67 - Discrete Mathematics, Fall 2017

Exercise #1: Implication

Due: September 17, 2017 at 11:59 p.m. This exercise is worth 3% of your final grade.

Warning: Your electronic submission on MarkUs affirms that this exercise is your own work and no one else's, and is in accordance with the University of Toronto Code of Behaviour on Academic Matters, the Code of Student Conduct, and the guidelines for avoiding plagiarism in CSC A67/MAT A67. Late exercises will not be accepted.

[15]

1. Let f: "the leaves will soon fall", b: "the blue birds have flown", and m: "the Maple Leafs have arrived".

   Which of the following statements are equivalent to $(b \wedge m) \to f$? You do not need to show your work however you can use a truth table when necessary to verify the equivalence of two statements or use equivalence laws from class such as:

   $\neg(p \wedge q) \Leftrightarrow \neg p \vee \neg q$ DeMorgan's Law

   or

   $\neg(p \vee q) \Leftrightarrow \neg p \wedge \neg q$ DeMorgan's Law

   or

   $p \to q \Leftrightarrow \neg p \vee q$ 反过来行 $\to$ Law

   You may indicate equivalent statements by making them **bold**.

   i) $\neg f \to (\neg b \vee \neg m)$
   ii) "If the leaves will not soon fall, then the blue birds have not flown or the Maple Leafs have not arrived."
   iii) $f \vee \neg b \vee \neg m$ $f \vee \neg(b \wedge m)$ $\neg(b \wedge m) \vee f$.
   iv) $\neg(b \vee m) \vee f$
   v) "If the leaves will soon fall, then the Maple Leafs have arrived or the blue birds have flown."
   vi) $f \to (b \wedge m)$
   vii) $\neg f \to (b \vee m)$
   viii) $f \vee \neg(b \wedge m)$
   ix) $\neg(b \vee m) \to \neg(\neg f)$
   x) "The Maple Leafs have not arrived or the blue birds have not flown, if the leaves will not soon fall."
   xi) "If the Maple Leafs have not arrived and the blue birds have not flown, then the leaves will not soon fall."
   xii) $\neg(b \vee m) \to \neg f$
   xiii) $\neg f \to (\neg b \vee m)$
   xiv) "If the leaves will not soon fall, then the blue birds have not flown and the Maple Leafs have not arrived."
   xv) "If the leaves will not soon fall, then the blue birds have not flown or the Maple Leafs have not arrived."

2. Construct truth tables for the following statements: [10]

(a) $(b \wedge a) \rightarrow b$ false.

(b) $a \wedge (b \vee c)$

(c) $(a \wedge b) \vee (a \wedge c)$

(d) What do you notice about 2b) and 2c)? Which law of arithmetic does this remind you of?

(e) $b \rightarrow (a \rightarrow b)$ ↓ a is distributied to b & c. Distributive law.

[Total: 25 marks]

(a)

a.	b.	$(b \wedge a)$	b.
T	T	T	T
T	F	F	F
F	T	F	T
F	F	F	F

(b)

a.	b.	c	$(b \vee c)$	$a \wedge (b \vee c)$
T	T	T	T	T
	T	F	T	T
	F	F	F	F
	F	T	T	T
F	T	T	T	F
	T	F	T	F
	F	F	F	F
	F	T	T	F

c)

a.	b	c	$(a \wedge b)$	$(a \wedge c)$	$(a \wedge b) \vee (a \wedge c)$
T	T	T	T	T	T
	T	F	T	F	T
	F	T	F	F	T
	F	F	F	F	F
F	T	T	F	F	F
	T	F	F	F	F
	F	T	F	F	F
	F	F	F	F	F

e).

a.	b.	$a \rightarrow b$.	$b \rightarrow (a \rightarrow b)$.
T	T	T	T
T	F	F	T
F	F	T	F
F	T	F	F