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Object Oriented Programming 2013/14

Final Exam
July 4, 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	Swing	8	1.0
Total				**10.0**

Version A

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Part I -- UML (1.5 marks)

1 – Consider a class diagram for bibliographic references (or publications). Books are publications with a title, publication date, publisher, and ISBN. Journals are publications with a title, publication date, volume and number. Conference papers are publications with a title, publication date and first and last page. A certain number of articles are published in a journal. An article includes the first and the last page. Books might be a compendium or the proceeding of conference papers. The compendium contains the publisher, publication date, ISBN and a number of editors. The proceedings contain the publisher, publication date, ISBN, conference location and conference date. Authors may publish several bibliographic references and one publication might have several authors.

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

b) [0.5 marks] Define an UML object diagram considering an article with three authors. Set all needed attributes/associations with some dummy values.

Part II -- Java (6.5 marks)

2 – A binary heap is an ordered tree-based data structure with the following properties: (i) every node has a value; (ii) every node's value is greater than all the values in the descendent nodes; (iii) all nodes have at most two descendants (left and right sub-heaps) that also fulfill the heap conditions. Provide an implementation of a binary heap, named `BinHeap`. The `BinHeap` class should be generic with type parameter `V` (for the value). In addition, the type parameter `V` must implement the `Comparable` interface. The `Comparable` is the only type you can use from `java.util` package.

a) **[0.5 marks]** Provide the skeleton of the necessary classes with fields and constructors. For the `BinHeap` class only a no-arg constructor is needed.
b) **[1.0 marks]** Provide an `insert` method that receives a `value` of type `V` and inserts the `value` in the heap; it returns `void`. If the `value` being inserted already exists in the heap then the new `value` is not inserted. When the `value` is placed in a node it must preserve the heap structure. In addition, the depth of the sub-heaps should be balanced, as much as possible.
c) **[0.5 marks]** Provide a `depth` method that returns the depth of the heap (the length of the largest branch).
d) **[0.5 marks]** Provide a `delete` method that receives a `value` of type `V` and removes from the heap that `value`.
e) **[0.5 marks]** Provide a `search` method receives a `value` of type `V` and returns `true` if the `value` belongs to the heap and `false` otherwise. Note that the heap structure should be taken into account to optimize the method.

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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	C	C	B	A	A

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. `33`
D. `123`
E. The statement throws a `ClassCastException`.

b) **[0.5 marks]** When `MyClass` is compiled the java compiler gives an error message:

`MyClass is not abstract and does not override abstract method` **`<some method>`** `in java.util.Comparator.`

Which of the following could replace **`<some method>`** in the error message?

A. `equals(Object obj)`
B. `compareTo(MyClass mc)`
C. `compare(MyClass mc1, MyClass mc2)`
D. `compareTo(Object obj)`
E. `compare(Object obj1, Object obj2)`

c) **[0.5 marks]** What is the size of a `char` variable in Java?

A. 2 bytes.
B. 4 bytes.
C. 8 bytes.
D. It depends on the compiler settings.
E. It depends on the operating system.

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d) **[0.5 marks]** Consider the following code segment. The first output line is `[[, A, ]]`. What is the second output line?

A. `[A]`
B. `[A, B]`
C. `[B, A]`
D. `ClassCaseExceptiom`
E. `NoSuchElementException`

```
List<String> list = new LinkedList<String>();
list.add("["); list.add("A"); list.add("]");
System.out.println(list);
Iterator<String> it = list.iterator();
while(it.hasNext()){
      if ("[".equals(it.next()) || "]".equals(it.next()))
            it.remove();
      else
            list.add("B");
}
System.out.println(list);
```

e) **[0.5 marks]** What is the value of `m` after the following statements are executed?

A. `0`
B. `1`
C. `-0.5`
D. `-0.75`
E. `-1`

```
double x = 5, y = 2;
int m = (int)(x+y+x/y-x*y-x/(10*y));
```

4 – [1.0 marks] Explain why generics were introduced in Java version 5.

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Part III -- XML (1 mark)

5 – [1.0 marks] Consider the problem presented in Part I and, particularly, problem 1b), that is, consider an article with three authors. Informally, present an XML document, with XML elements and attributes, to store all information needed, as well as the corresponding DTD.

Part IV -- Swing (1 mark)

6 – [1.0 marks] Explain, by words, what is an event handler.