Homework 2

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10a.

$$[\neg p \wedge (p \vee q)] \rightarrow q$$

p	q	$\neg p$	$p \vee q$	$\neg p \wedge (p \vee q)$	$\neg p \wedge (p \vee q) \rightarrow q$
0	0	1	0	0	1
0	1	1	1	1	1
1	0	0	1	0	1
1	1	0	1	0	1

10b.

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

p	q	r	$p \rightarrow q$	$q \rightarrow r$	$(p \rightarrow q) \wedge (q \rightarrow r)$	$(p \rightarrow r)$	$[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)]$
0	0	0	1	1	1	1	1
0	0	1	1	1	1	1	1
0	1	0	1	0	0	1	1
0	1	1	1	1	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	1	0	1	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1

10c.

$$[p \wedge (p \rightarrow q)] \rightarrow q$$

p	q	$p \rightarrow q$	$p \wedge (p \rightarrow q)$	$[p \wedge (p \rightarrow q)] \rightarrow q$
0	0	1	0	1
0	1	1	0	1
1	0	0	0	1
1	1	1	1	1

10d.

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

p	q	r	$p \wedge q$	$p \rightarrow r$	$q \rightarrow r$	$(p \wedge q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)$	$[(p \wedge q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$
0	0	0	0	1	1	0	1
0	0	1	0	1	1	0	1
0	1	0	0	1	0	0	1
0	1	1	0	1	1	0	1
1	0	0	0	0	1	0	1
1	0	1	0	1	1	0	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1

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$$(\neg p \wedge (p \to q)) \to \neg q$$

p	q	$\neg p$	$p \to q$	$\neg p \wedge (p \to q)$	$(\neg p \wedge (p \to q)) \to \neg q$
0	0	1	1	1	1
0	1	1	1	1	1
1	0	0	0	0	1
1	1	0	1	0	1

16 Is $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$?

p	q	$p \wedge q$	$\neg p \wedge \neg q$	$(p \wedge q) \vee (\neg p \wedge \neg q)$	$p \leftrightarrow q$
0	0	0	1	1	1
0	1	0	0	0	0
1	0	0	0	0	0
1	1	1	0	1	1

yes

18 Is $p \to q \equiv \neg q \to p$?

p	q	$p \to q$	$\neg q \to \neg p$
0	0	1	1
0	1	1	1
1	0	0	0
1	1	1	1

yes

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p	q	$p \leftrightarrow q$	$q \oplus p$	$\neg(q \oplus p)$
0	0	1	1	1
0	1	0	0	0
1	0	0	0	0
1	1	1	1	1

62a. Yes, $p = T, q = F$
62b. Yes, $p = F, q = T, r = F$
62c. Yes, $p = T, q = T, r = F, s = T$
4a. 0
4b. 1
4c. 1
12a. True
12b. True
12c. False
12d. True
12e. Flase
12f. True
12g. False
14a. True
14b. True
14c. True
14d. False
20a. $P(-5) \vee P(-3) \vee \ldots \vee P(5)$
20b. $P(-5) \wedge P(-3) \wedge \ldots \wedge P(5)$
20c. $(x = 1) \vee (x \neq 1 \wedge \neg P(x))$

20d. $(x \geq 0) \wedge (P(1) \vee P(3) \vee P(5))$
36a. x = 1
36b. x = 2
36c. x = 0
26a. False
26b. True
26c. False
26d. False
26e. True
26f. True
26g. True
26h. False
26i. False
28a. True
28b. True
28c. True
28d. False
28e. True
28f. True
28g. True
28h.

$$x + 2y = 2$$
$$x = 2 - 2y$$
$$2x + 4y = 5$$
$$2(2 - 2y) + 4y = 5$$
$$4 - 4y + 4y = 5$$
$$0 = 5$$

False
28i.

$$x + y = 2$$
$$x = 2 - y$$

$$2(2 - y) - y = 1$$
$$4 - y = 1$$
$$y = 3$$

False, $x = 0$, $y = 3$ does not work.
28j. True