

# Class/Object Lab

1. Following is a function that draws a happy face. Use this function as the basis of a new class called HappyFace. The HappyFace class constructor should take x, y and diam variables that will be stored in the class as fields. The class should have a method called display() that draws itself on the sketch window. The body of the display() method should closely follow the following happyFace() function. Test the class by creating a new instance of HappyFace positioned at the center of the sketch window and calling its display() method.

```
// Draw happy face
void happyFace(float x, float y, float diam){
  //Face
  fill(255, 255, 0);
  stroke(0);
  strokeWeight(2);
  ellipseMode(CENTER);
  ellipse(x, y, diam, diam);

  // Smile
  float startAng = 0.1*PI;
  float endAng = 0.9*PI;
  float smileDiam = 0.6*diam;
  arc(x, y, smileDiam, smileDiam, startAng, endAng);

  // Eyes
  float offset = 0.2*diam;
  float eyeDiam = 0.1*diam;
  fill(0);
  ellipse(x-offset, y-offset, eyeDiam, eyeDiam);
  ellipse(x+offset, y-offset, eyeDiam, eyeDiam);
}
```

2. Declare all the necessary classes in order to make the following driver program work properly (steps have been broken down for you in the sub-parts). For example, this is a sample output that is acceptable:

Generally, a Dolphin can be found in water, it can not lay eggs, and is often overheard saying 'ak, ak, ak, ak'

Generally, a Platypus can be found on land, it can lay eggs, and is often overheard saying 'errrr'

Generally, a Human can be found on land, it can not lay eggs, and is often overheard saying 'I'll take a grande latte with a double-shot of espresso'

Generally, a CSStudent can be found on land, it can not lay eggs, and is often overheard saying 'I love programming!'

```
void setup(){
    Mammal[] mammals = new Mammal[4];
    mammals[0] = new Dolphin();
    mammals[1] = new Platypus();
    mammals[2] = new Human();
    mammals[3] = new CSStudent();

    for (int i=0; i< mammals.length; i++){
        print("Generally, a " + mammals[i].getName());
        print(" can be found ");
        if(mammals[i].livesInWater() == false){
            print("on land, ");
        }
        else {
            print("in water, ");
        }

        print("it can ");
        if(mammals[i].laysEggs() == false) {
            print("not ");
        }
        print("lay eggs, and is often overheard saying '");
        mammals[i].speak();
        println("'");
    }
}
```

3. Declare a new class called Mammal with the following members:
  - Two String fields called 'name' and 'sound'
  - A constructor that accepts two String parameters ('name' and 'sound') and saves values in fields
  - A void method called 'speak()' that prints the object's sound to the console area,
  - A boolean method called 'laysEggs()' that returns false
  - A boolean method called 'livesInWater()' that returns false.
  - A 'getter' String method called 'getName()' that returns the object's name field;
4. Declare a new class called Platypus that extends Mammal. Override methods as appropriate.
5. Declare a new class called Dolphin that extends Mammal. Override methods as appropriate.
6. Declare a new class called Human that extends Mammal. Override methods as appropriate.
7. Declare a new class called CSStudent that extends Human. Override methods as appropriate.

8. Trace the following code. (Draw a table with the appropriate variables and fields.) What are the intermediate values of each of the array elements? Show what is printed in the correct order.

```
class A {
    int x;
    void b(int i){};
    A(int x) {
        this.x = x;
    }
}
class B extends A {
    B(int y) {
        super(y * y);
        println(x);
    }
    void b(int i){
        x = x + i;
    };
}

A[] array;

void setup() {
    array = new A[3];
    for (int i = 0; i < array.length; ++i) {
        if (i % 2 == 0) {
            array[i] = new A(i);
        } else {
            array[i] = new B(i);
        }
    }
    for (int j = 10; j < 13; j++) {
        int k = j % array.length;
        array[k].b(j);
        println(array[k].x);
    }
}
```

