CIS 113, Spring 2007   Final Exam

Print Name (last name first): __________________________________________________________

Do not open this exam until instructed to do so. The exam consists of 10 pages, numbered 1 through 10. Before starting to work, make sure that you have all 10 pages. There are six problems, each counting 20 points. The last page contains some miscellaneous facts that you may or may not find useful. Write all answers on the exam.

During this exam it is prohibited to:
1. exchange information with any other person in any way, including by talking or exchanging papers or books;
2. use any electronic aid, including calculators;
3. use any books or notes;
4. leave the exam room before you complete and turn in your exam.

I have read and understand all of the instructions above. On my honor, I pledge that I have not violated the provisions of the NJIT Academic Honor Code.

________________________________________
Signature and Date
1. Circle true or false for each of the following statements.

a) The return type of a method is part of the method’s signature.
   true false

b) An interface can be instantiated.
   true false

c) An abstract class must contain abstract methods.
   true false

d) An ArrayList object dynamically changes size as needed.
   true false

e) A Java method can have a varying number of parameters.
   true false

f) A child class can override methods defined in a parent class.
   true false

g) All members of a parent class are inherited by a child class.
   true false

h) An interface reference can refer to any object of any class that implements that interface.
   true false

i) A reference variable can refer to any object created from any class related to it by inheritance.
   true false

j) A try block can have more than one associated catch clause.
   true false
2. a) Consider the following method.

```java
void printSomething(int n)
{
    if(n<0) return;
    System.out.print(n);
    printSomething(n-1);
}
```

What is the output from the call `printSomething(5)`?

1. Nothing; will not compile because method can not call itself.
2. 54321
3. 543210
4. Method will not terminate.
5. None of the above.

b) In comparing insertion sort and selection sort, which of the following statements is correct?

1. For any array, insertion sort makes more pairwise comparisons than selection sort.
2. There exists an array for which insertion sort makes fewer pairwise comparisons than selection sort.
3. None of the above.
c) Consider the following class.

```java
public class Zero {
    public static void main(String[] args) {
        int numerator = 10, denominator = 0;
        try{
            int ratio = numerator/denominator;
            System.out.println(ratio);
        }
        catch(ArithmeticException e) {
            System.out.print("a");
        }
        finally {
            System.out.print("b");
        }
    }
}
```

Which of the following describes the output?

1. 0ab
2. 0a
3. a
4. ab
5. b
6. none of the above
3. Write a recursive function `pow()` that takes two positive integer parameters \( x \) and \( y \) and returns \( x^y \) (\( x \) raised to the power \( y \)). For example, \( \text{pow}(2, 3) \) should return 8.
4. Write a method `anagrams` that takes two String arguments and returns `true` if the strings are anagrams (words obtained by permuting the letters) and false otherwise. You may assume that both strings consist only of lower case letters.

For example, `anagrams("elvis", "lives")` should return `true`. 
5. Write a method `findMaxSum` that takes as parameter a two-dimensional array of integers and returns the index of the row with the largest sum.
6. Given the following class definition:

```java
abstract class Shape{
    abstract double getArea();

    string getType() { return "Shape"; }
}
```

a) Write two subclasses of Shape called Rectangle and Circle. The Rectangle subclass should have attributes for length and width, and the Circle subclass should have an attribute for radius. Both subclasses should have appropriate definitions (or redefinitions) of `getArea()` and `getType()`, as well as constructors to set the length and width (for Rectangle) and radius (for Circle).
b) Write a program which creates an array to hold four Shapes. Populate the array with two Rectangles and two Circles. The program should then use a for loop to output the result of calling the `getType` and `getArea` methods of each Shape.
Potentially Useful Facts

String Methods
int length()
int compareTo(String anotherString)
char charAt(int index)
String substring(int beginIndex, int endIndex)

Arrays Methods
static void sort(int[] a)
   Sort the array a into increasing order.

ArrayList Methods
ArrayList()
   Constructor: creates an initially empty list.
void add(int index, Object obj)
   Inserts the specified object to the end of this list.
void add(int index, Object obj)
   Inserts the specified object into this list at the specified index.
Object remove(int index, Object obj)
   Removes the object at the specified index in this list and returns it.
boolean isEmpty()
   Returns true if this list contains no elements.
int size()
   Returns the number of elements in this list.