

Discrete Math — Homework 1 Solutions

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Q1

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

Q2

- (a) $p \rightarrow q$ 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) $q \rightarrow \neg r$ means if u miss the final examination, then u won't pass the course.
- (d) $(p \rightarrow \neg r) \vee (q \rightarrow \neg r)$ 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) $q \rightarrow p$
- (b) $q \wedge \neg p$
- (c) $q \rightarrow p$

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) $(p \wedge q) \rightarrow p \iff (\neg p \vee \neg q) \vee p \iff \text{true}$
- (b) $p \rightarrow (p \vee q) \iff \neg p \vee (p \vee q) \iff (\neg p \vee p) \vee q \iff \text{true}$
- (c) $\neg p \rightarrow (p \rightarrow q) \iff p \vee (\neg p \vee q) \iff (p \vee \neg p) \vee q \iff \text{true}$
- (d) $(p \wedge q) \rightarrow (p \rightarrow q) \iff \neg p \vee \neg q \vee (\neg p \vee q) \iff \text{true}$
- (e) $\neg(p \rightarrow q) \rightarrow p \iff \neg(\neg p \vee q) \rightarrow p \iff (\neg p \vee q) \vee p \iff \text{true}$
- (f) $\neg(p \rightarrow q) \rightarrow \neg q \iff (\neg p \vee q) \vee \neg q \iff \text{true}$

Q8

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