

CS 180 Homework 1  
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**Question 1.**

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I, Dwijen Chawra, affirm that I have not given or received any unauthorized help on this assignment and that this work is my own. What I have submitted is expressed and explained in my own words. I have not used any online websites that provide a solution. I will not post any parts of this problem set to any online platform and doing so is a violation of course policy.

**Question 2.**

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$p$	$q$	$r$	$(\neg r \rightarrow q)$	$(p \vee \neg r)$	$(\neg r \rightarrow q) \leftrightarrow (p \vee \neg r)$
F	F	F	F	T	F
F	F	T	T	F	F
F	T	F	T	T	T
F	T	T	T	F	F
T	F	F	F	T	F
T	F	T	T	T	T
T	T	F	T	T	T
T	T	T	T	T	T

**Question 3.**

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$$(q \vee \neg q) \rightarrow \neg(\neg p \vee p)$$

**Question 4.**

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

**Question 5.**

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(a)  $(p \wedge q) \vee (\neg p \vee q)$

Counter example: When p and q are F, then the proposition is F.

(b)  $(p \wedge q) \rightarrow (p \vee q)$

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

$$\neg p \vee q \vee (p \vee q) \qquad \text{De Morgan}$$

$$\neg p \vee p \vee q \vee q \qquad \text{Commutative Property}$$

$$T \vee q \vee q \qquad \text{Negation Law}$$

$$T \vee q \qquad \text{Domination Law}$$

$$T \qquad \text{Domination Law}$$

(c)  $(p \vee \neg q) \rightarrow q$

$$\neg(p \vee \neg q) \vee q \qquad p \rightarrow q \equiv \neg p \vee q$$

$$\neg p \wedge \neg \neg q \vee q \qquad \text{De Morgan}$$

$$\neg p \wedge q \vee q \qquad \text{Double Negation}$$

Counter Example, when p is T and q is F, the proposition is F.

(d)  $(p \rightarrow q) \leftrightarrow q$

$$\neg(p \vee \neg q) \vee q \qquad p \rightarrow q \equiv \neg p \vee q$$

$$\neg p \wedge \neg \neg q \vee q \qquad \text{De Morgan}$$

$$\neg p \wedge q \vee q \qquad \text{Double Negation}$$

**Question 8.**

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- (a) Yes, because we know that
- (b)