Student Information

Full Name : Amirmohammad Erfan
Id Number : 2546794

Answer 1

a)

Our statement is Tautology.

q	$\neg q$
T	F
F	T

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

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

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

b)

$\mathbf{p} \to ((\mathbf{q} \vee \neg\mathbf{p}) \to \mathbf{r})$

$\neg p \vee ((q \vee \neg p) \to r)$	First rule table seven
$\neg p \vee (\neg(q \vee \neg p) \vee r)$	First rule table seven
$(\neg p \vee \neg(q \vee \neg p)) \vee r$	Associative table six
$(\neg p \vee (\neg q \wedge \neg\neg p)) \vee r$	Demorgan table six
$(\neg p \vee (\neg q \wedge p)) \vee r$	Double Negation table six
$((\neg p \vee \neg q) \wedge (\neg p \vee p)) \vee r$	Distributive table six
$((\neg p \vee \neg q) \wedge T) \vee r$	Negation table six
$(\neg p \vee \neg q) \vee r$	Identity table six
$\neg(p \wedge q) \vee r$	Demorgan table six
$(p \wedge q) \to r$	First rule table seven

c)

1. F **2.** F **3.** F **4.** T **5.** T

Answer 2

a) $\exists x(P(can, x) \wedge T(x, L))$
b) $\forall x \exists y(T(x, s) \to P(y, x) \wedge N(y, turk))$
c) $\forall x(T(x, S) \to \exists y \forall z(R(x, y) \wedge (T(z, S) \wedge (T(y, S) \wedge (R(x, z) \to y = z)))$
d) $\forall x \exists y(P(y, x) \wedge N(y, english) \to \neg W(M, x))$
e) $\exists x \exists y(N(x, turk) \wedge N(y, turk) \wedge T(x, G) \wedge T(y, G) \wedge x \neq y \wedge \forall p(T(p, G) \wedge N(p, Turk) \to p = x \vee p = y))$
f) $\exists x \exists y \exists z((T(x, y) \wedge T(x, z)) \wedge y \neq z)$

Answer 3

1.	$p \rightarrow q$	premise
2.	$(r \wedge s) \rightarrow p$	premise
3.	$(r \wedge \neg q)$	premise
4.	r	$\wedge$e, 3
5.	$\neg q$	$\wedge$e, 3
6.	s	assume
7.	$r \wedge s$	$\wedge$i, 4, 6
8.	p	$\rightarrow$e, 2, 7
9.	q	$\rightarrow$e, 1, 8
10.	$\neg q$	copy, 5
11.	$\bot$	$\neg$e, 9, 10
12.	$\neg s$	$\neg$i, 6-11

Answer 4

$$\exists x (P(x) \rightarrow S(x)), \forall x P(x) \vdash \exists x S(x)$$

Proof:

1.	$\exists x (P(x) \rightarrow S(x))$	**premise**
2.	$\forall x P(x)$	**premise**
3.	$P(a) \rightarrow S(a)$	**assume**
4.	$P(a)$	$\forall$**e, 2**
5.	$S(a)$	$\rightarrow$**e, 3, 4**
6.	$\exists x S(x)$	$\exists$**i, 5**
7.	$\exists x S(x)$	$\exists$**e, 3-6**