Student Information

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Answer 1

Table 1: Answer 1.1

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

Table 2: Answer 1.2

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

Answer 2

$$
\begin{aligned}
\neg p \to (q \to r) &\equiv \neg\neg p \vee (q \to r) && \textit{Using Table 7} \\
&\equiv p \vee (q \to r) && \textit{Double Negation Law} \\
&\equiv p \vee (\neg q \vee r) && \textit{Using Table 7} \\
&\equiv \neg q \vee (p \vee r) && \textit{Associative Laws} \\
&\equiv \neg\neg q \to (p \vee r) && \textit{Using Table 7} \\
&\equiv q \to (p \vee r) && \textit{Double Negation Law}
\end{aligned} \tag{1}
$$

Answer 3

(a) $\forall x L(x, Burak)$
(b) $\forall x L(Hazal, x)$
(c) $\forall x \exists y L(x, y)$
(d) $\neg(\exists y \forall x L(y, x))$
(e) $\forall x \exists y L(y, x)$
(f) $\neg(\exists x(L(x, Burak) \land L(x, Mustafa)))$
(g) $\exists x \exists y(L(Ceren, x) \land L(Ceren, y) \land \forall z(L(Ceren, z) \rightarrow ((z = x) \lor (z = y))) \land (x \neq y))$
(h) $\exists x(\forall y L(y, x) \land \forall z(\forall k L(k, z) \rightarrow (z = x)))$
(i) $\neg(\exists x(L(x, x)))$
(j) $\exists x \exists y(L(x, y) \land (y \neq x) \land \forall z((L(x, z) \land z \neq x) \rightarrow (z = y)))$

Answer 4

Table 3: Answer 4

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

Answer 5

Table 4: Answer 5

1.	$\forall x(p(x) \to q(x))$	*premise*
2.	$\neg(\exists z r(z))$	*premise*
3.	$\exists y p(y) \lor r(a)$	*premise*
4.	$r(a)$	*assumption*
5.	$\neg(\exists z q(z))$	*assumption*
6.	$\exists z r(z)$	$\exists i$, *4*
7.	$\bot$	$\neg e$, *2, 6*
8.	$\neg\neg(\exists z q(z))$	$\neg i$, *5-7*
9.	$\exists z q(z)$	$\neg\neg e$, *8*
10.	$\exists y p(y)$	*assumption*
11.	$p(c)$	*assumption*
12.	$p(c) \to q(c)$	$\forall e$, *1*
13.	$q(c)$	$\to e$, *11, 12*
14.	$\exists z q(z)$	$\exists i$, *13*
15.	$\exists z q(z)$	$\exists e$, *10, 11-14*
16.	$\exists z q(z)$	$\lor e$, *3, 4-9, 10-15*