CSE 321: Discrete Structures
Assignment #1
October 1, 2004
Due: Friday, October 8

Reading Assignment: Read Sections 1.1 - 1.4 carefully (make sure that you understand the examples).

Note: All exercise numbers refer to the 5th edition of the Rosen book.

Problems:

1. Section 1.1, exercise 10.
2. Section 1.1, exercise 18, parts a, b, c, d.
3. State in English the converse and contrapositive of each of the following implications:
   (a) If a is pushed onto the stack before b, then b is popped before a.
   (b) If the input is correct and the program terminates, then the output is correct. (Be sure to use De Morgan's Law to simplify the contrapositive.)
4. Section 1.1, exercise 56.
5. The following two statements form the basis of the most important methods for automated theorem proving. Use truth tables to prove that they are tautologies.
   (a) Resolution: $((p \vee q) \wedge (\neg q \vee r)) \rightarrow (p \vee r)$
   (b) Modus ponens: $((p \wedge (p \rightarrow q)) \rightarrow q$
6. Show that Modus ponens is a tautology without using a truth table. Show each step and indicate which logical equivalences you use.
7. Section 1.2, exercise 20.
8. **Extra Credit:** You have two memory registers, each with the same number of bits. You have an operation, `XOR(R1,R2)`, which takes two registers, `R1` and `R2`, performs bitwise $\oplus$ between them, and stores the result in `R1`. Show how you can swap the contents of the two registers using a sequence of `XOR`s without temporary memory registers. Explain why this works.