EEN218 SECOND TEST

20th April 2010

Who are you?

What is your student number?

"On my honour, I am not now, nor have I ever been giving or receiving aid on this examination"

(signed)

Writing in *my* boxes is strictly forbidden. These are my boxes, OK?

Question	5	6	7	8
You got				
Out of	33	33	33	1

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Thirteen words are to be inserted into an Ordered Binary Tree. The tree is initially empty, and the words are to be inserted in exactly the order given.

You must draw the tree in the normal way, with nodes containing the words, connected together by lines representing the pointers. Be sure to make it perfectly clear whether each pointer is a left pointer or a right pointer.

a.

Draw the tree exactly as it would look directly after adding the first word, Nub.

b.

Draw the tree exactly as it would look directly after adding the 2nd word, Blimp.

c.

Draw the tree exactly as it would look directly after adding the 3rd word, Dunce.

d.

Draw the tree exactly as it would look directly after adding the 4th word, Vole.

e.

Draw the tree exactly as it would look directly after adding the 5th word, Jam.

e.

Draw the tree exactly as it would look directly after adding the 6th word, Rood.

f.

Now the remaining seven words are added, in this order:

Lump
Xeric
Petrel
Telex
Zulu
Fucoid
Hyrax

Draw the tree exactly as it would look at the end.

g.

If a program takes 50nS to search for the word “Vole” in this tree,
Approximately how long would the search for “Hyrax” take?
And how long would the unsuccessful search for “Yeti” take?

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a.

Write in C++ struct or class definition(s), along with any useful constructors, that would be suitable for storing an Ordered Binary Tree of strings.

b.

Add to your definintion a method that would print all of the stored strings in their proper order (e.g. Blimp, Dunce, Fucoid, Hyrax, Jam, …, Xeric, Zulu).

c.

Add to your definintion a method that would print all of the stored strings in *reverse* order (e.g. Zulu, Xeric, Vole, Telex, Rood, …, Dunce, Blimp).

d.

Add to your definition a method that would find and return the *longest* string in the tree. That is, the one with the most characters.

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Consider a program running on a particular computer searching for strings that were inserted into an Ordered Binary Tree in random order. Suppose that when there are one million (1,000,000) strings in the tree, it takes an average of one microsecond (1μS) to perform a successful search...

a.

How long would you expect a successful search to take if the tree contained:

i. two million (2,000,000) strings?
ii. four million (4,000,000) strings?
iii. one thousand million (1,000,000,000) strings?
iv. one million million (1,000,000,000,000) strings?
v. one thousand (1,000) strings?

Briefly explain how you arrived at those answers.

b.

Back to a million strings inserted randomly:

i. How long would the average unsuccessful search take?
ii. How long should it take to insert a new string?

Briefly explain how you arrived at those answers.

c.

Now suppose that that same program running on that same computer is accidentally given its strings already in ascending order. How long would the average successful search be expected to take when there are:

i. two million (2,000,000) strings?
ii. four million (4,000,000) strings?
iii. one thousand million (1,000,000,000) strings?
iv. one million million (1,000,000,000,000) strings?
v. one thousand (1,000) strings?

Briefly explain how you arrived at those answers.

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If elephants were stored in a binary tree instead of words, what would it look like? What would it be called?