CSC 148H, Introduction to Computer Science
Test Duration: **50 minutes**
Aids Allowed: **NONE**

Student Number: |_|_|_|_|_|_|_|_|_|_|_|

Family Name: _____

Given Name: _____

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*Do **not** turn this page until you have received the signal to start.*
(In the meantime, please fill out the identification section above, and read the instructions below *carefully*.)

This midterm test consists of 3 questions on 5 pages (including this one), printed on one side of the paper. *When you receive the signal to start, please make sure that your copy of the test is complete.* Write your student number on the bottom of pages 2 to 5 of your test. If you use any space for rough work, please indicate clearly the part of your work that should be marked. Comments are not required in any Java code you write in this test.

MARKING GUIDE

0: _____/ 2
1: _____/12
2: _____/14
3: _____/12

TOTAL: _____/40

Good Luck!

Question 0. [2 MARKS]

Complete the "identification section" at the top of page 1, then write your student number **legibly** at the bottom of every page of this test except page 1 (where indicated).

Question 1. [12 MARKS]

Complete the body of the method `deleteFirst()` in class `StackUtils` below according to its external and internal comments.

```
public interface Stack {
  Object pop();
  void push(Object o);
  int size();
  boolean isFull();
}
public class S implements Stack { /* body not shown */ }
public class StackUtils {
  /** Remove the first item in the stack s (i.e. nearest the top) for
   *  which v.equals(item) is true.
   *  Requires: s and v are not null.
   *  Ensures: The size of stack s is reduced by at most one item, and all the remaining
   *  items in s are stored in the same LIFO order as the original stack s.
   *  Returns: true only if an item equal to v was found and deleted. */
  public boolean deleteFirst(Stack s, Object v) {
    Stack temp = new S(Math.max(1, s.size()));
    Object item;
    boolean found;
    // Complete the method below.  Do not declare any additional variables.
```

```
      // Continue on the back of this page if you need more room...
    } // end of removeFirst
} // end of class StackUtils
```

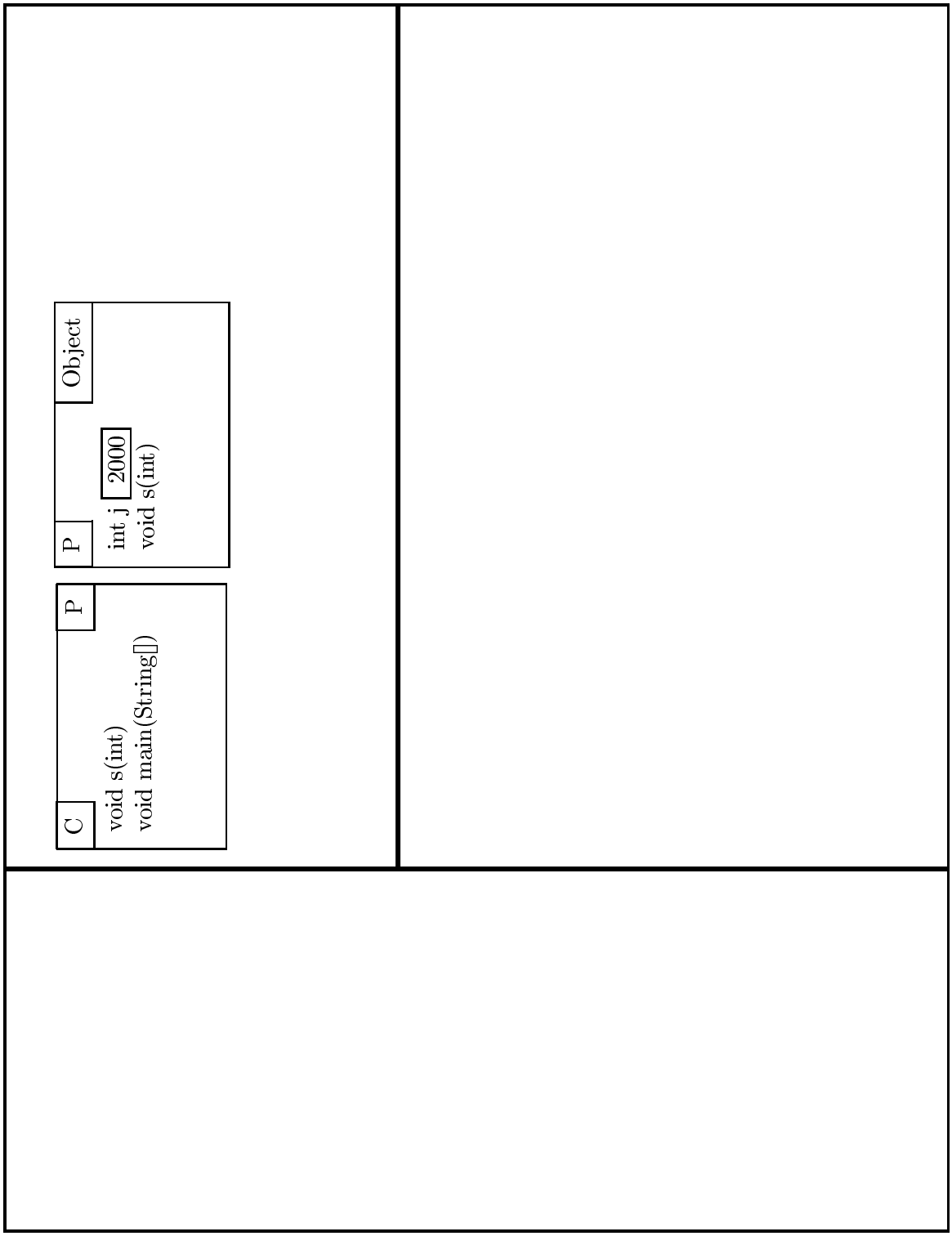
Question 2. [14 MARKS]

```
public class P {
  public int i;
  public static int j;
  public P(int i) { this.i = i; }
  public void m(int j) {
    i = j;
    s(i);
  }
  public static void s(int i) {
    j = j + 1000;
    System.out.println("P: "+i
        + ", " + j);
    // DRAW THE MEMORY MODEL WHEN
    // YOU GET HERE FOR THE LAST
    // TIME.
  }
}
```

```
public class C extends P {
  public int i;
  public C(int i) {
    super(i);
    this.i = i+100;
  }
  public void m(int j) {
    i = i + j;
    P.s(i);
  }
  public static void s(int i) {
    j = j + 1;
    System.out.println("C: "+i+", "+j);
  }
  public static void main(String[] ar) {
    P p = new C(1);
    p.m(20);
    P q = new P(3);
    q.s(4);
  }
}
```

Part (a) [12 MARKS]

Draw the memory model for this program **the last time** the method `s(int)` in class `P` is executed (possibly the only time), at the point indicated by the comment "`DRAW THE MEMORY MODEL ...`". You only need to draw boxes for classes C and P in the static and object spaces (i.e. you can ignore Object, String, String[], System, and so on). Draw everything that is on the runtime stack at this point in the program execution.



Part (b) [2 MARKS]

What does the program print?

Question 3. [12 MARKS]

The class `LinkedIntList` provides a linked list of `IntNodes`. Write the body of the method `deleteSmaller()` in this class which deletes each element of the list whose value is smaller than the maximum value of all the previous elements in the list. For example, if the original list contains elements 1, 3, 5, 2, 4, 5, 7 (in head to tail order), then the processed list contains the elements 1, 3, 5, 5, 7 (in the same order).

```
public class IntNode { // Nodes for our linked list.
  public int value;
  public IntNode link;
}
public class LinkedIntList {
  private IntNode head;
  // Constructor, etc. not shown.
  /** Delete each item in this list whose value is smaller than that of an
   *  item which comes earlier in this list (i.e. closer to the head).
   *  Ensures: The values in the new list increase, or stay the same, as
   *  we iterate through the list from head to tail. (See example above.) */
  public void deleteSmaller() {
```

```
    // Continue on the back of this page if you need more room...
  } // end of deleteSmaller()
} // end of class LinkedIntList
```

Total Marks = 40