CSE191, Spring 2011 **Assignment 7m** **Makeup Assgt.**

Reading: Please read all of Chapter 2 in one gulp. Generally the course will go faster relative to the text now, and you can see this was true in previous terms as well. Several reasons for this:

- Logic is less familiar as an object of study in itself.
- There were lots of natural-language interpretations and lots of charts in Chapter 1, in 6-or-7 long sections.
- Whereas Chapter 2 has mathematical concepts and notations you have already seen—the goal is to deepen a previous object of study.
- The material itself is "more mathematical" and hence simpler, with fewer sidebars.

Anyway, this problem set parallels Prof. Rapaport's HW7 and part of HW8. We are 2-1/2 lectures behind his calendar, owing to the snow day and our having one more prelim exam, in the second half of April.

(1) Prove that if $n \geq 2$ and n is a perfect square, then $n + 3$ is not a perfect square. First state it as a proposition in first-order logic with arithmetic (called FOL for short), say what you regard the domain as being, and then prove it. Your proof may be "informal"—i.e., you do not have to give every step with a formal name—but you should be formal about its top-level structure: is it a direct proof, a proof by contradiction, does it use contrapositive, things like that. (15 pts. total)

(2) Rosen, page 85, problem 28. Same rules as (1) (18 pts. total)

(3) Rosen, page 85, problem 32. Did you use a "circle" of three implications $(i) \longrightarrow (ii) \longrightarrow (iii) \longrightarrow (i)$, or did you prove (ii) and (iii) individually equivalent to (i)? (12 pts. total)

(4) Rosen, page 120, problem 8(b,d,f). The Friday lecture before spring break included the formal identification of natural numbers n with sets $[n]$: $[0] = \emptyset$, and for $n \geq 1$, $[n] = [n-1] \cup \{ [n-1] \}$. This means $[1] = \emptyset \cup \{ \emptyset \} = \{ \emptyset \} = \{ [0] \}$, and $[2] = [1] \cup \{ [1] \} = \{ \emptyset \} \cup \{ \{ \emptyset \} \} = \{ \emptyset, \{ \emptyset \} \} = \{ [0], [1] \}$. From here on it gets messy, but if you drop the square brackets on the right-hand sides, the rule is always $[n] = \{ 0, 1, \ldots, n-1 \}$. As stated in that lecture, this influenced the range-index convention of numbering from zero in C/C++/Java etc. Also note that Rosen uses $\subset$ to mean proper subset. ($3 + 3 + 3 = 9$ pts.)

(5) Rosen, page 120, problem 20 (6 pts.)

(6) Rosen, page 120, problem 26. (6 pts.)

(7) Rosen, page 120, problem 34. ($4 \times 3 = 12$ pts., for 78 total on this set)