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1. Because the waiter asked, "Does everyone want coffee?" The first person that exclaims, "not everyone wants coffee." Knows this because they, themselves, do not want it. If the girls before Hillary knew they didn't want any, they would have said, "Not everyone wants coffee." before her. The first person that does not want any will be able to say "Not everyone wants coffee." So, Aly and Meredith will want the coffee and Hillary will not.

2. a. $p \wedge q \equiv \neg(p \rightarrow \neg q)$

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

$\equiv$

$p \wedge q \equiv \neg(p \rightarrow \neg q)$

$\neg(p \rightarrow \neg q) \equiv \neg(\neg p \vee \neg q)$ ← RBI

$\neg(\neg p \vee \neg q) \equiv p \wedge q$ ← De Morgan's Law

b. $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$

Truth table other page

b.

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

$p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q) \equiv$

$p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$ def. of Biconditional

$\equiv (\neg p \vee q) \wedge (\neg q \vee p)$ RBI

$\equiv ((\neg p \vee q) \wedge \neg q) \vee ((\neg p \vee q) \wedge p)$ distributive

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

$\equiv ((\neg q \wedge \neg p) \vee \mathbf{F}) \vee (\mathbf{F} \vee (p \wedge q))$ negation Laws

$\equiv ((\neg q \wedge \neg p) \vee \mathbf{F}) \vee ((p \wedge q) \vee \mathbf{F})$ commutative laws

$\equiv (\neg q \wedge \neg p) \vee (p \wedge q)$ Identity Laws

$\equiv (p \wedge q) \vee (\neg p \wedge \neg q)$ Commutative laws x 2

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

3a. We know that for a disjunction to be true, one of the propositions ~~[illegible]~~ need to be true or both need to true. If we want a contradiction, both R and S need to contain only false truth values. Therefore, we know both R and S are contradictions.

b. We know that for a conjunction to be true, both propositions need to be true in their truth values. Therefore, we can assume both R and S are completely true in all truth values and are both tautolgies. We also know that a conjunction that is a tautology needs to be true in all truth values.

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