Student Information

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Answer 1

a)

p	q	$\neg p$	$q \to \neg p$	$p \leftrightarrow q$	$(q \to \neg p) \leftrightarrow (p \leftrightarrow q)$
T	T	F	F	T	F
T	F	F	T	F	F
F	T	T	T	F	F
F	F	T	T	T	T

b)

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

Since at the end we reach all True's, then this means that we found tautology.

Answer 2

We need to prove $\neg p \to (q \to r) \equiv q \to (p \vee r)$:
$\quad \neg p \to (q \to r)$
$\equiv p \vee (q \to r)$ logical eqv. implication elim.
$\equiv p \vee (\neg q \vee r)$ logical eqv. implication elim.
$\equiv \neg q \vee (p \vee r)$ assosiative law
$\equiv q \to (p \vee r)$ logical egv. implicaton introduction

Answer 3

a) ∀x L(x,Burak)
b)∀y L(Hazal,y)
c)∀x∃y L(x,y)

d)$\neg\exists$x ($\forall$y L(x,y))
e)
f)$\neg\exists$x (L(x,Burak) $\wedge$ L(x,Mustafa))
g)$\exists$x$\exists$y (L(Ceren,x) $\wedge$ L(Ceren,y) $\wedge$ (x $\neq$ y))$\wedge$ $\forall$z (L(Ceren,z) $\rightarrow$ ((z=x) $\vee$ (z=y)))
h)$\forall$x (($\exists$y L(x,y)) $\wedge$ $\forall$z(L(x,z) $\rightarrow$ (z=y)))
i)$\forall$x $\neg L(x,x)$
j) $\exists$x$\exists$y (L(x,y) $\wedge$ y $\neg$x) $\wedge$ $\forall$z(L(x,z) $\wedge$ (z=y) $\wedge$ (z$\neq$x))

Answer 4

1	p $\rightarrow$ (r $\rightarrow$ q)	*premise*
2	q $\rightarrow$ s	*premise*
3	p	*premise*
4	r $\rightarrow$ q	$\rightarrow$e 1,3
5	q	*Assumption*
6	r	*Assumption*
7	q	$\rightarrow e, 4$
8	$\perp$	$\neg e, 2, 5$
9	$\neg r$	$\neg i, 6-8$
10	$\neg r \vee s$	$\vee i$,9
11	.$\neg q \rightarrow (s \vee \neg r)$	$\rightarrow$i,5-10

Answer 5

1		$\forall x(p(x) \to q(x))$	*premise*
2		$\exists x \neg r(x)$	*premise*
3		$\exists x(p(x) \land q(x))$	*premise*
4		$\neg r(a)$	*Assumption*
5	c	$p(c) \lor r(a)$	*Assumption*
6		p(c)	*Assumption*
7		p(c)	copy
8		r(a)	*Assumption*
9		$\perp$	$\neg e, 4, 8$
10		p(c)	$\perp e, 9$
11		p(c)	$\lor e, 5, 6-7, 8-10$
12		$\forall y(p(y) \to q(y))$	$\forall xe, 1$
13		$p(c) \to q(c)$	$\forall xe, 12$
14		q(c)	$\to e, 11, 13$
15		$\exists z q(z)$	$\exists zi, 5-14$
16		$\exists z q(z)$	$\exists ze, 4-15$