EEN218
Lucky Second Test
14th November 2019

No books, notes, calculators, or phones.
No puppies, not even a little one.

Who are you?

What is your student number?

Did you cheat on this test?

Sign that statement.

Don't make any marks in my boxes.
These are my boxes.

Question	5	6	7	8
Out of	33	33	33	1
Grade				

5. Linked Lists

Things-Я-Us is a supermarket that sells products of all kinds. At the moment it is only a small company and doesn't stock very many varieties, but they expect to grow rapidly and one day sell many thousands of different types of thing.

They have decided that their inventory management software should use a linked list of pointers to objects to keep track of their stock. The objects are defined like this:

```
struct thing
{ int UPC;
  string descr;
  int price;
  int stock;

  thing(int u, string d, ... etc. /* just an ordinary constructor */ };
```

`UPC` is a special stock identification number.
`descr` is the name of the product, such as "Hippo food, 2 lbs".
`price` is the price each, in cents.
`stock` is the number of this kind of product currently in stock.

a. Define a struct or class to store the entire Things-Я-Us inventory in the form of a linked list of pointers to things. Give it a constructor suitable for setting up an empty inventory.

b. Define a method that adds a new product to the list.

c. Define a method that returns a pointer to to the i^{th} thing in the list if it exists (i is an integer parameter).

d. Define a method that returns as its result the total value of all things in stock. (For each, multiply the stock by the price, and add them all together).

6. Fast Sorting

Of course you can write extra functions that make the job easier.

a. Write a function that splits a linked list into two halves that are as close to equal in length as possible.

b. Show how this function can be used to make a sorting algorithm.
(don't just write the rest of the code; explain).

7. Basic Binary Trees.

Just in case you ever own a hippopotamus farm, you're going to make a binary tree to store all their hippopotamussly records. For each hippopotamus, the following pieces of information will be stored: first name, last name, birthday, weight (in ounces). Yes, modern hippopotamusses have two names, just like people.

a. Define a struct suitable for representing a hippopotamus.

b. Define a struct and its constructor suitable for representing a node in a binary tree of hippopotamusses.

c. Add a function that will add a new hippopotamus to a tree.
The tree should be ordered alphabetically on the hippopotamus' last names. If two hippopotamusses have the same last name, break the tie by using their first names.

d. Add a function that will search a tree to find a hippopotamus with given first and last names (parameters).
Be sure that your function behaves in a reasonable way if no hippopotamus with matching names can be found.

8. The End.

Draw a picture of Question 7.