

EEN511 Final, May 2008

Four Questions,
the first three are worth 30% each
the fourth is worth 10%

Send solutions to me
before noon
on
Saturday 10th May.

email to stephen@rabbit.eng.miami.edu

I will confirm receipt of each submission. If you wait until the very last moment, that won't do you much good.

1. (30%)

An OrganicCompound has three interesting properties: its name, its formula, and its molecular weight. Here are a few examples:

```
“trinitrotoluene”, “C6H2CH3(NO2)3”, 227.13
“acetylene”, “HCCH”, 26.04
“alcohol”, “C2H5OH”, 46.07
```

- a. Implement a hash table that is able to store a large number of OrganicCompound objects, giving a very fast search time when finding an OrganicCompound given its name. Completely define the class and all methods. Use public and protected appropriately.
- b. Include a method that allows a search based on molecular weight, so that given a particular number it will find the OrganicCompound whose molecular weight is closest to that number. This method does not need to be fast.

Do not use “Linear Probing”.

- c. Find out what Linear Probing is, and explain why it is often a very bad idea. Under what circumstances might Linear Probing be effective?

Your solution should be complete enough that it could be inserted into this program and work perfectly without any modifications or additions:

```
#include <string>
#include <iostream>

// insert your solution here

void main()
{ Hashtable H;
  H.add(new OrganicCompound(“trinitrotoluene”, “C6H2CH3(NO2)3”, 227.13));
  H.add(new OrganicCompound(“acetylene”, “HCCH”, 26.04));
  H.add(new OrganicCompound(“alcohol”, “C2H5OH”, 46.07));
  cout << “acetylene is ” << H.find(“acetylene”)->get_formula() << “\n”;
  cout << “chicken is ” << H.find(“chicken”)->get_formula() << “\n”;
  cout << H.find(200.0)->get_name() << “ has m.w. close to 200\n”; }
```

The output should be very close to this:

```
acetylene is HCCH
chicken is unknown
trinitrotoluene has m.w. close to 200
```

2. (30%)

Produce a random sequence of 20 words. Write down those words.

- a.** Draw precisely the 2-3-tree that would result from inserting those 20 words in the sequence shown.

Note that it is virtually impossible for any two people to come up with trees that have the same shape if they really use a random sequence of words. I hope no two people turn in trees with exactly the same shapes.

- b.** Draw precisely the max-heap that would result from inserting those 20 words in the sequence shown, then removing the first three. You only need to show the final heap.

3. (30%)

Find out about the Software Cost Estimation Tool called “COCOMO II”.

You will find a formula for calculating the amount of Effort that it should take to complete a given software implementation project. That effort is measured in Person-Months (which used to be called Man-Months).

Explain the effort formula. Your explanation should include why it has that particular form, what the various constants mean, and what the logic behind it is. In other words, explain and justify it.

Apply some critical reasoning, and discuss its validity. Does it make sense? Is it really logical? Could it be of practical use? What are its flaws and strengths (if any).

Finally, apply the formulas to your own final project for this class, and work out how long it should have taken a single programmer working full-time to complete.

Note that wikipedia may give you a start, but it does not provide an adequate answer.

Your opinions do not have to coincide with mine. Logical reasoning is what counts.

4. (10%)

Based on your experience and knowledge in programming, what are the three worst things about C++? Justify your answers and briefly state what could be done to improve them.