CSE 341 Midterm — February 14, 2003

Your name:

This exam is closed book and notes. 90 points total.

For the multiple choice questions (1 through 8) circle the correct answer (just one).

1. (5 points) How can you simulate a global function in Java?
   (a) Define an interface
   (b) Define a static member function of a class
   (c) Define an inner class
   (d) None of the above

2. (5 points) Consider this code:

```
class Point3D {
    private int x, y, z;
    ...
};
```

   What can you tell about the location of x, y, and z in any variable of type Point?
   (a) Always on stack
   (b) Either on stack or heap
   (c) Always on heap
   (d) None of the above

3. (5 points) In Java, what is the relationship between Integer and int?
   (a) Integer inherits int
   (b) int inherits Integer
   (c) Integer boxes an int into a Java object
   (d) They are synonyms
   (e) None of the above

4. (5 points) When can the garbage collector collect the memory allocated from an object?
   (a) When it can prove there is no reference to that object from any other object
   (b) When the reference initialized with “new” goes out of scope
   (c) When the method in which the object was created returns
   (d) Only when the program terminates
   (e) None of the above

5. (5 points) Consider the code below:

```
Ball b1 = new Ball();
Ball b2 = b1;
b2 = (Ball)b2.clone();
```

Which statement is true?

(a) `b1 == b2 && b1.equals(b2)`
(b) `b1 != b2 && b1.equals(b2)`
(c) `b1 == b2 && !b1.equals(b2)`
(d) `b1 != b2 && !b1.equals(b2)`

6. (5 points) Which of the following is true about Java interfaces?

(a) A class can only implement one interface but inherit multiple classes
(b) A class can implement multiple interfaces and inherit multiple classes
(c) An interface can inherit a class
(d) A class can only inherit one class but implement multiple interfaces
(e) None of the above

7. (5 points) Which statement is true regarding final classes in Java?

(a) They can't implement any interface
(b) They don't inherit from any class
(c) They don't have any subclasses
(d) They aren't accessible outside their package
(e) None of the above

8. (5 points) What does "fail-fast" mean for an iterator?

(a) As soon as the iterator reaches the end, calling `next()` will throw an exception
(b) The iterator's state is updated appropriately, so that it doesn't fail, if the collection is changed via another iterator
(c) The iterator throws an exception if the collection is changed except by that iterator
(d) None of the above

9. (10 points) Consider the following program in an Algol-like language.

```
begin
j: integer;
procedure p(k: integer);
    begin
    j := j+1;
    k := j+k;
    print(k);
    end;
j := 10;
p(j);
end;
```

What is printed if j is passed by value? By reference?

10. (10 points) Consider the following program in the same Algol-like language.

```
begin
j: integer;
procedure p(k: integer);
    begin
    print(k);
    j := j+1;
    print(k);
    end;
j := 10;
p(2*j);
end;
```

What is printed if j is passed by value? By name?

11. (10 points) Briefly explain in words the difference between overloading and overriding. Give an example of each in Java.

12. (10 points) Consider call-by-value versus call-by-reference. When is one more advantageous than the other in regard to efficiency?

13. (10 points) Consider the following Java classes.

```
class Pair {
  private int i;
  private String s;
  public Pair(int i, String s) {
    this.i = i;
    this.s = s;
    }
}

class Octopus {
  public static void main(String[] args) {
    Octopus o = new Octopus();
    o.test();
    }

  public void test() {
    int j;
    String t;
    Pair p;
    j = 42;
    t = "hello Mr. squid";
    p = new Pair(j, t);
    System.out.println("leaving test");
    }
}
```

Draw a picture of Java's memory structure just before the `println` method is invoked. Include both the stack and the heap, including the stack frames for `main` and `test`.