**HOMEWORK 4 – CS 211 Spring 2010**

**Due: May 10, 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. For a real number x, let trunc(x) denote the truncation of x, which is the integer obtained from x by deleting the part of x to the right of the decimal point. Write the ceiling function in terms of trunc.

1. Prove . Find an example to show that this is a proper subset.

Let

where Substitution

where and Def. of Difference Of Sets

and Substitution

Def. of Difference Of Sets

Therefore, .

1. Do problem 6 on page 72.

Breadth-first traversal:

Depth-first traversal:

1. Prove .

Let

iff

iff and

iff and

iff

Therefore, .

Q.E.D.

1. Draw a picture of the ordered tree that is represented by the list

<a, <b, <c>, <d, <e>>>, <r, <s>, <t>>, <x>>.

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1. Draw a picture of a binary search tree containing the three letter abbreviations for the 12 months of the year in dictionary order. Make sure that your tree has the least possible depth.

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7. Given the functions  and , let . Prove that if g or h is injective, then f is injective.

Let be injective, where and such that:

If is injective, then .

If , then .

Therefore, is injective.

Let be injective, where and such that:

If is injective, then .

If , then .

Therefore, is injective

8. Construct a counterexample to show that the converse of the above statement is false.

Let

The set has four elements, and has three elements.

There can be no surjection from to .

9. Show that is injective and not surjective.

This function is injective because for any and :

This function is not surjective because given , cannot map to 0.

10. Show that is surjective and not injective.

If , then:

Therefore, is surjective. Lastly, is not injective because, for example, .