The problems in this homework require you to review some concepts that should have been covered in CSCI 101. You do not have to write the actual programs for any of the problems, but you may want to experiment with some code to verify your own answers.

Problem 1

Suppose that Fruit, Apple, Orange, GoldenDelicious and McIntosh are classes defined in the following inheritance hierarchy.

A. Can you create the following objects in a way specified? For each of them state "yes" if you can, or explain why not. Assume that each class provides default constructor.

(a) Fruit f = new Apple();
(b) Fruit f = new GoldenDelicious();
(c) Apple a = new Fruit();
(d) Apple a = new McIntosh();
(e) Orange o = new Apple();
(f) Orange o = new Orange();

B. Each of the default constructors contains a print statement that states which classes constructor is called. Fruit class constructor prints "Fruit constructor called"; Apple class constructor prints "Apple constructor called"; and so on. Show the output when the following objects are created:

(a) Fruit f = new McIntosh();
(b) Apple a = new Apple();
Problem 2

Consider the following class definition

```java
public class Foo implements Comparable<Foo>{
    double x;
    double y;

    public Foo ( double x, double y ) {
        this.x = x;
        this.y = y;
    }

    public int compareTo ( Foo other ) {
        double d1 = x*x + y*y;
        double d2 = other.x * other.x + other.y * other.y;
        if ( d1 < d2 ) return -1 ;
        if ( d1 == d2 ) return 0;
        return 1;
    }

    public String toString ( ) {
        return "( " + x + " , " + y + " ) " ; // returns ( x, y )
    }
}
```

Given the array `fooList` of Foo objects pictured below (the values of x and y data fields are stated for each array element), show what the array will look like after the call to `Arrays.sort(fooList)`.

```
|       | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|---|---|---|---|---|---|---|---|---|
| x     | 1.0| 2.0| 1.0| 0.0| 2.5| 0.0| 1.0| 0.0| 0.0| 0.0|
| y     | 1.0| 2.0| 0.0| 0.0| 3.0| 0.0| 0.0| 0.0| 1.5|
```

Problem 3

Given the definition of the `Foo` class in Problem 2, write the lines of code that are needed to create an `ArrayList` object and fill it with ten (10) `foo` objects initialized with random values of x and y (Hint: this should be done with a loop). Do not hand in the entire program, just the lines that create and populate the `ArrayList` object.

How and what to submit

You can use the template provided at https://docs.google.com/document/d/1Aghj05nDgSTGcvVCFMU6Gdop0cGy23eGkhjHATLflXg/edit?usp=sharing to complete your solution.

The completed solutions should be submitted as PDF documents to NYU Classes.