Homework 4

1. For the following:

   (a) $(P \rightarrow Q) \wedge \neg Q \wedge \neg P$,
   (b) $(P \rightarrow Q) \rightarrow ((Q \rightarrow S) \rightarrow ((P \vee Q) \rightarrow R))$,
   (c) $\neg (P \rightarrow Q) \leftrightarrow ((P \vee Q) \wedge (\neg P \rightarrow Q))$,
   (d) $(P \leftrightarrow Q) \leftrightarrow (\neg (P \rightarrow \neg Q))$

   (a) establish whether they are valid, invalid, satisfiable or unsatisfiable,

   (b) obtain their DNF equivalent from the truth table,

   (c) transform them into their equivalent negation normal form (NNF),

   (d) obtain their DNF and CNF by transformations.

2. For the following formulae, give their DNF and CNF:

   (a) $(\neg P \rightarrow (Q \wedge R)) \rightarrow ((Q \vee \neg R) \leftrightarrow P)$;

   (b) $(P \vee \neg Q \vee (R \leftrightarrow S)) \leftrightarrow (S \wedge Q)$;

   (c) $(P \leftrightarrow (P \wedge Q)) \rightarrow \neg Q$;

   (d) $\neg (\neg P \vee Q \vee R) \vee (Q \rightarrow (P \vee \neg R))$;

   (e) $(\neg P \vee Q \vee R) \wedge (P \vee \neg R) \wedge (\neg Q \vee \neg R) \wedge \neg (P \wedge R)$.