Cats and Roses are two kinds of GardenThing. A Garden contains GardenThings, but is not itself a GardenThing. Cat extends Mammal, and Rose extends Plant. GardenThings accept GardenV visitors (e.g. Rain, Sunshine, and Status). Rain makes a Cat unhappy; Sunshine makes it happy. After a Rose is visited by Rain and Sunshine (in either order) it is blooming. A Status prints out "purr" if a Cat is happy, and "hiss" if it is unhappy. If a Status visits a Rose that is blooming, it prints "Blooming!!!" otherwise it prints nothing.

```java
Cat    cat    = new Cat("Fritz");
Rose   rose   = new Rose();
Garden garden = new Garden();

    garden.enter(c);  // the cat enters the garden
    garden.plant(r);  // the rose is planted in the garden
```

Here is Mammal (which is not a GardenThing):

```java
abstract public class Mammal extends Vertebrate {
    private String name;

    public Mammal(String s) { name = s; }
    public String getName() { return name; }
}
```

The following loops through the seven days of the week. Each day the garden is visited by either Sunshine or Rain, followed by the Status visitor. Note that garden.acceptVisitor passes the visitor to all the Cats and Roses in the Garden. Presume that the method goodWeather returns a boolean.

```java
Status status = new Status();
for (int i = 0; i < 7; i++) {
    GardenV v;
    if (goodWeather())
        v = new Sunshine();
    else
        v = new Rain();
    garden.acceptVisitor(v);
    garden.acceptVisitor(status);
}
```

Depending on what goodWeather returns, one result might be "purr" after the first day, then "hiss" and "Blooming!!!" the second day, etc.
1) [15%] **Indicate** any errors and **explain** why they are errors. If there are no errors in one of the following, just write “correct”

a)  GardenThing gt = new GardenThing();

    **GardenThing must be an interface, hence can't instantiate.**

b)  GardenThing gt = new Cat("Fritz");
    
    ((Cat)gt).getName();

    **correct**

c)  GardenThing gt = new Garden();
    
    gt.acceptVisitor(new Sunshine());

    **Garden explicitly said to not be a GardenThing, hence cannot cast to it.**

2) [20%] **write** GardenThing **here**:

    ```java
    public interface GardenThing {
        public acceptVisitor(GardenV v);
    }
    ```

    } // GardenThing
public class Cat extends Mammal implements Item, GardenThing {
    private boolean happiness;

    public Cat(String s) { super(s); }

    public void setHappy() { happiness = true; }
    public void setUnhappy() { happiness = false; }
    public boolean happy() { return happiness; }

    public acceptVisitor(GardenV v) { v.visit(this); }
}

public class Rose extends Plant implements Item, GardenThing {
    private boolean gotRain;
    private boolean gotSun;

    public void receiveRain() { gotRain = true; }
    public void receiveSunshine() { gotSun = true; }
    public boolean blooming() { return gotRain && gotSun; }

    public acceptVisitor(GardenV v) { v.visit(this); }
}

} // Rose
3) [20%] Draw the UML class diagram and write the code of the visitor hierarchy (GardenV, Rain, Sunshine, and Status).
4) [15%] Recall the CollectionI interface:

```java
public interface CollectionI {
    boolean add(Item i);
    Item    get();
    void    start();
    boolean more();
    ... others removed so you don't get tempted to meander off into trouble
}
```

Note that as Cats enter and Roses are planted they are added to contents (a CollectionI). When a Garden accepts a GardenV it passes that visitor to each item in contents. **Write Garden's acceptVisitor method.**

```java
public class Garden {
    private CollectionI contents;

    public Garden() { contents = new ListC(); }

    public void enter(Cat c)   { contents.add(c); }
    public void plant(Plant p) { contents.add(p); }

    public void acceptVisitor(GardenV v) {
        contents.start();
        while (contents.more()) {
            Item        i  = contents.get();
            GardenThing gt = (GardenThing)i;
            gt.acceptVisitor(v);
        }
    }
}
```

**or more verbosely**

```java
contents.start();
while (contents.more()) {
    Item i = contents.get();
    GardenThing gt = (GardenThing)i;
    gt.acceptVisitor(v);
}
```