Question 1: (25 points)

Part (a): (7 points)
Write in the box on the right the output that will be produced by executing the following program.

```
public class Q1a {

  public static void main(String[] args) {
    int n=3, p=6;
    int w= junk(p);
    System.out.println("w is " + w);
    System.out.println("n is " + n);
    System.out.println("p is " + p);
  }

  public static int junk(int n) {
    int p=1;
    n= n + p;
    System.out.println("n is " + n);
    System.out.println("p is " + p);
    return p;
  }
}
```

Output

```
n is 7
p is 1
w is 1
n is 3
p is 6
```

Part (b): (18 points) Consider class **`Counter`** below.

```
public class Counter {

  private int tally;

  public int getTally() { return tally; }

  public void stepCount() { tally= tally + 1; }

  public static void showName() { System.out.println("Class Counter"); }

  public void funTally1(int t) { tally= t; }
  public void funTally2(int t) { this.tally= t; }
  public void funTally3(int tally) { this.tally= tally; }
  public void funTally4(int tally) { tally= tally; }
}
```

For each sentence below, indicate whether it is correct by writing "*true*" or "*false*" on the blank:

___false_ Variable **`tally`** is a class variable.
_true____ Variable **`tally`** is an instance variable.
_true____ Variable **`tally`** is a field.
___false_ Method **`getTally()`** is a procedure.
_true____ Without changing the method header, **`stepCount()`** may be changed to contain a **`return`** statement.
_true____ Method **`stepCount()`** may be called from an instance of class **`Counter`**.
_true____ Method **`showName()`** may be called from an instance of class **`Counter`**.
_true____ Methods **`funTally1`** and **`funTally2`** have the same functionality.
_true____ Methods **`funTally1`** and **`funTally3`** have the same functionality.
___false_ Methods **`funTally1`** and **`funTally4`** have the same functionality.
___false_ Methods **`funTally3`** and **`funTally4`** have the same functionality.

Write a call to method **`showName()`**. (E.g., call **`showName()`** in DrJava's interaction pane.)

Counter.showName()

Question 2 (25 points)

A textile company mixes dyes to formulate special colors. Complete the method below to determine and print the color that results from mixing black and yellow dyes and from adding a metal oxide. The company's super secret formula is as follows:

- Using more yellow dye than black dye yields "*banana brown*"
- Using the same amounts of black and yellow dyes or using more black than yellow yields "*gooey grey*," but if over 80% of the mix is black dye, then the color becomes "*bean black*."
- Adding a metal oxide to the dye mix will add a metallic sheen, resulting in "*metallic banana brown*," "*metallic gooey grey*," or "*metallic bean black*."

Hint: Remember that you can concatenate **`String`**s using the **`+`** operator.

```
/** Mix dyes and metal oxide to form special colors as specified above.
 *    b is fraction of black dye (e.g., 80% black dye means b is 0.8)
 *    y is fraction of yellow dye
 *    addOxide has the value true if metal oxide is added to the dye mix
 */
public static void makeColor(double b, double y, boolean addOxide) {
  String color;  //the color created by mixing the dyes and metal oxide
```

```
    if ( y > b )

        color = "banana brown";

    else  // {b>=y}

        if ( b > 0.8 )

            color = "bean black";

        else

            color = "gooey grey";


    if (addOxide)

        color = "metallic " + color;
```

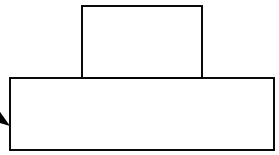
```
  System.out.println("The final color is " + color);
}
```

Question 3: (20 points)

Write a class **PyramidFrame** that customizes **JFrame** to have one procedure, **makePyramid()**. The task of method **makePyramid()** in an instance of this class is to create and show one other **JFrame** centered above this one (the original frame), see diagram. The top **JFrame** is half the width of the original frame and has the same height as the original frame. Below are the specifications of some useful instance methods from class **JFrame**:

`show()`	Show the frame
`getHeight()`	= (`int`) the height of the window in pixels
`getWidth()`	= (`int`) the width of the window in pixels
`setSize(w,h)`	Set the width and height of the window to `w` and `h`
`getX()`	= (`int`) x-coordinate of the top left corner of the window
`getY()`	= (`int`) y-coordinate of the top left corner of the window
`setLocation(u,v)`	Set the x- and y-coordinates of the top left corner of the window to `u` and `v`

The original frame, a ***PyramidFrame*** *object*



```
import javax.swing.*;

public class     PyramidFrame extends JFrame     {

  private JFrame top;  //top frame of the pyramid

  /** Create and show two frames stacked as a pyramid */
  public void makePyramid() {

    show();  //show the bottom frame
             //OK if this statement is not used

    top = new JFrame();

    top.setSize(getWidth()/2, getHeight());

    top.setLocation(getX() + getWidth()/4,
                    getY() - getHeight()  );

    top.show();

  }

}
```

Question 4: (30 points)

A *positive*, *even* number *n* is divisible by 2. For example,

8 is divisible by 2 three times (8/2 gives 4; 4/2 gives 2; 2/2 gives 1; 1 is not divisible by 2)
2 is divisible by 2 once
10 is divisible by 2 once (10/2 gives 5; 5 is not divisible by 2)

Given a positive integer value in variable **n** (type **int**), write a program fragment to determine *the number of times that* **n** *is divisible by 2* and store this number in a variable **d2** (type **int**). If variable **n** stores an odd number, set **d2** to zero and display the message "*n is not divisible by 2*."

Do *not* use any pre-defined methods other than **System.out.println**.

```
//Write your code fragment below assuming that n has been declared and initialized.
//n>0


    int d2=0;  //no. of times n gets divided by 2 so far
               //OK if student assumes d2 has been declared


    if (n%2==0)  // {n is even}

        for (; n%2==0; n/=2)  //enter loop if n is still even
                              //(loop stops when n becomes odd)

            d2++;

    else

        System.out.println("n is not divisible by 2");
```