HOMEWORK 5 – CS 211 Spring 2010

Due: May 24, 2010

(50 pts)

Name: _____

Names of students you worked with on this assignment (if any): _____

Each student must turn in an assignment and do her/his own work. Turn in these pages with your answers written in the spaces provided. Please write clearly and large enough for me to read. Each problem is worth 5 points. Word processed homework assignments can receive 5 points extra credit, but only if all symbols, expressions and sentences are correctly represented.

1. A palindrome is a string that reads the same left to right as right to left (as in RADAR). Give an inductive definition of the set of all palindromes.

2. Find an inductive definition for the set {1, 3, 7, 15, 31, 63, … }

3. Find an inductive definition for $\{a^m b^n \mid m, n \in Nat, where\ m > 0\ and\ n > 0\}$.

4. Find an inductive definition for the following set of lists, $\{L \mid L$ has even length over $\{a\}\}$. Use the cons constructor.

5. Find a grammar for $\{ba^n b \mid n \in Nat\}$

6. Find an equivalent grammar for the following that is not ambiguous.

$$S \rightarrow b \mid aS \mid Sa$$

7. Find a grammar for $\{a^{n+1}b^{n+1} | n \in \mathbb{N}\}$.

8. For each of the following conditions, find the smallest relation over the set $A = \{a, b, c\}$ satisfying the stated properties. Express your answers as sets and graphs. (5 pts)

   a. Symmetric but not reflexive and not transitive.

   b. Reflexive and symmetric but not transitive.

9. Given the relation "less" over the natural numbers, describe $less \circ less \circ less$ as set of the form $\{(x, y) \mid \text{property}\}$.

10. Describe the equivalence classes of the kernel relation of f that partition the domain of f where $f : reals \to Ints$ is defined by $f(x) = floor(x)$.