QUEEN MARY, UNIVERSITY OF LONDON
DCS/128 ALGORITHMS AND DATA STRUCTURES

Class Test Tuesday 16th March 2004 15.05-15.55

Please fill in your Examination Number here: .....

Student Number here: .....

All answers to this test should be written on the test sheet, but you may use spare paper for rough working. Answer as many of the questions as you can.

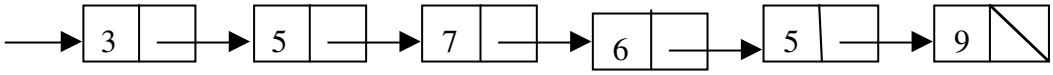
1) Explain in the space below how an item is deleted destructively from an ordered binary tree. You do not need to give any Java code for it.

2) Assume in this question the existence of a class of cells for building linked lists as given below:

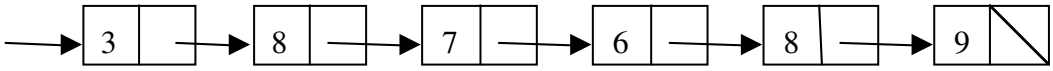
```
class Cell
{
 int first;
 Cell next;

 Cell(int f, Cell n)
 {
  first=f;
  next=n;
 }
}
```

a) Write in the space below a static method which takes as its arguments a linked list of integers and two integers and changes all occurrences of the first integer to the second destructively. For example, if integers are 5 and 8 and the list is:

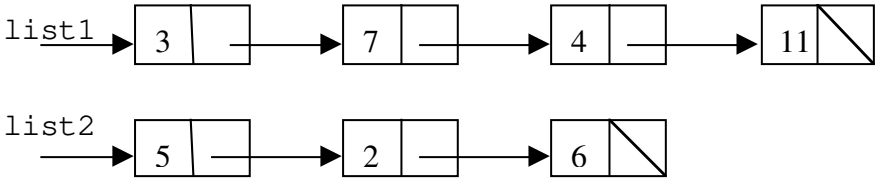


the list gets changed to:



b) Write in the space below a static method which performs the same operation as in part a), but does it constructively.

3) In this question assume the same definition of class `Cell` as in question 2, and three variables of class `Cell` called `list1`, `list2` and `ptr`. For each part of this question assume the initial situation is restarted to be as in the cells and pointers diagram below. Sketch what would be the situation after the execution of the code fragment given.



a)
```
for(ptr=list1; ptr.next!=null; ptr=ptr.next) {}
ptr.next=list2.next;
```

b)
```
for(ptr=list1; ptr!=null; ptr=ptr.next)
   ptr.first = ptr.first*3;
list2.first=list2.first*2;
```

c)
```
for(ptr=list2; ptr!=null; ptr=ptr.next) {
   ptr.first = ptr.first*3;
   list1.first = list1.first*2;
}
```

d)
```
list2.next = list1.next;
for(ptr=list1; ptr.next!=null; ptr=ptr.next)
   ptr.first = ptr.first+10;
```

4) a) Describe what is meant by a “nested class” in Java, and say why one might be used.

b) Explain how a Java `StringTokenizer` works.

c) Explain what the methods `head`, `tail` and `cons` do when called on an object of abstract data type `List`.

d) Explain the difference between pre-order, post-order and in-order traversal of a binary tree.