Exercises 1

张逸松

September 10, 2019

1.1

It is a true proposition.

It is a false proposition.

It is a true proposition.

It is a false proposition.

It is not a proposition.

It is not a proposition.

1.15

a) $p \to \neg q$ **4 rows.**

b) $(p \vee \neg r) \wedge (q \vee \neg s)$ **16 rows.**

c) $q \vee p \vee \neg s \vee r \vee \neg t \vee u$ **64 rows.**

d) $(p \wedge r \wedge t) \leftrightarrow (q \wedge t)$ **16 rows.**

1.17

a) $(p \vee q) \to (p \oplus q)$

p	q	$p \vee q$	$p \oplus q$	$(p \vee q) \to (p \oplus q)$
F	F	F	F	T
F	T	T	T	T
T	F	T	T	T
T	T	T	F	F

b) $(p \oplus q) \to (p \wedge q)$

p	q	$p \wedge q$	$p \oplus q$	$(p \oplus q) \to (p \wedge q)$
F	F	F	F	T
F	T	F	T	F
T	F	F	T	F
T	T	T	F	T

c) $(p \vee q) \oplus (p \wedge q)$

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

d) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$

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

e) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$

p	q	r	$p \leftrightarrow q$	$\neg p \leftrightarrow q$	$(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$
F	F	F	T	T	F
F	F	T	F	F	F
F	T	F	F	T	T
F	T	T	T	F	T
T	F	F	T	F	T
T	F	T	F	T	T
T	T	F	F	F	F
T	T	T	T	T	F

f) $(p \oplus q) \rightarrow (p \oplus \neg q)$

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

2.5

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

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

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

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

(c) $\neg p \rightarrow (p \rightarrow q)$

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

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

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

(e) $\neg(p \rightarrow q) \rightarrow p$

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

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

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

2.11

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

2.15

p	q	r	$(p \to q)$	$(q \to r)$	$(p \to r)$	$(p \to q) \wedge (q \to r) \to (p \to r)$
F	F	F	T	T	T	T
F	F	T	T	T	T	T
F	T	F	T	F	T	T
F	T	T	T	T	T	T
T	F	F	F	T	F	T
T	F	T	F	T	T	T
T	T	F	T	F	F	T
T	T	T	T	T	T	T

2.17

When r is true, and p q s are false, $(p \to q) \to (r \to s)$ is false, while $(p \to r) \to (q \to s)$ is true.

3.1

a) b) are truth values.

3.4

a) For all people, if you are a comedian, you are funny.

b) For all people, you are a comedian and you are funny.

c) There is a person, if he is a comedian, he is funny.

d) There is a person, who is a comedian and funny.

3.6

a) b) e) are true, others are false.