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Object Oriented Programming 2013/14

Final Exam
June 20, 2014

Directions (read carefully):

- CLEARLY print your name and ID on every page.
- The exam contains 8 pages divided into 4 parts. Make sure you have a complete exam.
- The point value of each problem is indicated next to the problem and below.
- You have two hours.
- It is wise to skim all the problems before beginning, to best plan your time.
- This is a closed book exam. No notes of any kind are allowed. Do all work in the space provided, using the backs of sheets if necessary.
- **Over the table it should ONLY be this exam, a pen and an ID.**
- Turn off the mobile phone. The use of a mobile phone annuls the exam.

Part	Problem	Description	Page	Marks
I	1 a) b)	UML	2	1.5
II	2 a) b) c) d) e)	Java development	3	3.0
	3 a) b) c) d) e)	Java multiple choice	6	2.5
	4	Java miscellaneous	7	1.0
III	5	XML	8	1.0
IV	6	Internet	8	1.0
Total				**10.0**

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Part I -- UML (1.5 marks)

1 – Consider customers shopping online. A customer contains a unique number, address, phone and e-mail. Each customer has exactly one account. Accounts store login name and password, and own a shopping cart and orders. An order has a unique number, order date, shipping date, an address where to ship, a status, and the total price of the order. It also has none or several payments; payments contain the value and a textual description. A shopping cart contains the date when it was created as well as line items that contain the quantity, the price and the product itself. The product contains a unique number, a name, and the supplier. Whenever these line items are ordered and the customer checks out they also become associated with the corresponding order. All unique numbers, in the customer, order and product, should be set properly in the UML.

a) **[1.0 mark]** Define the UML class diagram for the presented problem.

b) [0.5 marks] Define an UML object diagram considering a shopping cart already ordered and checked out by the customer. Set all needed attributes/associations with some dummy values.

Part II -- Java (6.5 marks)

2 – A sparse matrix is a matrix populated primarily with zeros. When storing and manipulating sparse matrices on a computer, it is beneficial and often necessary to use specialized algorithms and data structures that take advantage of the sparse structure of the matrix. Consider an implementation of a sparse matrix (named `CSparseMatrix`) as a linked list of nodes, where each node of the list contains an entry of the matrix that is different from zero. The nodes should provide the row `i`, column `j`, and the integer value that appears in the entry `(i,j)` of the matrix. There are not two different nodes with the same `(i,j)` entry, nor nodes with the value 0.

a) **[0.8 marks]** Provide the skeleton of the necessary classes with fields and constructors. For the `CSparseMatrix` class provide a constructor that receives two positive integers, `n` and `m`, and builds the matriz `nxm` where all entries are zeros.
b) **[0.5 marks]** Provide a `set` method that receives three parameters, a row `i`, a column `j`, and a value `x`, and inserts the value `x` in the entry `(i,j)` of the matrix.
c) **[0.4 marks]** Provide a `get` method that receives two parameters, a row `i` and a column `j`, and returns the value in the entry `(i,j)` of the matrix.
d) **[0.5 marks]** Provide a `trace` method that returns the sum of the elements in the diagonal of the matrix. If the matrix is not square the `trace` method should throw the exception `java.lang.UnsupportedOperationException`.
e) **[0.8 marks]** Provide a `prod` method that receives another sparse matrix and multiplies it to `this` (and so, changing `this`). If the dimension of the received matrix is not appropriate it throws the exception `java.lang.UnsupportedOperationException`.

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3 – Fill the answers of multiple choice questions in the following table (use only capital letters). If you want to correct your answer scratch out and write the correct answer. Each correct question is marked 0.5 points. A question not answered is marked 0 points, whereas a wrong answer discounts 0.2 points. If you think NONE of the options are correct, write NONE.

Question	a)	b)	c)	d)	e)
Answer	D	E	C	B	B

a) **[0.5 marks]** What is displayed by:

```
System.out.println("1" + new Integer(2) + 3);
```

A. The statement has a syntax error and won't compile.
B. `6`
C. `15`
D. `123`
E. The statement throws a `ClassCastException`.

b) **[0.5 marks]** Consider the following classes:

```
public class Year2013 {
     public String toString() { return "2013"; }
}
public class Test2013 extends Year2013 {
     public void print() {
          <missing statement>
     }
}
```

Which of the following could replace **`<missing statement>`** so that `Test2013` would compile with no errors and

```
Test2013 test = new Test2013();
test.print();
```

would display `2013`?

I. `System.out.println(new Year2013());`
II. `System.out.println(new Test2013());`
III. `System.out.println(this);`

A. I only
B. II only
C. I and II
D. II and III
E. I, II, and III

c) **[0.5 marks]** What is the size of a `double` variable in Java?
A. 2 bytes.
B. 4 bytes.
C. 8 bytes.
D. It depends on the compiler setting.
E. It depends on the operating system.

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d) **[0.5 marks]** What is the value of `a[1]` after the following code is executed?

A. `0`
B. `1`
C. `2`
D. `3`
E. `4`

```
int[] a = {0, 2, 4, 1, 3};
for (int i = 0; i < a.length; i++)
     a[i] = a[(a[i] + 3) % a.length];
```

e) **[0.5 marks]** What is the output of the following code?

A. `0`
B. `0.0`
C. `0.5`
D. `-0.5`
E. `-2.5`

```
int x = 5, y = 2;
System.out.println(x/y - (double)(x/y));
```

4 – [1.0 marks] Consider the following interfaces and classes:

```
public interface InterfaceA { void methodA(); }

public interface InterfaceB extends InterfaceA { void methodB(); }

public class ClassA implements InterfaceA
{
     public void methodA() {}
     public void methodB() {}
}

public class ClassB extends ClassA implements InterfaceB
{
     public ClassB() {}
     //... <methods not shown>
}
```

What is the minimum number of methods that must be defined in `ClassB` for it to compile with no errors? Explain why.

None, classB inherits the methods of classA and those methods implement all methods from superinterfaces.

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Part III -- XML (1 mark)

5 – [1.0 marks] Consider an XML with an element `Ypto` with an attribute `y` with a fixed value `"ypto"`. Provide the DTD (including the DOCTYPE) and two XML documents, one valid and other invalid.

```
<!DOCTYPE Ypto [
      <!ELEMENT Ypto (#PCDATA)>
      <!ATTLIST Ypto y CDATA #FIXED "ypto">
]>

Valid XML:
1. <ypto>hello</ypto>
2. <ypto y="ypto">hello</ypto>
3. <ypto/>

Invalid XML:
<ypto y="hello">hello<ypto>
```

Part IV -- Swing (1 mark)

6 – [1.0 marks] Explain, by words, the mechanism used by Java Swing to react to button clicks.