David Wang

# HW 1

3a.) $p \vee q \equiv q \vee p$

| $p$ | $q$ | $p \vee q$ | $p \vee q \rightarrow q \vee p$ | $q \vee p$ |
|---|---|---|---|---|
| T | T | T | T | T |
| F | T | T | T | T |
| T | F | T | T | T |
| F | F | F | T | F |

3b.) $p \wedge q \equiv q \wedge p$

| $p$ | $q$ | $p \wedge q$ | $p \wedge q \rightarrow q \vee p$ | $q \wedge p$ |
|---|---|---|---|---|
| T | T | T | T | T |
| F | T | F | T | F |
| T | F | F | T | T |
| F | F | F | T | T |

6.) $\neg(p \wedge q) \equiv \neg p \vee \neg q$

| $p$ | $q$ | $\neg p \vee \neg q \equiv \neg(p \wedge q)$ |
|---|---|---|
| F | F | T |
| T | F | T |
| T | T | F |

9.) $(p \wedge q) \rightarrow (p \rightarrow q)$

| $p$ | $q$ | $(p \wedge q) \rightarrow (p \rightarrow q)$ |
|---|---|---|
| F | F | T |
| F | T | T |
| T | F | T |
| T | T | T |

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23.) $(p \to r) \wedge (q \to r) \equiv (p \vee q) \to r$

$\neg(p \to r) \wedge (q \to r))$

$\neg(p \to r) \wedge \neg(q \to r)$

$(p \vee q) \to r$

25) $(p \to r) \vee (q \to r) \longleftrightarrow (p \wedge q) \to r$

$\neg(p \to r) \vee \neg(q \to r)$

$p \wedge q \to r$

$(p \to r) \vee (q \to r)$ is F only when both are F, and when r is F both are T

$p \wedge q \to r$ is the same because p and q implies r

27.) $p \leftrightarrow q \equiv (p \to q) \wedge (q \to r)$

For $p \leftrightarrow q$ both p and q must be F or T for $p \leftrightarrow q$ to be T

$(p \to q) \wedge (q \to r)$ is the same because $p \to q$ and $q \to p$ are true only when p and q are true

31.) $(p \to q) \to r \equiv p \to (q \to r)$

| p | q | r | $p \to q$ | $(p \to q) \to r$ | $q \to r$ | $p \to (q \to r)$ |
|---|---|---|---|---|---|---|
| T | T | T | T | T | T | T |
| T | T | F | T | F | F | F |
| T | F | T | F | T | T | T |
| T | F | F | F | T | T | T |
| F | T | T | T | T | T | T |
| F | T | F | T | F | F | T |
| F | F | T | F | T | T | T |
| F | F | F | T | F | T | T |

when ~~q, r, and~~

$p = F$, $q = T$, $r = F$ the proposition are

<u>not</u> logically consistent