1. Which of these are propositions? What are the truth values of those that are propositions?
   (a) Either Smith or Sara will do the homework.
   (b) There is no Chinese or Korean player on this basketball team.
   (c) What is your favourite team?
   (d) I would like coffee with cream and sugar.
   (e) 3 + 5 = 7.
   (f) Put on your jacket or youll catch a cold.
   (g) Do you like my new shoes?
   (h) The sky is purple.
   (i) There is a number that is larger than infinity.
2. Evaluate the following:
   (a) $(T \vee T) \wedge F$
   (b) $T \vee T \wedge F$
   (c) $T \vee \neg T \wedge F$
   (d) $(T \oplus \neg F) \rightarrow F$
   (e) $(F \vee \neg F) \leftrightarrow (T \wedge F)$
3. Construct truth tables for the following.
   (a) $\neg p \vee \neg q$
   (b) $(p \vee \neg q) \rightarrow r$
4. Let p and q be the propositions

   p : It is below freezing.
   q : It is snowing.

   Write these propositions using p and q and logical connectives (including negations).
   (a) It is below freezing and snowing.
   (b) It is below freezing but not snowing.
   (c) It is not below freezing and it is not snowing.
   (d) It is either snowing or below freezing (or both).
   (e) If it is below freezing, it is also snowing.
   (f) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing.

(g) That it is below freezing is necessary and sufficient for it to be snowing.

5. Let p and q be the propositions

p : I bought a lottery ticket this week.
q : I won the million dollar jackpot.

Express each of these propositions as an English sentence.

(a) $\neg p$

(b) $p \vee q$

(c) $p \rightarrow q$

(d) $p \wedge q$

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

(f) $p \leftrightarrow q$

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

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

6. Using the truth table show the following:

(a) $p \oplus q \equiv \neg(p \leftrightarrow q)$

(b) $(p \rightarrow q) \rightarrow r \not\equiv p \rightarrow (q \rightarrow r)$

(c) $(p \vee q) \wedge r \equiv (p \wedge r) \vee (q \wedge r)$.

(d) $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r) \equiv True$ (tautology)