Student Information

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Answer 1

a)

p	q	$\neg q$	$p \to q$	$p \wedge \neg q$	$p \to q \oplus p \wedge \neg q$
T	T	F	T	F	T
T	F	T	F	T	T
F	T	F	T	F	T
F	F	T	T	F	T

b)

$$
\begin{aligned}
p \to ((q \vee \neg p) \to r) &\equiv \neg p \vee ((q \vee \neg p) \to r) && \textit{table } 7, \textit{Equivalence } 1 \\
&\equiv \neg p \vee (\neg(q \vee \neg p) \vee r) && \textit{table } 7, \textit{Equivalence } 1 \\
&\equiv \neg p \vee ((\neg q \vee \neg\neg p) \vee r) && \textit{table } 6, \textit{De Morgan's Second Law} \\
&\equiv \neg p \vee ((\neg q \vee p) \vee r) && \textit{table } 6, \textit{Idempotent Law} \\
&\equiv \neg(q \vee r) \to \neg p && \textit{table } 7, \textit{Equivalence } 3 \\
&\equiv (\neg q \wedge \neg r) \to \neg p && \textit{table } 6, \textit{De Morgan's Second Law}
\end{aligned}
$$

c)

- F
- F
- F
- T
- T

Answer 2

a) $\exists x(P(Can, x) \wedge T(x, L))$
b) $\forall x(T(x, L) \to \exists y(N(y, Turkish) \wedge P(y, x)))$
c) $\forall x \exists y \exists z(T(x, S) \wedge R(x, y) \wedge T(y, S) \wedge R(x, z) \wedge T(z, S) \wedge (y = z))$

d) $\exists y \exists z(W(M,y) \wedge \neg(P(z,y) \wedge N(z,English))$
e) $\forall z \exists x \exists y((x \neq y) \wedge N(x,Turkish) \wedge P(x,G) \wedge P(y,G) \wedge (P(z,G) \leftrightarrow (z \neq x \vee z = y)))$
f) $\exists x \exists y \exists z(T(x,y) \wedge T(x,z) \wedge (y \neq z))$

Answer 3

	$p \to q, (r \wedge s) \to p, (r \wedge \neg q) \vdash \neg s$	
1	$p \to q$	*premise*
2	$(r \wedge s) \to p$	*premise*
3	$(r \wedge \neg q)$	*premise*
4	r	$\wedge e, 3$
5	$\neg q$	$\wedge e, 3$
6	$r \wedge s$	*assumption*
7	p	$\to$e $2, 5$
8	q	$\to$e $1, 6$
9	$\bot$	$\neg$e $5, 8$
10	$\neg(r \wedge s)$	$\neg$i $6 - 9$
11	s	*assumption*
12	$r \wedge s$	$\wedge$i $4, 11$
13	$\bot$	$\neg$e $10, 12$
14	$\neg s$	$\neg$i $11 - 13$

Answer 4

- $\exists x(S(x) \to P(x))$
- $\forall x(P(x))$
- $\exists y S(y)$

	$\exists x(P(x) \to S(x)), \forall x(P(x)) \vdash \exists y S(y)$	
1	$\exists x(P(x) \to S(x))$	*premise*
2	$\forall x(P(x))$	*premise*
3	$P(c) \to S(c)$	*assumption*
4	$P(c)$	$\forall$e 2
5	$S(c)$	$\to$e $3, 4$
6	$\exists y S(y)$	$\exists$i 5
7	$\exists y S(y)$	$\exists$e $3 - 6$