Question 1

Does each of the following programs compile and run? If no, explain the reason; otherwise, give the output.

1. public class P1 {
   public static void main(String[] args){
     System.out.println(f(4,2));
   }
   int f(int x, int y){
     return x > y ? x : y;
   }
}

2. public class P2 {
   public static void main(String[] args) {
     System.out.println(f("234");
   }
   public static int f(String s) {
     int n = s.length();
     if (n == 0)
       return 0;
     else
       return f(s.substring(0, n-1)) + (s.charAt(n-1) - '0');
   }
}
3. public class P3 {
    int p = 0;
    public P3(int p) {
        this.p = p;
    }
    public void setP(int p) {
        this.p = p;
    }
    public static void main(String[] args) {
        P3 o = new P3();
        System.out.println(o.p);
    }
}

4. public class P4 {
    public static void main(String[] args) {
        int n = 2;
        f(n);
        System.out.println("n is " + n);
    }
    static void f(int n) {
        ++n;
    }
}

5. public class P5 {
    public static void main(String[] args) {
        System.out.println(f(234));
    }
    public static String f(int n) {
        StringBuilder s = new StringBuilder();
        do {
            s.append(n%10);
            n /= 10;
        } while (n != 0);
        return s.toString();
    }
}
Question 2

Write a function (static method) of the following specification:

```java
public static boolean isEqual(int[][] a, int[][] b)
```

The function takes two 2-dimensional arrays, `a` and `b`, and returns `true` if the two arrays are equal and `false` otherwise. The two arrays `a` and `b` are equal if both have the same dimension sizes, and each entry in `a` is equal to its corresponding entry in `b`. For example, the following two arrays are equal:

```java
a = {{{1},
    {2,3},
    {4,5,6}}};
b = {{{1},
    {2,3},
    {4,5,6}}};
```
Question 3

Suppose that the Circle class is given as shown in the following UML.

Write a test program that creates an array of 100 circles of random radiuses in the range of 1..11 (1 is inclusive and 11 is exclusive) and displays the sum of the areas of the circles.
Question 4

Consider the following functions:

```java
public static String f(String s) {
    StringBuilder sb = new StringBuilder();
    f(s, s.length(), sb);
    return sb.toString();
}

public static void f(String s, int n, StringBuilder sb) {
    if (n == 0)
        return;
    else {
        sb.append(s.charAt(n-1));
        f(s, n-1, sb);
    }
}
```

- What is the return value of the function call `f("123")`?
- What does the function `f` return in general?
- Convert the recursive function to an iterative one.
Question 5

Write a class, named `UnsignedBigInteger`, that uses an array of digits to store an unsigned big integer. The class contains the following members:

- A constant filed (i.e., `public static final`) of type `UnsignedBigInteger`, named `ZERO`, that represents the value 0.
- A constant field of type `UnsignedBigInteger`, named `ONE`, that represents the value 1.
- A data field, named `digits`, of type `char[]`, that stores the digits of the unsigned big integer, where `digits[0]` is the least significant digit. For example, the integer 123 is represented as `{3,2,1}`.
- A constructor of the specification
  
  ```java
  UnsignedBigInteger(String val)
  ```

  that initializes `digits` to the digits in `val`.
- A method of the specification
  
  ```java
  UnsignedBigInteger add(UnsignedBigInteger val)
  ```

  that returns the sum of `this` and `val`.
- A method of the specification
  
  ```java
  String toString()
  ```

  that returns a String representation of the value.