

Sokolov
Maxim B53-5

Homework #3

N1

- a) p - John is 6 feet tall
 q - John weights at least 200 pounds

$$\overline{p \wedge q} = \bar{p} \vee \bar{q}$$

Answer: John is not 6 feet tall
^{or} ~~and~~ he weights less than 200 pounds

- b) p - the bus was late
 q - Tom's watch was slow

$$\overline{p \vee q} = \bar{p} \wedge \bar{q}$$

Answer: The bus wasn't late and
Tom's watch wasn't slow

N2

a) $(\sim p \vee q) \rightarrow \sim q$

p	q	$\sim p$	$\sim p \vee q$	$\sim q$	$(\sim p \vee q) \rightarrow \sim q$
0	0	1	1	1	1
0	1	1	1	0	0
1	0	0	0	1	1
1	1	0	1	0	0

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

p	q	r	$\sim q$	$p \wedge \sim q$	$(p \wedge \sim q) \rightarrow r$
0	0	0	1	0	1
0	0	1	1	0	1
0	1	0	0	0	1
0	1	1	0	0	1
1	0	0	1	1	0
1	0	1	1	1	1
1	1	0	0	0	1
1	1	1	0	0	1

N3

- a) $r \wedge \sim p$
 b) $\sim p \wedge q \wedge r$
 c) $r \rightarrow (q \leftrightarrow \sim p)$

N4

a) or
$$\begin{array}{r} 1011110 \\ 0100001 \\ \hline 1111111 \end{array} \quad \text{and} \quad \begin{array}{r} 1011110 \\ 0100001 \\ \hline 0000000 \end{array} \quad \text{xor} \quad \begin{array}{r} 1011110 \\ 0100001 \\ \hline 1111111 \end{array}$$

b) or
$$\begin{array}{r} 11110000 \\ 10101010 \\ \hline 11111010 \end{array} \quad \text{and} \quad \begin{array}{r} 11110000 \\ 10101010 \\ \hline 10100000 \end{array} \quad \text{xor} \quad \begin{array}{r} 11110000 \\ 10101010 \\ \hline 01011010 \end{array}$$

N5

i. Disjunctions is Commutative

p	q	$p \vee q$	$q \vee p$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

ii.

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

N4

i.

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

Answer: disprove

N8

ii.

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

Answer: prove

i.

$$p \rightarrow q = \neg p \vee q$$

$$\neg p \rightarrow \neg q = p \wedge \neg q$$

Answer: disprove

p	q	$\neg p \vee q$	$p \wedge \neg q$
T	T	T	F
T	F	F	T

ii.

$$q \rightarrow p = \neg q \vee p$$

$$\neg p \rightarrow \neg q = p \vee \neg q = \neg q \vee p = q \rightarrow p$$

Answer: prove

N/g

i) (1) $p \leftrightarrow q = p \rightarrow q \wedge q \rightarrow p = (\neg p \vee q) \wedge (\neg q \vee p)$

(2) $(p \rightarrow q) \rightarrow (q \rightarrow p) = (\neg p \vee q) \rightarrow (\neg q \vee p) =$
 $= \neg(\neg p \vee q) \vee (\neg q \vee p) = (p \wedge \neg q) \vee (\neg q \vee p)$

p	q	(1)	(2)
T	T	T	T
T	F	F	T
F	T	F	F
F	F	T	T

Answer: disprove

ii) $p \wedge q$

$(p \vee \neg q) \wedge q = (q \wedge \neg q) \vee (q \wedge p) = p \wedge q$

Answer: prove