

CSE1030 Test 2

Tuesday, July 29, 2014
20:30–22:00 (90 minutes)

Introduction

This test consists of a short programming question and some short-answer written questions. I recommend budgeting 50 minutes for the programming question and 30 minutes for the written questions.

Please follow the instructions given in the test.

Setting Up

In eclipse:

1. Create a new Java Project (perhaps called `test2`)
2. Do not create a package for your class; it can go into the default package.
3. In the package you just created, create an empty text file named `answers.txt` for your answers to the written questions:
 1. select the `File` menu
 2. select `New`
 3. select `File`
 4. type `answers.txt` for the file name and press `Finish`

Programming Question (32 points)

It is expected that your program (1) compiles, (2) meets the specifications given in the APIs, and (3) follows the style guidelines for CSE1030. **Javadoc comments are not required.**

For this part you are to implement several classes that store information about various kinds of chocolate.

Complete mutable classes called `Chocolate`, `DarkChocolate`, `WhiteChocolate`, and `MilkChocolate` that implement the API given (...1030/labtest/Test2/index.html)

You must create and complete the constructors, as well as some other methods:

- 1 accessor and 1 mutator methods
- several constructors
- 3 `toString` methods

All of your constructors and methods should be short (up to 4 lines of code or so). Feel free to create private fields as necessary.

Once the 4 classes have been completed, create a `Test2` class, in which you test the polymorphism in Java:

- Create one instance of each of the non-abstract classes you created
- Create a List (e.g., a `LinkedList`) of `Chocolate`-s and insert all of the instances you have created into the list
- Print the content of your list, one-by-one (to demonstrate that the corresponding `toString` methods are called)

Written Questions (32 points)

Type the answers to the written questions into the file `answers.txt` that you were instructed to create earlier. Make sure that you number your answers to match the questions.

1. Consider the following main method:

```
public static void main(String[] args) {  
  
    Point2D pA = new Point2D.Double (2.0, 1.5);  
    Point2D pB = new Point2D.Double (3.0, 1.5);  
    Point2D pC = new Point2D.Double (2.5, 3.5);  
    Triangle2D t = new Triangle2D (pA, pB, pC);  
  
    boolean b = pB == t.getB();  
  
}
```

(a) [1 mark] If `Triangle2D` used aggregation for its field named `B`, what is the value of the variable named `b`? Why (in one short sentence)?

`true, because pB and B refer to the same object.`

(b) [1 mark] If `Triangle2D` used aggregation for its field named `B`, how many `Point2D` objects are (most likely) created in the main method? List them.

`3: pA, pB, pC (pB and B refer to the same object)`

(c) [1 mark] If `Triangle2D` used composition for its fields named `A`, `B`, `C`, what is the value of the variable named `b`? Why (in one short sentence)?

`false, because pB would be a deep copy of B`

(d) [1 mark] If `Triangle2D` used composition for its field named `B`, how many `Point2D` objects are (most likely) created in the main method? List them.

`7: pA, pB, pC, A, B, C, and the copy created inside of getB`

`(if some student answers 5 - i.e. no A and C, give partial marks, same for no listing the copy created by getB).`

2. Consider the following code:

```
List<Date> l = new LinkedList<Point2D>();  
l.add(new Point2D.Double ());  
l.add(new Point2D.Double (1.0, 1.0));  
l.add(new Point2D.Double (1.0, 1.0));
```

(a) [2 marks] How many (additional) `LinkedList` objects will be created if you make an alias for `l`?

0

How many (additional) `Point2D` objects will be created if you make an alias for `l`?

0

(b) [2 marks] How many (additional) `LinkedList` objects will be created if you make a shallow copy for `l`?

1

How many (additional) `Point2D` objects will be created if you make a shallow copy for `l`?

0

(c) [2 marks] How many (additional) `LinkedList` objects will be created if you make a deep copy for `l`?

1

How many (additional) `Point2D` objects will be created if you make a deep copy for `l`?

3

(d) [2 marks] What kind of copy of `t` is created by the following line of code?

```
LinkedList <Point2D> u = new LinkedList<Point2D>(l);
```

A shallow copy

(e) [2 marks] Using three sentences or less, explain what you must do to make a deep copy of a `TreeMap<String, Point2D>` object.

You must make a new `TreeMap<String, Point2D>`. For each key (keys are `String` references), you must make a deep copy of the corresponding value (values are `Point2D` references). You do not need to create new keys because `String` is immutable.

3. Assuming we have the following classes:

```
public class Animal
public class Mammal
public class Reptile
public class Dog
```

```
public interface Walking
public interface Tailed
```

a) **[2 marks]** Assuming inheritance was used to describe the classes, describe the most likely inheritance relationships between the classes (ignore the interfaces for now).

Animal is a superclass of Mammal and of Reptile (an indirectly of Dog).

Mammal and Reptile are subclasses of Animal.

Dog is a subclass of Mammal (and indirectly of Animal)

b) **[2 marks]** Is the following definition of class `Creature1` valid? Explain why or why not.

```
public class Creature1 extends Animal, Mammal{...}
```

No, you can only inherit from one class in Java

c) **[2 marks]** Is the following definition of class `Creature2` valid? Explain why or why not.

```
public class Creature2 extends Animal, Mammal implements Walking, Tailed {...}
```

No, you can only inherit (extend) from one class in Java

d) **[2 marks]** Is the following definition of class `Creature3` valid? Explain why or why not.

```
public class Creature3 extends Mammal implements Walking, Tailed {...}
```

Yes, one can implement multiple interfaces.

4. Suppose that you have a GUI application where the user can interact with one button in a single frame. The UML class diagram for such an application is shown below:



a) [2 marks] Explain why the `Controller` has a reference to the `View`.

The `Controller` must invoke `View` methods.

b) [2 marks] Explain why the `Controller` has a reference to the `Model`.

The `Controller` must invoke `Model` methods.

c) [2 marks] Explain why the `View` has a reference to the `JFrame`.

The `View` creates the `JFrame`

d) [4 marks] There is a missing relationship between the `JFrame` and the `Controller`. Does the `JFrame` have a reference to the `Controller`, or does the `Controller` have a reference to the `JFrame`? You must explain your answer to receive any marks.

The `JFrame` has a reference to the `Controller` because the `JFrame` must invoke the `ActionPerformed` method in the `Controller`.

Submit

Submit your answers to the written questions and your Java program when you are finished:

```
submit 1030 Test2 Chocolate.java DarkChocolate.java WhiteChocolate.java
MilkChocolate.java Test2.java answers.txt
```