CS-210 Discrete Mathematics

Problem Set 1

1. Suppose the following two propositions are both **False**.

   - If the student has passed Calculus, then he is registered for Discrete Math.
   - The student has not passed Programming.

   Determine the truth value of the following propositions. Just list the truth value.

   (a) The student has passed Programming and he is registered for Discrete Math.

   (b) The student has passed Calculus and he has passed Programming.

   (c) The student is not registered for Discrete Math or he has passed Programming.

   (d) If the student is not registered for Disc. Math, then the student has not passed Calc..

   (e) If the student is registered for Discrete Math, then he has passed Programming.

   (f) If the student has not passed Calculus, then he is not registered for Discrete Math.

   (g) If the student is registered for Discrete Math, then he has passed Calculus.

   (h) The student has passed Programming if and only if he has passed Calculus.

   (i) The student has passed Programming or he has passed Calculus but not both.

   (j) The student has passed Programming or he has passed Calculus or he is registered for Discrete Math.

2. Show the following equivalences using using logical equivalence laws.

   (a) Show that $(P \to R) \vee (Q \to R) \equiv (P \wedge Q) \to R$

   (b) Show that $P \wedge (Q \vee R) \equiv (P \wedge Q) \vee (P \wedge R)$.

   (c) Show that $\neg[\neg[(P \vee Q) \wedge R] \vee \neg Q] \equiv Q \wedge R$

   (d) Show that $(P \vee Q \vee R) \wedge (P \vee T \vee \neg Q) \wedge (P \vee \neg T \vee R) \equiv P \vee [R \wedge (T \vee \neg Q)]$

3. Let A, B and C be propositions. Using truth table show that the following is a logical equivalence. $(\neg A \vee B) \wedge (\neg B \vee C) \wedge (\neg C \vee A) \wedge (\neg A \vee \neg B \vee \neg C) \equiv (\neg A \wedge \neg B \wedge \neg C)$.

A	B	C					LHS	RHS

4. Use Truth tables to see if the following statements are true :

   (a) $P \to (Q \wedge R) \equiv (Q \to P) \wedge (P \to R)$
   (b) $(P \vee Q) \to R \equiv [(P \to R) \wedge (Q \to R)]$
   (c) $[P \to (Q \vee R)] \equiv [\neg R \to (P \to Q)]$

5. Complete the following truth table:

p	q	r	$\overbrace{p \to (q \to r)}^{s}$	$\overbrace{(p \to q) \to (p \to r)}^{t}$	$s \to t$