

MAT 2440 - HW1 Solutions

September 2016

Section 1.1

Exercise 10

b

The election is decided or the votes have been counted.

d

If the votes have been counted, then the election is decided.

e

If the votes have not been counted, then the election is not decided.

f

If the election is not decided then the votes have not been counted.

g

The election is decided if and only if (iff) the votes have been counted.

Exercise 14

a

$$r \wedge \neg q$$

b

$$p \wedge q \wedge r$$

c

$$p \rightarrow r$$

d

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

(it can also be $p \wedge \neg q \wedge r$, depending on how you interpret the sentence.)

e

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

Exercise 28

a

Converse: If I stay at home, then it will snow tonight.

Contrapositive: If I don't stay at home, then it won't snow tonight.

Inverse: If it doesn't snow tonight, then I won't stay at home.

c

Converse: If I need to sleep up till noon, then I stayed up late.

Contrapositive: If I don't need to sleep until noon, then I didn't stay up late.

Inverse: If I don't stay up late, then it is not necessary that I sleep till noon.

Exercise 32

a

p	$\neg p$	$p \rightarrow \neg p$
T	F	F
F	T	T

b

p	$\neg p$	$p \leftrightarrow \neg p$
T	F	F
F	T	T

d

p	q	$p \wedge q$	$p \vee q$	$(p \wedge q) \rightarrow (p \vee q)$
T	T	T	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	T

e

p	q	$\neg p$	$q \rightarrow \neg p$	$p \leftrightarrow q$	$(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$
T	T	F	F	T	F
T	F	F	T	F	F
F	T	T	T	F	F
F	F	T	T	T	T

Exercise 44

a

$$11000 \wedge (01011 \vee 11011) \equiv 11000 \wedge 11011 \equiv 11000$$

b

$$(01111 \wedge 10101) \vee 01000 \equiv 00101 \vee 01000 \equiv 01101$$

Section 1.3

Exercise 4

a

p	q	r	$p \vee q$	$(p \vee q) \vee r$
T	T	T	T	T
T	T	F	T	T
T	F	F	T	T
F	F	F	F	F
T	F	T	T	T
F	T	T	T	T
F	F	T	F	T
F	T	F	T	T

p	q	r	$q \vee r$	$p \vee (q \vee r)$
T	T	T	T	T
T	T	F	T	T
T	F	F	F	T
F	F	F	F	F
T	F	T	T	T
F	T	T	T	T
F	F	T	F	T
F	T	F	T	T

Exercise 22

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

We get the second expression from the first equivalence in Table 7 in page 28 of the book. We get the third expression from distributive law in Table 6 in page 27.