COMPUTER SCIENCE E-20, SPRING 2014
In-class Problems - Group 5 (Rachna Sha)
7.1 (a) ,(b)

1. Put the following formula in disjunctive normal form: $(p \leftrightarrow q) \wedge r$.

   Solution:

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

2. Put the following formula in disjunctive form: $(p \wedge q) \rightarrow (r \vee q)$. Solution:

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