30

a)

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

Contrapositive: If I do not stay at home, then it will not snow tonight.

Inverse: If it does not snow tonight, then I will not stay home.

b)

Converse: Whenever I go to the beach, it is a sunny summer day.

Contrapositive: Whenever I do not go to the beach, it is not a sunny summer day.

Inverse: Whenever it is not a sunny day, I do not go to the beach.

c)

Converse: If I sleep until noon, then I stayed up late.

Contrapositive: If I do not sleep until noon, then I did not stay up late.

Inverse: If I don't stay up late, then I don't sleep until noon.

32

a) $2^2 = 4$

b) $2^3 = 8$

c) $2^6 = 64$

d) $2^5 = 32$

37

p	q	p → ¬q	¬p ↔ q	(p → q)∨(¬p → q)	(p → q)∧ (¬p → q)	(p ↔ q)∨(¬p ↔ q)	(¬p ↔ ¬q) ↔(p ↔ q)
T	T	F	F	T	T	T	T
T	F	T	T	T	F	T	T
F	T	T	T	T	T	T	T
F	F	T	F	T	F	T	T

44

充分性

如果有多于2个p_k为真（假设$k = i, j$），则$\neg p_i \vee \neg p_j$为假，由于外面为并，所以整个式子一定为假

当只有一个p_k为真或所有p_k为假，则$\neg p_i \vee \neg p_j$全为真，因此整个式子为真

必要性

如果整个式子为真，则对于$\forall i, j \in (1, n)$，$\neg p_i \vee \neg p_j$全为真，如果存在多于2个p_k为真，则一定有一个$\neg p_i \vee \neg p_j$为假，矛盾。因此只有至多一个p_k为真

Section 1.2

6

$$u \to (b_{32} \wedge g_1 \wedge r_1 \wedge h_{16}) \vee (b_{64} \wedge g_2 \wedge r_2 \wedge h_{32}).$$

8

a) $r \wedge \neg p$
b) $(r \wedge p) \to q$
c) $\neg r \to \neg q$
d) $(\neg p \wedge r) \to q$

10

可描述为$a \to \neg b$, $b \to c$, $\neg c \to \neg a$,形成了逻辑闭环，因此可以认为是一致的

14

a) WEST AND VIRGINIA AND HIKING.

b) (VIRGINIA AND HIKING) NOT WEST

21

如果第一个教授不想要咖啡，那么他会知道女主人的问题的答案是“不”。因此，女主人和剩下的教授知道第一个教授确实想要咖啡。同样，第二个教授也必须想要咖啡。当第三个教授说“不”时，女主人知道第三个教授不想要咖啡。

37

通过枚举检验可以得到

Fred薪水最高, Maggie其次, Janice最低

45

a) $\neg(p \wedge (q \vee \neg r))$
b) $((\neg p) \wedge (\neg q)) \vee (p \wedge r)$

Section 1.3

4

p	q	r	p∨q	(p ∨q) ∨r	q ∨ r	p ∨ (q∨ r)
T	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
F	T	T	T	T	T	T
F	T	F	T	T	T	T
F	F	T	F	T	T	T
F	F	F	F	F	F	F

p	q	r	p ∧ q	(p ∧ q) ∧ r	q ∧ r	p ∧ (q ∧ r)
T	T	T	T	T	T	T
T	T	F	T	F	F	F
T	F	T	F	F	F	F
T	F	F	F	F	F	F
F	T	T	F	F	T	F
F	T	F	F	F	F	F
F	F	T	F	F	F	F
F	F	F	F	F	F	F

12

a)

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

b)

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

c)

p	q	$p \to q$	$p \wedge (p \to q)$	$[p \wedge (p \to q)] \to q$
T	T	T	T	T
T	F	F	F	T
F	T	T	F	T
F	F	T	F	T

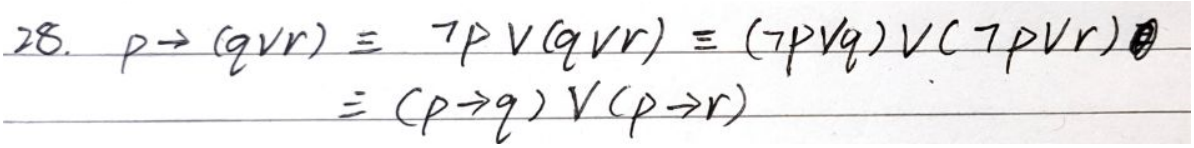
d)

p	q	r	$(p \vee q) \wedge (p \to r) \wedge (p \to r)$	$[(p \vee q) \wedge (p \to r) \wedge (p \to r)] \to r$
T	T	T	T	T
T	T	F	F	T
T	F	T	T	T
T	F	F	F	T
F	T	T	T	T
F	T	F	F	T
F	F	T	F	T
F	F	F	F	T

24

两个命题都是： 当p和q具有相同的真值时，这些命题中的每一个都是真实的；而当p和q具有相反的真值时，这些命题都是假的。因此，这两个命题在逻辑上是等价的。

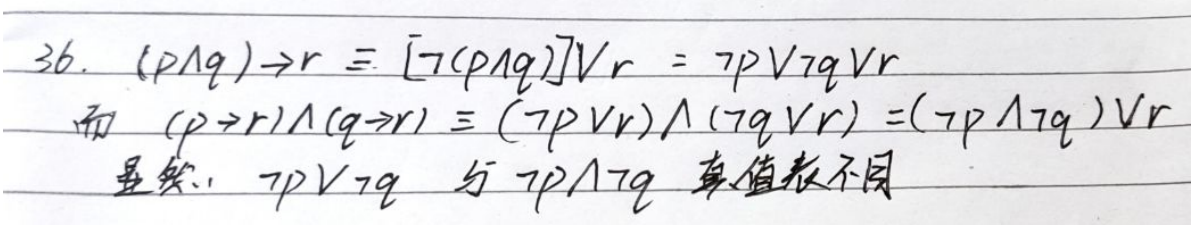
28



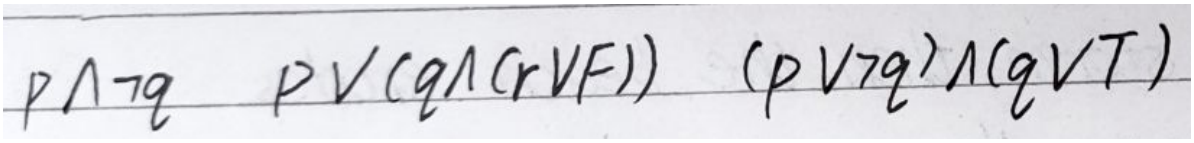
31

按照$p \longleftrightarrow q$的定义可知其既要满足 $p \to q$, 又要满足$q \to p$, 即$(p \to q) \wedge (q \to q)$

36



38



66

a) **satisfiable**

b) **satisfiable**

c) **satisfiable** p, q, s true, and r false.

71

$\wedge_{i=1}^{9} p(i,j,n)$保证列$j$有数字$n$, $\wedge_{n=1}^{9} \vee_{i=1}^{9} p(i,j,n)$ 保证第j列有所有的9个数字，
$\wedge_{j=1}^{9} \wedge_{n=1}^{9} \vee_{i=1}^{9} p(i,j,n)$保证任何列都有所有数字