

1. What design principles does this code violate?
2. Refactor the code to improve its design.

Person.java

```
public class Person {
    public String last;
    public String first;
    public String middle;

    public Person(String last, String first, String middle) {
        this.last = last;
        this.first = first;
        this.middle = middle;
    }
}
```

PersonClient.java

```
// The clients are in one file for convenience;
// imagine them as non-test methods in separate client classes.
```

```
import junit.framework.TestCase;
```

```
import java.io.*
```

```
public class PersonClient extends TestCase {
    public PersonClient(String name) {super(name);}

    public void client1(Writer out, Person person) throws IOException {
        out.write(person.first);
        out.write(" ");
        if (person.middle != null) {
            out.write(person.middle);
            out.write(" ");
        }
        out.write(person.last);
    }

    public String client2(Person person) {
        String result = person.last + ", " + person.first;
        if (person.middle != null)
            result += " " + person.middle;
        return result;
    }
}
```

```
}
```

```
public void client3(Writer out, Person person) throws IOException {  
    out.write(person.last);  
    out.write(", ");  
    out.write(person.first);  
    if (person.middle != null) {  
        out.write(" ");  
        out.write(person.middle);  
    }  
}
```

```
public String client4(Person person) {  
    return person.last + ", " +  
        person.first +  
        ((person.middle == null) ? "" : " " + person.middle);  
}
```

```
public void testClients() throws IOException {  
    Person bobSmith = new Person("Smith", "Bob", null);  
    Person jennyJJones = new Person("Jones", "Jenny", "J");  
    StringWriter out = new StringWriter();  
    client1(out, bobSmith);  
    assertEquals("Bob Smith", out.toString());  
  
    out = new StringWriter();  
    client1(out, jennyJJones);  
    assertEquals("Jenny J Jones", out.toString());  
  
    assertEquals("Smith, Bob", client2(bobSmith));  
    assertEquals("Jones, Jenny J", client2(jennyJJones));  
  
    out = new StringWriter();  
    client3(out, bobSmith);  
    assertEquals("Smith, Bob", out.toString());  
  
    out = new StringWriter();  
    client3(out, jennyJJones);  
    assertEquals("Jones, Jenny J", out.toString());  
  
    assertEquals("Smith, Bob", client4(bobSmith));  
    assertEquals("Jones, Jenny J", client4(jennyJJones));  
}
```

}
}