1. Which of the following are correct?
   a. $(A \wedge B) \models (A \Leftrightarrow B)$
   b. $A \Leftrightarrow B \models \neg A \vee B$
   c. $(C \vee (\neg A \wedge \neg B)) \equiv ((A \Rightarrow C) \wedge (B \Rightarrow C))$.
   d. $(A \vee B) \wedge \neg(A \Rightarrow B)$is satisfiable

   $KB \models \alpha$ if and only if $M(KB) \subseteq M(\alpha)$

   a. $(A \wedge B) \models (A \Leftrightarrow B)$ is true because the left-hand side has exactly one model that is one of the two models of the right-hand side.□
   b. $A \Leftrightarrow B \models \neg A \vee B$ is true because the RHS is $A \Rightarrow B$, one of the conjuncts in the definition of $A \Leftrightarrow B$. □
   c. $(C \vee (\neg A \wedge \neg B)) \equiv ((A \Rightarrow C) \wedge (B \Rightarrow C))$ is true; proof by truth table enumeration, or by application of distributivity (Fig 7.11). □

      LHS = $(C \vee (\neg A \wedge \neg B))$
      $= (C \vee \neg A) \wedge (C \vee \neg B)$
      $= (\neg A \vee C) \wedge (\neg B \vee C)$
      $= (A \Rightarrow C) \wedge (B \Rightarrow C)$

   d. If a sentence α is true in model m, we say that m satisfies α or sometimes m is a model of α.

      $(A \vee B) \wedge \neg (A \Rightarrow B)$
      $= (A \vee B) \wedge \neg (\neg A \vee B)$
      $= (A \vee B) \wedge (A \wedge \neg B)$
      $= (A \wedge A \wedge \neg B) \vee (B \wedge A \wedge \neg B)$
      $= A \wedge \neg B$

      $(A \vee B) \wedge \neg(A \Rightarrow B)$ is satisfiable; model has A and $\neg B$.

2. Consider a vocabulary with only four propositions, A, B, C, and D. How many models are there for the following sentences?
   a. $B \vee C$
   b. $\neg A \vee \neg B \vee \neg C \vee \neg D$
   c. $(A \Rightarrow B) \wedge A \wedge \neg B \wedge C \wedge D$

   These can be computed by counting the rows in a truth table that come out true, but each has some simple property that allows a short-cut:

   a. Sentence is false only if B and C are false, which occurs in 4 cases for A and D, leaving 12. □
   b. Sentence is false only if A, B, C, and D are false, which occurs in 1 case, leaving 15. □
   c. The last four conjuncts specify a model in which the first conjunct is false, so 0. □