CSC148H
Summer 2006
L0101 Midterm

Duration: 50 minutes

Last Name: ______________________________________
First Name: ______________________________________
Student Number: __________________________________

____________________________________________________________________________________________

Do not turn this page until you have received the signal to start.

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Midterm aids allowed: NONE
Please write legibly.
If you run out of space on a question, use the back of the page.

#1: ____ / 10
#2: ____ / 10
#3: ____ / 10

Total: ____ / 30
Question 1. [10 MARKS]

Consider the following Java code:

```java
public class IntNode {
    public IntNode next;
    public int data;
}
```

In this question you will write a `public static` method called `deleteLast` for the `IntNode` class. This method should take a single `IntNode` as a parameter, representing the start of a linked-list, and its return type should be `void`. You may assume that the `IntNode` parameter represents a linked-list with more than one element.

a) Implement `deleteLast` as an iterative method. Include the method header and an appropriate comment (Javadoc is not necessary). [5 MARKS]

b) Implement `deleteLast` as a recursive method. Include the method header and an appropriate comment (Javadoc is not necessary). [5 MARKS]
Question 2.  [10 MARKS]
Assume that each of the following operations is implemented using the most efficient (in the Big-Oh sense) algorithm.
For each, give the worst-case time complexity in Big-Oh (using the smallest, simplest expression), and give a BRIEF explanation of why this performance is produced.

a) Determine whether an unsorted linked-list of length \( n \) contains any duplicate entries.  [2 MARKS]
Runtime efficiency: \( O(\quad ) \)
Explanation:

b) Find the \( m \)th element in a sorted linked list of \( n \) items. (Assume \( m \) is less than \( n \).)  [2 MARKS]
Runtime efficiency: \( O(\quad ) \)
Explanation:

c) Determine whether the value \( n \) is a power of 2.  [2 MARKS]
Runtime efficiency: \( O(\quad ) \)
Explanation:

d) Find the value that occurs most often in a sorted array of \( n \) elements.  [2 MARKS]
Runtime efficiency: \( O(\quad ) \)
Explanation:

e) Print the \( m \)th element of an array of length \( n \). (Assume \( m \) is less than \( n \).)  [2 MARKS]
Runtime efficiency: \( O(\quad ) \)
Explanation:
Question 3.  [10 MARKS]
The following Java program compiles properly. In the box provided, write the output after running the main method.

```java
public class ExceptionTrace {
    public static void main(String[] args) {
        A a = new A(2);
        B b = new B(2);
        try {
            f(2, a);
            f(2, b);
            f(1, b);
            System.out.println("Done");
        } catch (Exception e) {
            System.out.println("Oops");
        }
    }

    public static void f(int i, A a) throws Exception {
        a.m2(i);

        if (i % 2 == 0) {
            a.m(i);
        } else {
            ((B)a).m();
        }

        System.out.println("End of f.");
    }
}

public class A {
    private int r[];

    public A(int x) { r = new int[x]; }

    public int m(int i) {
        System.out.println("A.m: i=",i);
        return r[i-1];
    }

    public void m2(int i) {
        System.out.println("A.m2:" + r.length);
    }
}

public class B extends A {
    public B(int x) {
        super(x);
    }

    public void m2(int i) {
        System.out.println("B.m2: i=",i);
        super.m(2*i);
    }

    public void m() throws Exception {
        System.out.println("B.m");
        throw new Exception();
    }
}
```

Output:

```java
public class A {
    private int r[];

    public A(int x) { r = new int[x]; }

    public int m(int i) {
        System.out.println("A.m: i=",i);
        return r[i-1];
    }

    public void m2(int i) {
        System.out.println("A.m2:" + r.length);
    }
}

public class B extends A {
    public B(int x) {
        super(x);
    }

    public void m2(int i) {
        System.out.println("B.m2: i=",i);
        super.m(2*i);
    }

    public void m() throws Exception {
        System.out.println("B.m");
        throw new Exception();
    }
}
```