Student Information

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Answer 1

1(a)

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

Hence, it is a contradiction.

1(b)

$$
\begin{aligned}
p \rightarrow ((q \vee \neg q) \rightarrow (p \wedge q)) &\equiv \neg p \vee ((q \vee \neg q) \rightarrow (p \wedge q)) && \text{By table 7 line 1} \\
&\equiv \neg p \vee (\neg(q \vee \neg q) \vee (p \wedge q)) && \text{By table 7 line 1} \\
&\equiv \neg p \vee ((\neg q \wedge q) \vee (p \wedge q)) && \text{By table 6 De Morgan's Laws} \\
&\equiv \neg p \vee (\mathrm{F} \vee (p \wedge q)) && \text{By table 6 Negation Laws} \\
&\equiv \neg p \vee (p \wedge q) && \text{By table 6 Identity Laws} \\
&\equiv (\neg p \vee p) \wedge (\neg p \vee q) && \text{By table 6 Distributive Laws} \\
&\equiv \mathrm{T} \wedge (\neg p \vee q) && \text{By table 6 Negation Laws} \\
&\equiv \neg p \vee q && \text{By table 6 Identity Laws}
\end{aligned}
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Answer 2

a) $\forall x \exists y (W(x, y))$
b) $\exists x \exists y \neg(F(x, y))$
c) $\forall x (W(x, P) \rightarrow A(Ali, x))$
d) $\exists y (W(Busra, y) \wedge F(TUBITAK, y))$
e) $\exists x \exists y \exists z (S(x, y) \wedge S(x, z) \wedge y \neq z)$
f) $\neg \exists y \exists x \exists z (W(x, y) \wedge W(z, y) \wedge x \neq z)$
g) $\exists x \exists y \exists z ((W(x, z) \wedge W(y, z) \wedge x \neq y) \wedge \forall t (W(t, z) \rightarrow (t = x \vee t = y)))$

Answer 3

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

Answer 4

$$p, p \to (q \land r), r \to s \vdash \neg(s \to \neg q)$$

1	p	*premise*
2	$p \to (q \land r)$	*premise*
3	$r \to s$	*premise*
4	$s \to \neg q$	*assumption*
5	$q \land r$	$\to e2, 1$
6	r	$\land$ e 5
7	s	$\to$e $3, 6$
8	$\neg q$	$\to$ e $4, 7$
9	q	$\land$e 5
10	$\perp$	$\neg$e $8, 9$
11	$\neg(s \to \neg q)$	$\neg$i $4 - 10$

Answer 5

1	$\forall x(P(x) \to (Q(x) \to R(x)))$	*premise*
2	$\exists x(P(x))$	*premise*
3	$\forall x(\neg R(x))$	*premise*
4	$Q(c)$	*assumption*
5	$P(c)$	*assumption*
6	$P(c) \to (Q(c) \to R(c))$	$\forall e1$
7	$Q(c) \to R(c)$	$\to$e $6, 5$
8	$Q(c)$	$copy4$
9	$R(c)$	$\to$e $7, 8$
10	$\neg R(c)$	$\forall e3$
11	$\perp$	$\neg$e $10, 9$
12	$\perp$	$\exists e2, 5 - 11$
13	$\neg Q(x)$	$\neg$i $4 - 12$
14	$\exists x(\neg Q(x))$	$\exists$i 13