CSE 321: Discrete Structures | Assignment #1
January 3, 2007 | Due: Friday, January 12

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

Problems:

1. Section 1.1, exercise 10
2. Section 1.1, exercise 18, parts (a) to (e) [5th edition: exercise 16]
3. State in English the converse and contrapositive of each of the following impliations:
   (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 58 [5th edition: exercise 54]
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 22 [5th edition: exercise 20]
8. Give the negation of each of the following statements:
   - All good students study hard.
   - No students in mathematics are unable to use a computer.
   - $\forall x \exists y\ x = y^2$
9. Prove or disprove the claim that the compound proposition $\forall x\, P(x) \vee \forall x\, Q(x)$ is logically equivalent to $\forall x\, (P(x) \vee Q(x))$
10. Section 1.3, exercise 62 [5th edition: exercise 58]
11. Prove or disprove the claim that the proposition $\forall x\, (P(x) \rightarrow Q(x))$ is logically equivalent to $\forall x\, P(x) \rightarrow \forall x\, Q(x)$

(more on other side)

12. Section 1.4, exercise 8

13. Determine the truth value of $\exists x \forall y (x \leq y^2)$ when the universe of discourse is the

    (a) Positive reals

    (b) Non-negative reals

    (c) Positive integers

    (d) Non-negative integers

14. Section 1.4, exercise 52 [5th edition: exercise 49]