IS 2935/TEL 2810 Introduction to Computer Security  
Homework 1  
Due Date: By Midnight September 10, 2004

1. [30 Points] Do the following problems from Chapter 1, Section 1.12: 1, 4, 7

2. [50 Points] Exercise on Propositional/Predicate logic & Induction

   1. Show that \( p \rightarrow q \) is equivalent to \( \neg p \lor q \) using truth table.
   2. Do the following from Exercise 34.4 (page 956-957): 2(a), 2(b), 3, 4(a), 4(b)

3. [20 Points] Exercise on Lattice

   Let \( S_n \) denote a set of all binary numbers containing \( n \) digits. For \( a \in S_n \), we can write \( a = a_1 \ a_2 \ldots \ a_n \) where \( a_i \)'s are binary digits. Let relation \( \preceq \) be the “dominance” relation on \( S_n \). For every \( a, b \in S_n \) we say \( a \) is dominated by \( b \) (written as \( a \preceq b \)) if \( a_i \leq b_i \) for all \( i = 1 \) to \( n \) (here \( \leq \) is the “less than or equal to” relation on binary digits, i.e., \( 0 \leq 0, 0 \leq 1, 1 \leq 1 \))

   For example \( S_1 = \{ 0, 1 \} \); Here \( 0 \preceq 1 \). As a lattice diagram, it can be represented as

   \[
   \begin{array}{c}
   1 \\
   \bullet \\
   0 \\
   \end{array}
   \]

   Similarly, \( S_2 = \{ 00, 01, 10, 11 \} \) (set of all binary numbers containing 2 digits). The lattice formed by \( \preceq \) over \( S_3 \) can be represented as

   \[
   \begin{array}{c}
   11 \\
   \bullet  \\
   10 \\
   \bullet  \\
   01 \\
   \bullet  \\
   00 \\
   \end{array}
   \]

   Does relation \( \preceq \) over \( S_3 \) form a total ordering or partial ordering? Represent the ordering diagrammatically (as above and as was done in class).