CSE 321: Discrete Structures — Assignment #2
October 6, 2006 — Due: Friday, October 13

Reading Assignment: Supplementary Logic Notes and Rosen's text 6th Edition: sections 1.5-1.7 & 3.4 (or, 5th Edition: sections 1.5 & 2.4).

Problems:

1. Let $Q(x, y)$ be the statement "x has been sued by y." Express the following sentences in terms of $Q(x, y)$, quantifiers and logical connectives, where the universe of discourse for x is the set of all students at UW and the universe of discourse for y is the set of all lawyers at the RIAA (Recording Industry Association of America). Then give their negations in English.

   - No student at UW has ever been sued by a lawyer at the RIAA.
   - Every lawyer at the RIAA has sued a UW student.

2. 6th edition: Section 1.3, Exercise 60. (5th edition: Section 1.3, Exercise 56)

3. 6th edition: Section 1.4, Exercise 10, parts (d),(h),(i),(j).
   (5th edition: Section 1.4, Exercise 10, parts (d),(h),(i),(j).)

4. 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

5. Prove or disprove the claim that the proposition $\forall x\,(P(x) \rightarrow Q(x))$ is logically equivalent to $\forall x\,P(x) \rightarrow \forall x\,Q(x)$

6. 6th edition: Section 1.5, Exercise 16. (5th edition: Section 1.5, Exercise 12.)

7. Prove or disprove: $n^2 + 3n + 1$ is always prime for integer $n > 0$.

8. Prove that for any integer n if $3n + 2$ is even then n is even.

9. **Extra Credit:** We define a new logical operator '|' as follows: $p \,|\, q$ is true when either p or q or both are false, and it is false when p and q are both true. Show that $\{|\}$ is a functionally complete collection of logical operators. (For the meaning of "functionally complete," see the discussion in Section 1.2 of Rosen. In the 6th edition, it precedes exercise 43, while in the 5th edition it precedes exercise 37.)

10. **Extra Credit:** Prove that if m and n are integers and mn is even then m is even or n is even.