Exercises: Inheritance/Polymorphism

For each of the Java programs below, identify whether or not the program is correct by writing Correct or Incorrect. For a Java program to be Correct it must both compile and run without errors. If the program is Correct, then write out what would be displayed to the console, if anything. If the program is Incorrect, then briefly explain why.

Supporting classes can be found on subsequent pages.

Problem 1

```java
public class Driver {
    public static void main( String[] args ) {
        Dog d1 = new Dog("Fido", 10, "Phil");
        Snake s42 = new Snake("Snuggles", 7, "Katie");
        Exotic reference;
        reference = d1;
        System.out.println( reference );
    }
}
```

Solution: Incorrect. d1 is not a descendant of Exotic

Problem 2

```java
public class Driver {
    public static void main( String[] args ) {
        Dinosaur dino;
        TRex tina = new TRex("Tina", 26, "Talulah");
        dino = tina;
        System.out.println(dino.speak());
    }
}
```

Solution: Correct.

I AM A TREX AND I SAY RAAAWWWRR!
Problem 3

```java
public class Driver {
    public static void main(String[] args) {
        Pet p;
        Snake sally = new Snake("Sally", 2, "Suzy");
        p = sally;
        System.out.println(p);
    }
}
```

Solution: Correct.

I am Sally the snake and have a DANGER factor of 7

Problem 4

```java
public class Driver {
    public static void main(String[] args) {
        Dinosaur ex;
        Tiger ricky = new Tiger("Ricky", 23, "Pi");
        Brontosaurus booboo = new Brontosaurus("BooBoo", 3, "Yogi");
        ex = ricky;
        System.out.println(ex);
        ex = booboo;
        System.out.println(ex);
    }
}
```

Solution: Incorrect. ricky is not a descendant of Dinosaur

Problem 5

```java
public class Driver {
    public static void main(String[] args) {
        Exotic ex;
        Tiger ricky = new Tiger("Ricky", 23, "Pi");
        Brontosaurus booboo = new Brontosaurus("BooBoo", 3, "Yogi");
        ex = ricky;
        System.out.println(ex);
        ex = booboo;
        System.out.println(ex);
    }
}
```

Solution: Correct.

I am Ricky the tiger and have a DANGER factor of 8
I AM BOOBOO THE BRONTOSAURUS AND HAVE A DANGER FACTOR OF 5
Problem 6
What is the output of the following program?

```java
public class Driver {
    public static void main(String[] args) {
        Cat c1 = new Cat("Betty", 3, "Barb");
        Dog d1 = new Dog("Rufus", 4, "Ralph");
        Raptor r1 = new Raptor("Snowball", 10, "Sally");
        Tiger t1 = new Tiger("Fluffy", 3, "Frank");
        c1.setCutenessFactor(9);
        r1.setDangerFactor(2);
        System.out.println(c1);
        System.out.println(t1);
        System.out.println(d1);
        System.out.println(r1);
    }
}
```

Solution:
I am Betty the cat and have a cuteness factor of 9
I am Fluffy the tiger and have a DANGER factor of 8
I am Rufus the dog and have a cuteness factor of 8
I AM SNOWBALL THE RAPTOR AND HAVE A DANGER FACTOR OF 2
Problem 7

What is the output of the following program?

```java
public class Driver {
    public static void main(String[] args) {
        Brontosaurus b1 = new Brontosaurus("Barry", 100, "Bart");
        Snake s1 = new Snake("Sneeky", 2, "Severus");
        Cat c1 = new Cat("Nellie", 6, "Nell");
        Dog d1 = new Dog("Chip", 5, "Chris");

        s1.setDangerFactor(10);
        d1.setCutenessFactor(c1.getCutenessFactor());

        System.out.println(c1);
        System.out.println(b1);
        System.out.println(s1);
        System.out.println(d1);
    }
}
```

Solution:

I am Nellie the cat and have a cuteness factor of 7
I AM BARRY THE BRONTOSAURUS AND HAVE A DANGER FACTOR OF 5
I am Sneeky the snake and have a DANGER factor of 10
I am Chip the dog and have a cuteness factor of 7
Problem 8

What is the output of the following program?

```java
public class Driver {
    public static void main(String[] args) {
        Cat c1 = new Cat("Princess", 1, "Patti");
        Cat c2 = new Cat("Issy", 2, "Iris");
        T Rex trex = new T Rex("FancyPants", 50, "Frank");
        Tiger tgr = new Tiger("Tiny", 15, "Terry");

        c1.setCutenessFactor(9);
        tgr.setDangerFactor(2);

        System.out.println(c1);
        System.out.println(trex);
        System.out.println(c2);
        System.out.println(tgr);
    }
}
```

Solution:

I am Princess the cat and have a cuteness factor of 9
I AM FANCYPANTS THE TREX AND HAVE A DANGER FACTOR OF 10
I am Issy the cat and have a cuteness factor of 7
I am Tiny the tiger and have a DANGER factor of 2
Problem 9

What is the output of the following program?

```java
public class Driver {
    public static void main(String[] args) {
        Dog d1 = new Dog("Fido", 10, "Phil");
        Dog d2 = new Dog("Scruffy", 12, "Simon");
        Snake s42 = new Snake("Snuggles", 7, "Katie");
        Raptor r2d2 = new Raptor("Sharpie", 88, "Steve");
        d2.setCutenessFactor(2);
        r2d2.setDangerFactor(10);
        System.out.println(d1);
        System.out.println(d2);
        System.out.println(s42);
        System.out.println(r2d2);
    }
}
```

Solution:

I am Fido the dog and have a cuteness factor of 8
I am Scruffy the dog and have a cuteness factor of 2
I am Snuggles the snake and have a DANGER factor of 7
I AM SHARPIE THE RAPTOR AND HAVE A DANGER FACTOR OF 10
Problem 10
What is the output of the following program?

```java
public class Driver {
    public static void main(String[] args) {
        Brontosaurus phineas = new Brontosaurus("Phineas", 12, "Mom");
        Tiger ferb = new Tiger("Ferb", 12, "Mom");
        Raptor perry = new Raptor("Perry", 6, "Phineas & Ferb");
        Cat candace = new Cat("Candace", 16, "Mom");

        phineas.setDangerFactor(ferb.getDangerFactor());

        System.out.println(phineas);
        System.out.println(ferb);
        System.out.println(perry);
        System.out.println(candace);
    }
}
```

Solution:
I AM PHINEAS THE BRONTOSAURUS AND HAVE A DANGER FACTOR OF 8
I am Ferb the tiger and have a DANGER factor of 8
I AM PERRY THE RAPTOR AND HAVE A DANGER FACTOR OF 9
I am Candace the cat and have a cuteness factor of 7
Supporting Classes

```java
public class Pet {
    protected String name;
    protected int age;
    protected String owner;
    protected String type;

    public Pet(String n, int a, String o, String t) {
        name = n;
        age = a;
        owner = o;
        type = t;
    }

    public String getOwner() {
        return owner;
    }

    public String getName() {
        return name;
    }

    public String getType() {
        return type;
    }

    public String toString() {
        return name + " the " + type;
    }

    public int getAge() {
        return age;
    }

    public String speak() {
        return "I am a " + type + " and I say ";
    }
}
```
public class Domestic extends Pet {
    protected int cutenessFactor;

    public Domestic(String n, int a, String o, String t) {
        super(n, a, o, t);
        if (t.equals("cat")) {
            cutenessFactor = 7;
        } else if (t.equals("dog")) {
            cutenessFactor = 8;
        } else {
            cutenessFactor = 4;
        }
    }

    public int getCutenessFactor() {
        return cutenessFactor;
    }

    public void setCutenessFactor(int c) {
        cutenessFactor = c;
    }

    public String toString() {
        return "I am " + super.toString() + " and have a cuteness factor of " + cutenessFactor;
    }
}

public class Cat extends Domestic {
    public Cat(String n, int a, String o) {
        super(n, a, o, "cat");
    }

    public String speak() {
        return super.speak() + "meow!";
    }
}

public class Dog extends Domestic {
    public Dog(String n, int a, String o) {
        super(n, a, o, "dog");
    }

    public String speak() {
        return super.speak() + "bark!";
    }
}
public class Exotic extends Pet {
    protected int dangerFactor;

    public Exotic(String n, int a, String o, String t) {
        super(n, a, o, t);
        if (t.equals("snake")) {
            dangerFactor = 7;
        } else if (t.equals("tiger")) {
            dangerFactor = 8;
        } else if (t.equals("trex")) {
            dangerFactor = 10;
        } else if (t.equals("raptor")) {
            dangerFactor = 9;
        } else if (t.equals("brontosaurus")) {
            dangerFactor = 5;
        }
    }

    public int getDangerFactor() {
        return dangerFactor;
    }

    public void setDangerFactor(int d) {
        dangerFactor = d;
    }

    public String toString() {
        return "I am " + super.toString()
            + " and have a DANGER factor of " + dangerFactor;
    }
}

public class Snake extends Exotic {
    public Snake(String n, int a, String o) {
        super(n, a, o, "snake");
    }

    public String speak() {
        return super.speak() + "ssssssssss!";
    }
}

public class Tiger extends Exotic {
    public Tiger(String n, int a, String o) {
        super(n, a, o, "tiger");
    }

    public String speak() {
        return super.speak() + "rawr!";
    }
}
public class Dinosaur extends Exotic {
    public Dinosaur(String n, int a, String o, String t) {
        super(n, a, o, t);
    }
    public String toString() {
        return super.toString().toUpperCase();
    }
}

public class Brontosaurus extends Dinosaur {
    public Brontosaurus(String n, int a, String o) {
        super(n, a, o, "brontosaurus");
    }
    public String speak() {
        return super.speak().toUpperCase() + "munch munch.";
    }
}

public class Raptor extends Dinosaur {
    public Raptor(String n, int a, String o) {
        super(n, a, o, "raptor");
    }
    public String speak() {
        return super.speak().toUpperCase() + "SCREEECH!";
    }
}

public class TRex extends Dinosaur {
    public TRex(String n, int a, String o) {
        super(n, a, o, "trex");
    }
    public String speak() {
        return super.speak().toUpperCase() + "RAAWWWRR!";
    }
}