COSC 1047 EL01 FINAL EXAM
INTRODUCTION TO COMPUTER SCIENCE II

Tuesday, April 20/2004, 9:00 am

Time Allowed: 3 hours

Instructor: Barry G. Adams

Name (PLEASE PRINT) _______________________________________
Student # _____________________________________________

1. Answer ALL questions. Write your answers on this questionnaire.
2. Use back of exam pages for rough work if necessary.
3. Do not write comments in your programs.
4. No aids permitted
5. Number of Questions: 6
6. Total Marks: 60
Question 1 (10 marks)

Warning: In this question it is important that the Circle class you are asked to write be IM-MUTABLE. Given an immutable Point class having the structure

```java
public class Point {
    private double x, y;
    // constructor for point (0,0)
    public Point() {...}
    // constructor for point (x,y)
    public Point(double x, double y) {...}
    // return string representation of this point
    public String toString() {...}
    // return true if this point has same coordinates as p
    public boolean isEqual(Point p) {...}
    // return x coordinate of this point
    public double getX() {...}
    // return y coordinate of this point
    public double getY() {...}
}
```

write an immutable Circle class using as data fields a Point object for the center and a double number for the radius. The class should have the following constructors and methods:

1. A default constructor for center (0,0) and radius 1,
2. a constructor for a circle given the coordinates x, y of the center and radius r,
3. a constructor for a circle given the center as a Point object and the radius r,
4. an isEqual instance method to determine if two circles are equal (same center and radius),
5. getCenter and getRadius instance methods to return the center and radius of a circle,
6. and a toString method that returns a string representation of a circle.

Do not write any comments in your class.

Begin answer here and continue on next page.
Answer to question 1 continued
Question 2 (10 marks)

Given the following `BankAccount` class

```
public class BankAccount {
    public BankAccount(int accountNumber, String ownerName, double balance) {...}
    public void deposit(double amount) {...}
    public void withdraw(double amount) {...}
    public int getNumber() {...}
    public String getName() {...}
    public double getBalance() {...}
    public String toString() {...}
}
```

(a) Write a class called `JointBankAccount` that extends `BankAccount` by adding a joint account owner.

**Answer:**
(b) Write a class called `SavingsAccount` that extends `BankAccount` by including a new data field for the interest rate in percent that will be applied to the account balance at the end of each month.

**Answer:**

(c) Write some statements that construct an array of four `SavingsAccount` objects. Then use a loop to calculate the total interest paid on these accounts at the end of one month.

**Answer:**
Question 3 (10 marks)

Write a complete class whose constructor takes two String arguments: the name of an input text file and the name of an output text file. Include a method that reads each line of the input file using a BufferedReader and writes to the output file, using a PrintWriter, only the non-blank lines.

The files can be opened using statements such as

```java
BufferedReader in = new BufferedReader(new FileReader(inFileName));
PrintWriter out = new PrintWriter(new BufferedWriter(new FileWriter(outFileName)));
```

You do not need to write the import statements or include any comments.

Answer:
Question 4 (10 marks)

Using the method prototype

```java
public int search(BankAccount[] b, BankAccount x, int start, int end)
```

write the recursive binary search algorithm assuming the array `b` is sorted in lexicographical order by owner name. Here `x` is the account to find. The method should return the array index if `x` is found and -1 otherwise.

**Answer:**
Question 5 (10 marks)

The insertion sort algorithm for an integer array is given by

```java
public void sort(int[] a, int start, int end)
{
    for (int i = start + 1; i <= end; i++)
    {
        int x = a[i];
        int j = i - 1;
        while ( (j >= start) && (x < a[j]) )
        { 
            a[j+1] = a[j];
            j--;
        }
        a[j + 1] = x;
    }
}
```

Write a version of this algorithm that sorts an ArrayList of BankAccount objects in alphabetical order by owner name (use the compareTo method). Recall that an ArrayList has the following methods for getting and setting an array list value at a given index:

```java
public Object get(int index)
public void set(int index, Object obj)
```

Answer:
Question 6 (10 marks)

Write a GUI application called `TemperatureTable` that looks as follows for size $450 \times 300$.

If the “Fahrenheit to Celsius” button was clicked, and

if the “Celsius to Fahrenheit” button was clicked.

- The two input fields contain the starting and ending temperatures as integers. These are interpreted as Celsius values if you want to convert from Celsius to Fahrenheit and Fahrenheit values if you want to convert from Fahrenheit to Celsius.
- The buttons determine which type of conversion is desired.
• The first picture was obtained by clicking the “Fahrenheit to Celsius” button.

• The second picture was obtained by clicking the “Celsius to Fahrenheit” button.

• Note that the JTextArea is inside a JScrollPane.

• Do not write any import statements.

• Use a NumberFormatException to determine if valid integers were typed in the input boxes. If not an error message can be displayed in the JTextArea.

• Use inner classes for the two button handlers.

• Recall that the conversion formula from Fahrenheit to Celsius is $c = \frac{5}{9}(f - 32)$ and the one for Celsius to Fahrenheit is $f = \frac{9}{5}c + 32$.

• You can omit comments.

Begin your answer here and continue on next page.
Answer to question 6 continued

The End

Have a great summer, it will be sunny and hot.