



**3. Inheritance** – There are two errors in the following code. Describe the errors and modify the code to fix them. **(2.0%)**:

```
1 interface C {
2     public int m();
3     public abstract int n();
4 }
5
6 abstract class D implements C {
7     public int m() {
8         return 3;
9     }
10 }
11
12 abstract class E extends D {
13     public int n() {
14         return 4;
15     }
16     public int o() {
17         return 5;
18     }
19 }
20
21 class F extends E {
22
23 }
24
25 public class Problem3 {
26     public static void main(String [] args) {
27         F f = new F();
28         f.m();
29         f.n();
30         f.o();
31         E e = new E();
32         e.m();
33         e.n();
34         e.o();
35         C c = new F();
36         c.m();
37         c.n();
38         c.o();
39     }
40 }
```

**4. Strings** – Strings are immutable in Java. What does immutable mean? Provide an example with two Strings and a main memory diagram that shows how immutability works. **(1.0%)**

**5. File I/O** – Give two conditions that would cause an IOException to be thrown when trying to write to a file. **(1.0%)**

6. **GUI** - Write the code to generate the following GUI. The screenshots are all from the same execution of the program with the window resized, which should help you to determine the layout manager(s) in use. Assume you have access to an image named `usc.jpg` and `ucla.jpg` in your project directory. **(2.5%)** Add an event to the radio button that changes the bottom part when clicked, as shown in the screenshots. **(2.5%)**



