Student Information

Full Name : Hasan Küreli
Id Number : 2580751

Answer 1

a)

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

So it is a contradiction.

b)

$p \implies ((q \vee \neg q) \implies (p \wedge q))$	
$\neg p \vee ((q \vee \neg q) \implies (p \wedge q))$	Table 7, Line 1
$\neg p \vee (T \implies (p \wedge q))$	Negation laws
$\neg p \vee (F \vee (p \wedge q))$	Table 7, Line 1
$\neg p \vee (p \wedge q)$	Identity laws
$(\neg p \vee p) \wedge (\neg p \vee q)$	Distributive laws
$T \wedge (\neg p \vee q)$	Negation laws
$\neg p \vee q$	Identity laws

Answer 2

a) $\forall x \exists y W(x, y)$

b) $\neg \forall y \exists x F(x, y)$

c) $\forall x (W(x, P) \implies A(Ali, x))$

d) $\exists y (W(Busra, y) \wedge F(TUBITAK, y))$

e) $\exists x \exists y_1 \exists y_2 (S(x, y_1) \wedge S(x, y_2) \wedge (y_1 \neq y_2))$

f) $\neg \exists x_1 \exists x_2 \exists y (W(x_1, y) \wedge W(x_2, y) \wedge (x_1 \neq x_2))$

g) $\exists x_1 \exists x_2 \exists y \forall x (W(x_1, y) \wedge W(x_2, y) \wedge (x_1 \neq x_2) \wedge ((x \neq x_1 \wedge x \neq x_2) \implies \neg W(x, y)))$

Answer 3

1	$p \implies q$	
2	$(q \land \neg r) \implies s$	
3	$\neg s$	
4	$\quad p$	
5	$\quad q$	$\Rightarrow$E, 1, 4
6	$\quad\quad \neg r$	
7	$\quad\quad q \land \neg r$	$\land$I, 5, 6
8	$\quad\quad s$	$\Rightarrow$E, 2, 7
9	$\quad\quad \bot$	$\neg$E, 3, 8
10	$\quad \neg\neg r$	$\neg$I, 6–9
11	$\quad r$	$\neg\neg$E, 10
12	$p \implies r$	$\Rightarrow$I, 4–11

Answer 4

1	p	
2	$p \implies (q \land r)$	
3	$r \implies s$	
4	$(q \land r)$	$\Rightarrow$E, 1, 2
5	r	$\land$E, 4
6	s	$\Rightarrow$E, 3, 5
7	$\quad s \implies \neg q$	
8	$\quad \neg q$	$\Rightarrow$E, 6, 7
9	$\quad q$	$\land$E, 4
10	$\quad \bot$	$\neg$E, 8, 9
11	$\neg(s \implies \neg q)$	$\neg$I, 7–10

Answer 5

1		$\forall x(P(x) \implies (Q(x) \implies R(x)))$	
2		$\exists x P(x)$	
3		$\forall x(\neg R(x))$	
4	d	$P(d)$	
5		$P(d) \implies (Q(d) \implies R(d))$	$\forall$E, 1
6		$Q(d) \implies R(d)$	$\Rightarrow$E, 4, 5
7		$Q(d)$	
8		$R(d)$	$\Rightarrow$E, 6. 7
9		$\neg R(d)$	$\forall$E, 3
10		$\bot$	$\neg$E, 8, 9
11		$\neg Q(d)$	$\neg$I, 7–10
12		$\exists x(\neg Q(x))$	$\exists$I, 11
13		$\exists x(\neg Q(x))$	$\exists$E, 2, 4–12