

## 1 Creating Cats

- 1.1 Given the `Animal` class, fill in the definition of the `Cat` class so that when `greet()` is called, the label “Cat” (instead of “Animal”) is printed to the screen. Assume that a `Cat` will make a “Meow!” noise if the cat is 5 years or older and “MEOW!” if the cat is less than 5 years old.

```
1 public class Animal {
2     protected String name, noise;
3     protected int age;
4
5     public Animal(String name, int age) {
6         this.name = name;
7         this.age = age;
8         this.noise = "Huh?";
9     }
10
11    public String makeNoise() {
12        if (age < 5) {
13            return noise.toUpperCase();
14        } else {
15            return noise;
16        }
17    }
18
19    public void greet() {
20        System.out.println("Animal " + name + " says: " + makeNoise());
21    }
22 }
```

```
1 public class Cat extends Animal {
```

@Override

public Cat (String name, int age) {

super (name, age);

this.noise = "Meow!";

}

@Override

public void greet() {

System.out.println("Cat " + name + " says: " + makeNoise());

}

## 2 Raining Cats and Dogs

static dynamic  
a Animal Cat

- 2.1 Assume that `Animal` and `Cat` are defined as above. What would Java print on each of the indicated lines?

```

1 public class TestAnimals {
2     public static void main(String[] args) {
3         Animal a = new Animal("Pluto", 10);
4         Cat c = new Cat("Garfield", 6);
5         Dog d = new Dog("Fido", 4);
6
7         a.greet();           // (A) -----
8         c.greet();           // (B) -----
9         d.greet();           // (C) -----
10        a = c;
11        ((Cat) a).greet();    // (D) -----
12        a.greet();           // (E) -----
13    }
14 }
15
16 public class Dog extends Animal {
17     public Dog(String name, int age) {
18         super(name, age);
19         noise = "Woof!";
20     }
21
22     @Override
23     public void greet() {
24         System.out.println("Dog " + name + " says: " + makeNoise());
25     }
26
27     public void playFetch() {
28         System.out.println("Fetch, " + name + "!");
29     }
30 }

```

Animal Pluto says Huh?  
Cat Garfield says Meow!  
Dog Fido says WOOF!  
DB  
DB

Consider what would happen if we added the following to the bottom of `main` under line 12:

```

1 a = new Dog("Spot", 10);
2 d = a;

```

Why would this code produce a compiler error? How could we fix this error?

$d = (\text{Dog}) a;$

### 3 An Exercise in Inheritance Misery *Extra*

- 3.1 Cross out any lines that cause compile-time errors or cascading errors (failures that occur because of an error that happened earlier in the program), and put an X through runtime errors (if any). Don't just limit your search to main, there could be errors in classes A,B,C. What does D.main output after removing these lines?

```

1  class A {
2      public int x = 5;
3      public void m1() {System.out.println("Am1-> " + x);}
4      public void m2() {System.out.println("Am2-> " + this.x);}
5      public void update() {x = 99;}
6  }
7  class B extends A {
8      public void m2() {System.out.println("Bm2-> " + x);}
9      public void m2(int y) {System.out.println("Bm2y-> " + y);}
10     public void m3() {System.out.println("Bm3-> " + "called");}
11 }
12 class C extends B {
13     public int y = x + 1;
14     public void m2() {System.out.println("Cm2-> " + super.x);}
15     public void m4() {System.out.println("Cm4-> " + super.super.x);}
16     public void m5() {System.out.println("Cm5-> " + y);}
17 }
18 class D {
19     public static void main (String[] args) {
20         B a0 = new A();
21         a0.m1(); X
22         a0.m2(16); X
23         A b0 = new B();
24         System.out.println(b0.x);
25         b0.m1();
26         b0.m2();
27         b0.m2(61);
28         B b1 = new B();
29         b1.m2(61);
30         b1.m3();
31         A c0 = new C();
32         c0.m2();
33         C c1 = (A) new C();
34         A a1 = (A) c0;
35         C c2 = (C) a1;
36         c2.m3();
37         c2.m4(); X
38         c2.m5();
39         ((C) c0).m3();
40         (C) c0.m3();
41         b0.update();
42         b0.m1();
43     }
44 }

```

5  
 Am1 → 5  
 Bm2 → 5  
 Bm2y → 61  
 Bm3 → called  
 Cm2 → 5  
 Bm3 → called  
 Cm5 → 6  
 Bm3 → called  
 Am1 → 99

static      dynamic  
 b0      A      B  
 b1      B      B  
 c0      A      C  
 a1      A      C  
 c2      C      C