

1. Vocabulary Terms – Matching [5 pts]

Select the **best** definition for each of the words below by writing the appropriate letter in the blank beside the word.

1. _____ Scope

2. _____ Polymorphism

3. _____ Dynamic Binding

4. _____ Method Overloading

5. _____ .equals()

- A.** A method which Objects should define to specify how to test for equivalence.
- B.** The region of the program in which a variable can be “seen” by the compiler.
- C.** The ability for an instance of a subclass to be treated as an instance of its parent class.
- D.** The process by which constructor calls are resolved when **new** is used.
- E.** A method which Objects should define to specify how they should be represented as String.
- F.** When there are multiple methods of the same name, in the same class with different parameter lists.
- G.** Used when one type is a subtype of another. Functionality of the supertype is in the subtype, unless changed by the subtype.
- H.** When a subclass redefines a method of the exact same signature as one in the parent class.
- I.** The process by which method calls are resolved at runtime based upon the type of the actual object present, not the declared type of the reference.
- J.** A variable whose value cannot be changed once it is initially set.
- K.** When two variables are in scope at the same time and the more local one hides the more global one.
- L.** When one constructor calls another using **this()**.
- M.** The process by which a constructor inherits initialization lists from the constructor in a parent class.

2. Iteration [10 pts]

Write the method **public void printDots(int num)**. Which prints a right triangle of Dots of base and height **num**. For example, if this method were called with a parameter of 5, the output should be

```
.  
..  
...  
....  
.....
```

If this method were called with 0 as a parameter, no output would be printed. You must use iteration **ONLY** for this method. If you do not use iteration, or you use any recursion, you will receive no credit for this method. You may assume that **num** will be greater than or equal to 0.

3. Multidimensional Array – Coding [15 pts]

- 9 (a) Write the method `public int max(int[][][] data)`. This method should return the largest item in the array `data`. You may not assume that the array is cubical or rectangular, it may have uneven lengths in any given dimension. You may assume that there is at least one element in the array. You may assume that the array is not *null* and that none of the array references in it are *null*.
- ```
public int max(int[][][] data){
```

```
}
```

- 3 (b) Declare a variable `myArray` to be a 3 dimensional array of floats, and then initialize it to be a 2 by 5 by 8 array of floats.
- 3 (c) What is the data type of `myArray[0][1]`?

4. **.equals()** and **toString()** [ 20 pts ]

Write a class **Box** which has the following:

- a public int **length**
- a public int **width**
- a public String **color**
- a **.equals** method.
- a **toString()** method.

The **.equals** method should behave as follows:

- if the item passed in is not a **Box**, return **false**.
- if the **Box** passed in has the same **length**, **width**, and the **colors** match, then return **true**, else return **false**.

The **toString()** method should yield a String of the following format:

*A **color** Box that is **length** by **width**.*

For example

*A Red Box that is 3 by 5.*

You do NOT need to write accessors and modifiers for your variables, or any constructors.

## 5. References [ 10 pts ]

- (a) Explain what a reference is. Be sure to include the significance of references, what types of variables are reference variables, what types of variables are not reference variables, and how they differ.
- (b) Given the following:
- ```
SomeObject a=new SomeObject(7);  
SomeObject b=new SomeObject(7);  
SomeObject c=b;
```
- (a) What does the expression **a==b** evaluate to? Explain your answer.
- (b) What does the expression **b==c** evaluate to? Explain your answer.
- (c) Assume that **SomeObject** has a public instance variable **int x**, and that the constructor sets **x** to its parameter. If, after the above code we did

```
    a.x=5;  
    c.x=8;
```

What is the value of **b.x**? Explain your answer.

6. Inheritance – Coding [pts]

Given the following code: Write the class **Square** as follows:

- **Square** is a subclass of **Shape**
- **Square** has a double for **sideLen**
- **Square** has an accessor for **sideLen**
- **Square** has a constructor that takes a **String** for **color** and a double for **sideLen**. It initializes **color** via the parent class constructor. It then initializes **sideLen**.
- **Square** has a constructor that takes only a **String** for **color**. It chains to the two parameter constructor with a size of 1.

Below, write the code for class **Square** as described above:

7. Strings – Coding [15 pts]

Write the method **public boolean isAll(String s, char c)**. This method should return true if all letters in **s** are **c**, false if (and only if) **s** contains some other character. You **MUST** use recursion only for this method. If you do not use recursion, or if you use any iteration, you will receive no credit for this method. You may write any helper methods that you wish to. You may assume that **s** is not *null*. Below is an exclusive list of the methods from the String class that you may use. This means that you may use these methods from String, but no other methods from the String class.

1. public char charAt(int index)
2. public String substring(int beginIndex)
3. public boolean .equals(Object o)

Here are some examples of what should be returned:

isAll("", 'q') = true

isAll("aaaaaa", 'a') = true

isAll("aaaabaa", 'a') = false

```
public boolean isAll(String s, char c) {
```

```
}
```

8. Constructor Chaining – Tracing [15 pts]

Given the following code: Write the output when the **main** method is run.