University of Toronto
csc148—Introduction to Computer Science, Fall 1997

First Term Test — Horton's evening section

Duration: 50 minutes

Aids allowed: None

Make sure that your examination booklet has 6 pages (including this one). Write your answers in the spaces provided. Write legibly.

Family Name: ______________________ **Lecturer:** ______________________

First Name: ______________________ **Tutor:** ______________________

Student # : ______________________

1.	________	/ 7
2.	________	/ 11
3.	________	/ 9
4.	________	/ 8
Total	________	/ 35

Question 1

[7 marks in total]

Tic-tac-toe is a very simple game, played on a 3-by-3 grid. There are two players, named player X and player O. They take turns writing their symbol, X or O, into an empty spot on the grid. A player wins, and the game ends, if their symbol occurs in 3 consecutive spots, either vertically, horizontally, or diagonally. Below is an example game where player X has won.

X		O
	X	O
		X

It is also possible that neither player wins.

Define a simple ADT for a tic-tac-toe grid.

Question 2

[11 marks in total]

This question uses the `IntNode` class, given here:

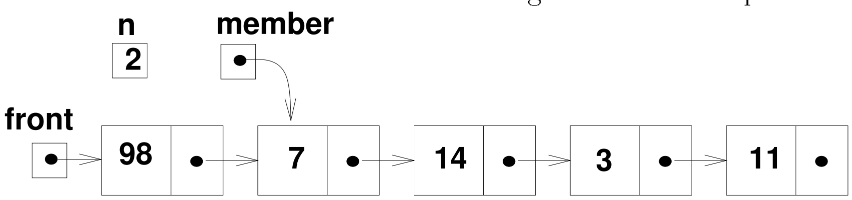
```
class IntNode {
   public int num;
   public IntNode next;

   // Constructor
   public IntNode(int n) {
      num = n;
      next = null;
   }
}
```

We need to write a body for the following Java method:

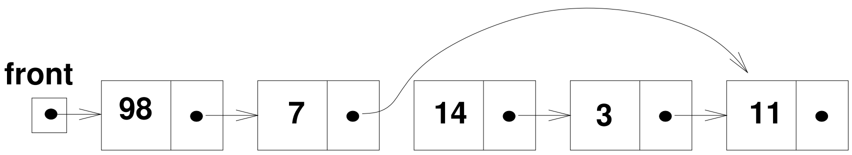
```
static IntNode removeNodes (IntNode front, IntNode member, int n)
```

This method takes `front`, a reference to the front node in a linked list; `member`, a reference to some node within that linked list (possibly the front one, possible not); and an integer `n`. The method must delete from the linked list `n` nodes after the node referenced by `member`, and return a reference to the front of the list.

For example, if `removeNode` were called with the following linked list and parameter values:



then it should do the following to the list, and return a reference to the front node:



(a) [2 marks]
We chose to have the method return a reference to the front of the revised list. Was this necessary? Circle the appropriate answer:

Yes   No

Briefly explain your answer.

(b) [7 marks]
Complete the method. You may assume that all of the preconditions listed below are true.

```
// Preconditions: front must not be null;
//                member must not be null;
//                n >= 0; and
//                there are indeed n nodes after the node referenced by member.
public static IntNode removeNodes (IntNode front, IntNode member, int n) {
```

(c) [2 marks]
How does Java know that the method labelled a constructor (in our comments) is a constructor?

Question 3

[9 marks]

The code in this question uses the same `IntNode` class as used in Question 2. For each code segment below, circle the right answer to indicate whether it will crash or not. If it crashes, explain why. If it doesn't crash, show what the output would be.

```
IntNode n1 = new IntNode(3);
IntNode n2 = new IntNode(3);
IntNode n3 = n1;
if (n1 == n2)
   System.out.println("alpha");
if (n1 == n3)
   System.out.println("beta");
```

will crash because: will run and give the following output:

```
IntNode[] list;
list = new IntNode[15];
System.out.print("The contents of list: ");
for (int i=0; i<15; i++)
    System.out.print(list[i].num);
```

will crash because: will run and give the following output:

```
IntNode[] anotherList = new IntNode[5];
anotherList[3] = new IntNode(99);
IntNode temp = new IntNode(101);
temp.next = anotherList[3];
anotherList[3] = temp;
System.out.println(anotherList[3].num);
```

will crash because: will run and give the following output:

Question 4

[8 marks in total]

Suppose you are writing a program to keep track of inventory in a warehouse. The following class might be useful:

```
class InventoryItem {
    private int itemID;
    private int inStock;

    public InventoryItem(int identifier) {
         itemID = identifier;
         inStock = 0;
    }
    public void recordArrival (int numUnits) {
         inStock = inStock + numUnits;
    }
    public void recordShipment (int numUnits) {
         inStock = inStock - numUnits;
    }
    public int numberOfUnits () {
         return inStock;
    }
}
```

(a) [6 marks]
Write a code fragment that creates an array of 1000 inventory items, and records the fact that 50 units of each inventory item have arrived in the warehouse. The ID numbers of the items should correspond to their array positions. That is, inventory item 52 should be in array position 52.

(b) [2 marks]
What does it mean to say that the `inStock` counter is private?

Why should it be private?