Discrete Math — Homework 1 Solutions

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Q1

propositions: a, b
proposition a is *true*.
proposition b is *false*.

Q2

(a) $p \to q$ means if u have the flu, u'll miss the final examination.

(b) $\neg p \leftrightarrow r$ means u don't have the flu if and only if u pass the course.

(c) $q \to \neg r$ means if u miss the final examination, then u won't pass the course.

(d) $(p \to \neg r) \vee (q \to \neg r)$ means either your having the flu or your missing the fianl examination will make u fail the course.

(e) $(p \wedge q) \vee (\neg q \wedge r)$ means either u have the flu and miss the final examination or u don't miss the final exam and pass the course.

Q3

see another paper

Q4

(a) $11000 \wedge (01101 \vee 11011) = 11000 \wedge 11111 = 11000$

(b) $(01111 \wedge 10101) \vee 01000 = 00101 \vee 01000 = 01101$

(c) $(01010 \oplus 11011) \oplus 01000 = 10001 \oplus 01000 = 11001$

(d) $(11011 \vee 01010) \wedge (10001 \vee 11011) = 11011 \wedge 11011 = 11011$

Q5

(a) $q \to p$

(b) $q \wedge \neg p$

(c) $q \to p$

Q6

(a) because both types of cannibals will answer *No*.

(b) if i were to ask u whether u are a liar, what would u say?

Q7

(a) $(p \wedge q) \to p \iff (\neg p \vee \neg q) \vee p \iff true$

(b) $p \to (p \vee q) \iff \neg p \vee (p \vee q) \iff (\neg p \vee p) \vee q \iff true$

(c) $\neg p \to (p \to q) \iff p \vee (\neg p \vee q) \iff (p \vee \neg p) \vee q \iff true$

(d) $(p \wedge q) \to (p \to q) \iff \neg p \vee \neg q \vee (\neg p \vee q) \iff true$

(e) $\neg(p \to q) \to p \iff \neg(\neg p \vee q) \to p \iff (\neg p \vee q) \vee p \iff true$

(f) $\neg(p \to q) \to \neg q \iff (\neg p \vee q) \vee \neg q \iff true$

Q8

(a) $(p \vee \neg q) \wedge (\neg p \vee q) \wedge (\neg p \vee \neg q) \iff (\neg p \to \neg q) \wedge (p \to q) \wedge (p \to \neg q)$, so when p is *false* and q is *false*, the proposition is true.

(b) $(p \to q) \wedge (p \to \neg q) \wedge (\neg p \to q) \wedge (\neg p \to \neg q)$ when p is *true*, q contradicts with $\neg q$; when p is *false*, q still contradicts with $\neg q$. Thus, this proposition is not satisfiable.

(c) $(p \leftrightarrow q) \wedge (\neg p \leftrightarrow q)$ means q has the same truth value with both q and $\neg q$ which leads to a contradiction. Thus, this proposition is not satisfiable.