Practice Questions, Set 3: Classes and Objects

1. What is wrong with the following program or code fragment? How would you correct the errors?

(a) assume that the Circle class has a default constructor and getRadius method

```java
public class ShowErrors {
    public void method1() {
        Circle c;
        System.out.println("What is radius "+c.getRadius());
        c = new Circle();
    }
}
```

(b)

```java
public class ShowErrors {
    public static void main(String[] args) {
        C c = new C(5.0);
        System.out.println(c.value);
    }
}

class C {
    int value = 2;
}
```

(c)

```java
public class Test {
    public static void main(String[] args) {
        A a = new A();
        a.print();
    }
}

class A {
    private String s;
    A(String s) {
        this.s = s;
    }
    public void print() {
        System.out.print(s);
    }
```
(d) assume that the Circle class has a default constructor

```java
public class Foo {
    public static void method0() {
        method1();
    }
    public void method1() {
        method2();
    }
    public static void method2() {
        System.out.println("What is radius " + c.getRadius());
    }
    Circle c = new Circle();
}
```

(e)

```java
public class C {
    private int p;
    public C() {
        C(0);
    }
    public C(int p) {
        p = p;
    }
    public void setP(int p) {
        p = p;
    }
}
```

2. If all objects of a class need to share the same variable, how must you declare that variable?

3. Suppose that the class Foo is defined as shown. Let f be an instance of Foo. Which of the statements in are invalid?

```java
public class Foo {
    int i;
    static String s;
    void imethod() { ... }
    static void smethod() { ... }
}
```

(a) System.out.println(f.i);
(b) System.out.println(f.s);
4. To make a member accessible by only other members of its class, what access modifier must be used?

5. Can you invoke an instance method or reference an instance variable from a static method? Can you invoke a static method or reference a static variable from an instance method?

6. The name of a method plus its parameter list constitutes the method’s ________________.

7. What is the difference between a class and an object?

8. What does each object have its own copy of?

9. What name does a constructor have?

10. What does new do?

11. What is this?

12. Can a constructor have one or more parameters?

13. Describe the difference between passing a parameter of a primitive type and passing a parameter of a reference type.

14. Write a method that, given an array of Circle objects, sorts the circles from smallest to largest. Assume that the Circle class is defined as follows:

```java
public class Circle {
    private float radius;
    public Circle ( float r ) {
        if (r >=0 ) radius = r;
        else radius = 1;
    }
    public float getRadius() {
        return radius;
    }
    public int compareTo( Circle c ) {
        if (radius == c.radius ) return 0;
```
```java
else if (radius < c.radius ) return -1;
else return 1;
}
}

You should use the following signature for the method:

void sortCircles ( Circle [] circles )

You can use any sorting algorithm.

15. Suppose that \( s_1 \) and \( s_2 \) are two instances of the Java String class. Which of the following statements or expressions are incorrect?

(a) String s = new String("new string");
(b) String s3 = s1 + s2;
(c) String s3 = s1 - s2;
(d) s1 == s2;
(e) s1 >= s2;
(f) s1.compareTo(s2);
(g) int i = s1.length();
(h) char c = s1(0);
(i) char c = s1.charAt(s1.length());

16. Show the output of the following program

```java
public class Test {
    public static void main(String[] args) {
        System.out.println("Number of strings is " + args.length);
        for (int i = 0; i < args.length; i++)
            System.out.println(args[i]);
    }
}
```

when invoked using

(a) java Test I have a dream
(b) java Test "1 2 3"
(c) java Test
(d) java Test "*
(e) java Test *
17. If all the data fields in a class are private and primitive type, and the class contains no set methods, is the class immutable?

18. Which of the following classes are immutable?
   - Rectangle
   - String
   - Random

19. Consider the following problem description:

   Users place coins in a vending machine and select a product by pushing a button. If the inserted coins are sufficient to cover the purchase price of the product, the product is dispensed and change is given. Otherwise, the inserted coins are returned to the user.

   Design a class to implement it?

20. Consider the following problem description:

   Employees receive their biweekly paychecks. They are paid their hourly rates for each hour worked; however, if they worked more than 40 hours per week, they are paid at 150 percent of their regular wage for those overtime hours.

   Design a class to implement it?

21. Describe the role of the this keyword.

22. Look at the methods in the Integer class. Which are static? Why?

23. In the following class, the variable n occurs in multiple scopes. Which declarations of n are legal and which are illegal?

```java
public class X {
    private int n;

    public int f() {
        int n = 1;
        return n;
    }

    public int g(int k) {
        int a;
        for (int n = 1; n <= k; n++)
            a = a + n;
    }
}
```
24. Show the output of the following programs:

(a)

```java
class Test {
    public static void main(String[] args) {
        Count myCount = new Count();
        int times = 0;
        for (int i = 0; i < 100; i++)
            increment(myCount, times);
        System.out.println("count is " + myCount.count);
        System.out.println("times is " + times);
    }
}
```
public static void increment(Count c, int times) {
    c.count++;
    times++;
}

class Count {
    public int count;
    public Count(int c) {
        count = c;
    }
    public Count() {
        count = 1;
    }
}

public class Test {
    public static void main(String[] args) {
        T t1 = new T();
        T t2 = new T();
        System.out.println("t1's i = " +
            t1.i + " and j = " + t1.j);
        System.out.println("t2's i = " +
            t2.i + " and j = " + t2.j);
    }
}

class T {
    static int i = 0;
    int j = 0;
    T() {
        i++;
        j = 1;
    }
}

class Test {
    public static void main(String[] args) {
        int[] a = {1, 2};
        swap(a[0], a[1]);
        System.out.println("a[0] = " + a[0] + " a[1] = " + a[1]);
    }
}
```java
public static void swap(int n1, int n2) {
    int temp = n1;
    n1 = n2;
    n2 = temp;
}
```

(d)

```java
public class Test {
    public static void main(String[] args) {
        int[] a = {1, 2};
        swap(a);
        System.out.println("a[0] = " + a[0] + " a[1] = " + a[1]);
    }
    public static void swap(int[] a) {
        int temp = a[0];
        a[0] = a[1];
        a[1] = temp;
    }
}
```

25. Write a method that given a string object that consists of digits, computes and returns the sum of every other digit (starting at the very first one). The string of digits can be arbitrary length, but you may assume that the sum of the digits fits in a variable of type int.

26. What type (class or primitive type) would you use to store the result computed by a method calculating factorial of positive integers in the range of 0 to 500?

27. Describe the role of setup() and draw() methods in the Processing programs.