

CS 12 Spring 2004 – Mid-term exam #1

Name: _____

You have 50 minutes for this exam. **Write clearly and legibly.** All answers must be in your blue book(s). Read the questions carefully. **Be succinct yet complete:** I expect you to address any relevant topics, but not to add superfluous material to your answers in the hope of a serendipitous answer.

1. (15 points) For the following sequence of lines of Java code, label the lines where a cast is needed, and whether it will be automatic (implicit) or must be forced (explicit):

```
int i = 5;
double d = i;
char c = i;
double d2 = c;
int i2 = c + 3;
char c2 = c + '3';
```

2. (15 points) What output will the following program generate?

```
class ArrayStuff {

    private static void doStuff (int[] x) {

        x[1] = 22;
        x = new int[6];
        x[2] = -20;

    }

    public static void main (String[] args) {

        int[] x = new int [4];
        x[2] = -15;
        doStuff(x);
        for (int index = 0; index < x.length; index++) {
            System.out.println("x[" + index + "] = " + x[index]);
        }

    }

}
```

3. (15 points) What output will the following program generate?

```
class Fib {  
  
    private static int fib (int n) {  
  
        if ((n == 0) || (n == 1)) {  
  
            System.out.println("Base case " + n);  
            return 1;  
  
        } else {  
  
            System.out.println("Beginning " + n);  
            int i = fib(n - 1);  
            System.out.println("Middle " + n);  
            int j = fib(n - 2);  
            System.out.println("End " + n);  
            return i + j;  
  
        }  
    }  
  
    public static void main (String[] args) {  
  
        fib(4);  
  
    }  
}
```

4. (15 points) Consider the following definitions of the classes `Foo` and `Bar`:

```
class Foo {  
  
    protected int _x;  
    public void yahoo (int i) {  
        _x = i * 13 + 2;  
    }  
  
}
```

```
class Bar extends Foo {  
  
    public void geronimo () {  
        _x = _x / 2;  
    }  
  
}
```

Now consider the following methods that are **not** part of `Foo` or `Bar`, but that use objects of those types:

```
public static void fleeble (Foo p, Foo q) {  
  
    p.yahoo(5);  
    q.yahoo(6);  
  
    Bar b = (Bar)q;  
    b.geronimo();  
  
    b = (Bar)p;  
    b.geronimo();  
  
}
```

```
public static void yadda () {  
  
    Foo f = new Foo();  
    Bar b = new Bar();  
  
    fleeble(f, b);  
  
}
```

The question: This code will either not compile or not run. Where is the error? How will it manifest itself? *Why* is it an error?

5. (20 points) Write a class named `Shape` that can serve as the parent class for subclasses whose objects will represent different geometric shapes. (That is, it should be possible to create a `Rectangle` subclass, a `Ellipse` subclass, etc.) Define the `Shape` class to have the following characteristics:

- Each `Shape` object stores its position as a pair of real-valued Cartesian coordinates that indicate the shape's center.
- The coordinates of the center of a `Shape` object can be obtained by calling its `getX()` and `getY()` methods.
- A `Shape` object is *immutable*.
- Each `Shape` object contains a method named `getArea()` which returns the area contained by that shape.
- The class contains a `getNumberPoints()` method that returns the number of `Shape` objects that have been created so far.

6. (20 points) Consider the following arrays of `char`:

- (a) `Hello there!`
- (b) `ello`
- (c) `foo`
- (d) `Hll`

We say that (b) is *contained* by (a)—that is, (b) is a *subsequence* of (a). We can also say that (c) is **not** contained by (a), since those characters don't appear in that order within (a). Finally, we can say that even (d) is not contained by (a); although those letters **do** appear in that order in the character array, they do not appear contiguously.

Write a method named `contains` that determines whether or not one character array *contains* another. Specifically, this method should accept two pointers to character arrays from the caller. If the first character array contains the second, then this method should return `true`; otherwise, it should return `false`. Be sure that your code is *robust*—that is, it should not crash at run time, no matter what arguments are passed.