CS 381 Solutions to Homework 3

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p	q	r	p ∧ q	q ∧ r	(p ∧ q) ∧ r	p ∧ (q ∧ r)
F	F	F	F	F	F	F
F	F	T	F	F	F	F
F	T	F	F	F	F	F
F	T	T	F	T	F	F
T	F	F	F	F	F	F
T	F	T	F	F	F	F
T	T	F	T	F	F	F
T	T	T	T	T	T	T

4 (b) is the label for this table (to the left of the p column).

8 (a) Kwame will not take a job in industry, and will not go to grad school.
(c) James is not young or not strong.

12 (b) $[(p \rightarrow q) \wedge (q \rightarrow r)] \leftrightarrow (\neg p \vee q) \wedge (\neg q \vee r)$
$\leftrightarrow [(\neg p \vee q) \wedge \neg q] \vee [(\neg p \vee q) \wedge r]$
$\leftrightarrow (\neg p \wedge \neg q) \vee [(\neg p \vee q) \wedge r]$
$\leftrightarrow [(\neg p \wedge \neg q) \vee (\neg p \vee q)] \wedge [(\neg p \wedge \neg q) \vee r]$
$\leftrightarrow [(\neg p \wedge \neg q) \vee (\neg p \vee q)] \wedge (\neg p \vee r) \wedge (\neg q \vee r)$
$\rightarrow (\neg p \vee r)$
$\leftrightarrow (p \rightarrow r)$

(c) $[p \wedge (p \rightarrow q)] \leftrightarrow [p \wedge (\neg p \vee q)] \leftrightarrow [(p \wedge \neg p) \vee (p \wedge q)] \leftrightarrow (p \wedge q) \rightarrow q$

35 (a) $p \vee \neg q \vee \neg r$
(c) $(p \wedge T) \vee (q \wedge F)$

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4(a) Simplification
(b) Disjunctive Syllogism
(c) Modus Ponens
(d) Addition
(e) Hypothetical Syllogism

6. (1) The trophy was not awarded. (given)
(2) If the sailing race is held, then the trophy is awarded. (given)
(3) The sailing race was not held. (from (1) and (2) by Modus Tollens)
(4) The sailing race was not held or the lifesaving demo did no go on (from (3) by Addition)
(5) It is not the case that sailing race was held and the lifesaving demo went on. (from (4) by De Morgan)
(6) If it does not rain or it is not foggy, then the sailing race is held and the life saving demo will go on. (given)
(7) It is not the case that it did not rain or it was not foggy. (fron (5) and (6) by Modus Tollens).
(8) It rained and it was foggy. (from (7) by De Morgan)
(9) It rained. (from (8) by Simplification)
Hence if the trophy was not awarded, it rained.