Composite Pattern:

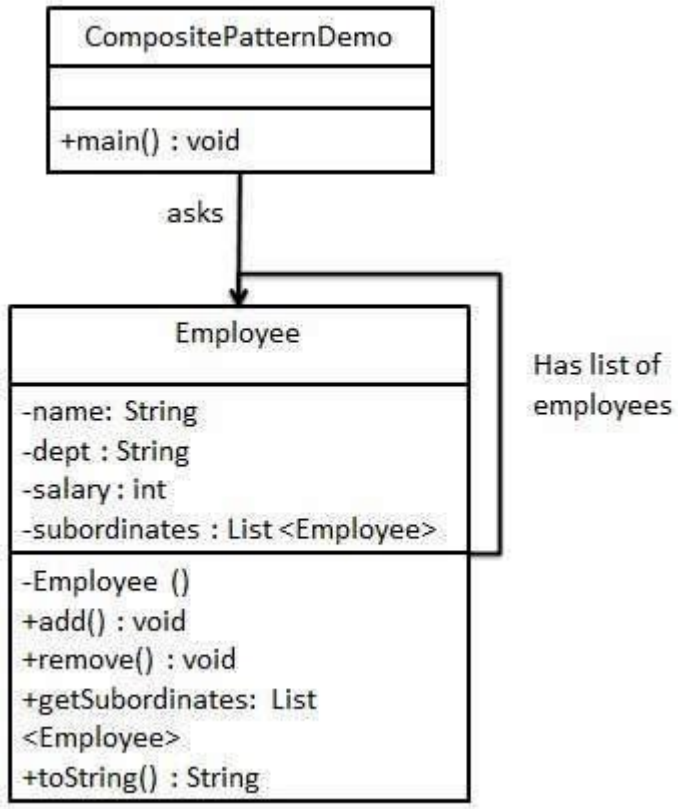
Composite pattern is used where we need to treat a group of objects in similar way as a single object. Composite pattern composes objects in term of a tree structure to represent part as well as whole hierarchy. This type of design pattern comes under structural pattern as this pattern creates a tree structure of group of objects.

This pattern creates a class that contains group of its own objects. This class provides ways to modify its group of same objects.

We are demonstrating use of composite pattern via following example in which we will show employees hierarchy of an organization.

Implementation

We have a class *Employee* which acts as composite pattern actor class. *CompositePatternDemo*, our demo class will use *Employee* class to add department level hierarchy and print all employees.



Step 1

Create *Employee* class having list of *Employee* objects.

Employee.java

```
import java.util.ArrayList;
import java.util.List;

public class Employee {
   private String name;
   private String dept;
   private int salary;
   private List<Employee> subordinates;

   // constructor
   public Employee(String name,String dept, int sal) {
      this.name = name;
      this.dept = dept;
      this.salary = sal;
      subordinates = new ArrayList<Employee>();
   }

   public void add(Employee e) {
      subordinates.add(e);
   }

   public void remove(Employee e) {
      subordinates.remove(e);
   }

   public List<Employee> getSubordinates(){
     return subordinates;
   }

   public String toString(){
      return ("Employee :[ Name : " + name + ", dept : " + dept + ", salary :" + salary+" ]");
   }
}
```

Step 2

Use the *Employee* class to create and print employee hierarchy.

CompositePatternDemo.java

```
public class CompositePatternDemo {
   public static void main(String[] args) {

      Employee CEO = new Employee("John","CEO", 30000);

      Employee headSales = new Employee("Robert","Head Sales", 20000);

      Employee headMarketing = new Employee("Michel","Head Marketing", 20000);

      Employee clerk1 = new Employee("Laura","Marketing", 10000);
      Employee clerk2 = new Employee("Bob","Marketing", 10000);

      Employee salesExecutive1 = new Employee("Richard","Sales", 10000);
      Employee salesExecutive2 = new Employee("Rob","Sales", 10000);

      CEO.add(headSales);
      CEO.add(headMarketing);

      headSales.add(salesExecutive1);
      headSales.add(salesExecutive2);

      headMarketing.add(clerk1);
      headMarketing.add(clerk2);

      //print all employees of the organization
      System.out.println(CEO);

      for (Employee headEmployee : CEO.getSubordinates()) {
         System.out.println(headEmployee);

         for (Employee employee : headEmployee.getSubordinates()) {
            System.out.println(employee);
         }
      }
   }
}
```

Step 3

Verify the output.

```
Employee :[ Name : John, dept : CEO, salary :30000 ]
Employee :[ Name : Robert, dept : Head Sales, salary :20000 ]
Employee :[ Name : Richard, dept : Sales, salary :10000 ]
Employee :[ Name : Rob, dept : Sales, salary :10000 ]
Employee :[ Name : Michel, dept : Head Marketing, salary :20000 ]
Employee :[ Name : Laura, dept : Marketing, salary :10000 ]
Employee :[ Name : Bob, dept : Marketing, salary :10000 ]
```

Decorator pattern:

Decorator pattern allows a user to add new functionality to an existing object without altering its structure. This type of design pattern comes under structural pattern as this pattern acts as a wrapper to existing class.

This pattern creates a decorator class which wraps the original class and provides additional functionality keeping class methods signature intact.

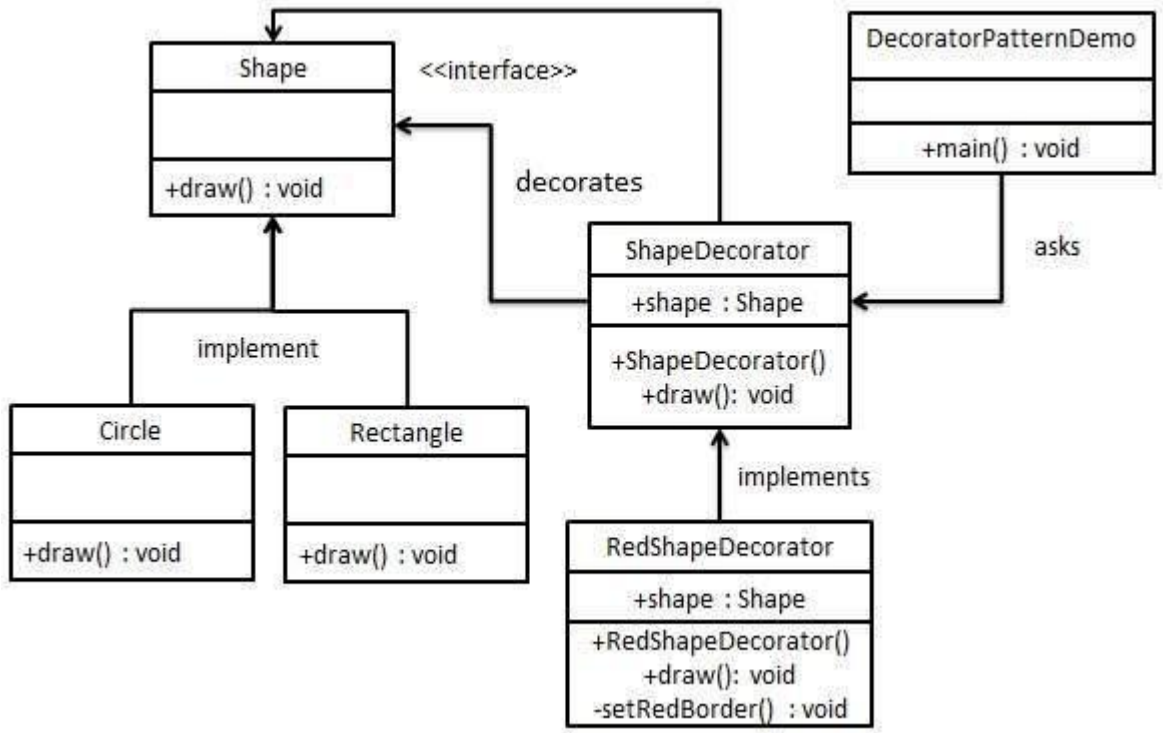
We are demonstrating the use of decorator pattern via following example in which we will decorate a shape with some color without alter shape class.

Implementation

We're going to create a *Shape* interface and concrete classes implementing the *Shape* interface. We will then create an abstract decorator class *ShapeDecorator* implementing the *Shape* interface and having *Shape* object as its instance variable.

RedShapeDecorator is concrete class implementing *ShapeDecorator*.

DecoratorPatternDemo, our demo class will use *RedShapeDecorator* to decorate *Shape* objects.



Step 1

Create an interface.

Shape.java

```
public interface Shape {
   void draw();
}
```

Step 2

Create concrete classes implementing the same interface.

Rectangle.java

```
public class Rectangle implements Shape {

   @Override
   public void draw() {
      System.out.println("Shape: Rectangle");
   }
}
```

Circle.java

```
public class Circle implements Shape {

   @Override
   public void draw() {
      System.out.println("Shape: Circle");
   }
}
```

Step 3

Create abstract decorator class implementing the *Shape* interface.

ShapeDecorator.java

```
public abstract class ShapeDecorator implements Shape {
   protected Shape decoratedShape;

   public ShapeDecorator(Shape decoratedShape){
      this.decoratedShape = decoratedShape;
   }
 public void draw(){
      decoratedShape.draw();
   }
}
```

Step 4

Create concrete decorator class extending the *ShapeDecorator* class.

RedShapeDecorator.java

```
public class RedShapeDecorator extends ShapeDecorator {

  public RedShapeDecorator(Shape decoratedShape) {
    super(decoratedShape);
  }

  @Override
  public void draw() {
    decoratedShape.draw();
    setRedBorder(decoratedShape);
  }

  private void setRedBorder(Shape decoratedShape){
    System.out.println("Border Color: Red");
  }
}
```

Step 5

Use the *RedShapeDecorator* to decorate *Shape* objects.

DecoratorPatternDemo.java

```
public class DecoratorPatternDemo {
  public static void main(String[] args) {

    Shape circle = new Circle();

    Shape redCircle = new RedShapeDecorator(new Circle());

    Shape redRectangle = new RedShapeDecorator(new Rectangle());
    System.out.println("Circle with normal border");
    circle.draw();

    System.out.println("\nCircle of red border");
    redCircle.draw();

    System.out.println("\nRectangle of red border");
    redRectangle.draw();
  }
}
```

Step 6

Verify the output.

Circle with normal border
Shape: Circle

Circle of red border
Shape: Circle
Border Color: Red

Rectangle of red border
Shape: Rectangle
Border Color: Red