CSE 321: Discrete Structures Spring 2004

Problem Set 1

Due Friday, April 9, 2004, in class

Reminder: If you haven't done so already, subscribe to CSE 321 mailing list ASAP by following the link from the course webpage `http://www.cs.washington.edu/321`.

Instructions: Information on the collaboration policy and honor code in solving problem sets can be found off the course webpage — **please be sure to read it**. In a nutshell, you are allowed to collaborate with fellow students taking the class to the extent of discussing solution ideas, *provided you think about each problem on your own for at least 20 minutes*. You must write down solutions on your own, and must clearly ackowledge each person with whom you dicussed the solutions. You are expected to refrain from looking up solutions from websites or other literature, and you should never be in possession of someone else's written solutions.

Please be as clear as possible in your arguments and answers. Poorly written solutions, even if more or less correct, will be penalized.

All exercise numbers refer to the number in Rosen's book, 5th Edition.

1. Section 1.1, Exercise 10.
2. Section 1.1, Exercise 44.
3. Section 1.1, Exercise 58.
4. Tautologies and Logical Equivalence: Section 1.2, Exercises 8d, 24, 28.
5. Section 1.2, Exercise 36.
6. State in English the converse and contrapositive of each of the following implications:
   (a) If job A arrives at the printer before job B, then A will be printed before B.
   (b) If the Red Sox and Mariners both make the playoffs, then either the Yankees or the Athletics will not make the playoffs.
7. Show how to swap the contents of two n-bit registers using no extra storage and only the bit operators $\wedge, \vee$, and $\oplus$. For an example of the use of these operations, if register 1 contains X and register 2 contains Y, then you can perform the bitwise XOR of X and Y and store the result in register 1. After this, the contents of register 1 is $X \oplus Y$ and the contents of register 2 is Y.
8. * **(Optional problem for fun, doesn't bear any direct relation to current topics of discussion)**
   Suppose we start out with an $n \times n$ chessboard where some number k of cells are *infected*. The infection spreads in the following manner: if a square has two or more infected neighbors, then it becomes infected itself. (Neighbors are orthogonal only, so each square has at most 4 neighbors.) The process continues till the infection can spread no more. Prove that if at the end of this process all squares in the board are infected, then it must be that $k \geq n$.