Object Oriented Programming 2

Date: Friday 5th June 2009
Time: 09:45 – 11:45

Answer the 20 short questions in Section A (worth 60 marks)
Answer ONE question from Section B (worth 20 marks)
Answer ONE question from Section C (worth 20 marks)

Use separate Answerbooks for EACH section

Note: Do not answer more than the required number of questions. Clearly cross out anything you do not wish to be marked.

The use of electronic calculators is permitted provided they are not programmable and do not store text.
Section A

Answer all questions

1. Java utilises inheritance and polymorphism. Answer the following questions with reference to inheritance and polymorphism.

   a) What is inheritance?
   b) When utilising inheritance can you override superclass methods?
   c) What keyword enables a subclass to inherit from another class?
   d) What is polymorphism?

   (4 marks)

2. When an exception is thrown, two of the most useful properties are StackTrace and (associated) Message. With this in mind, answer the following:

   a) What is a StackTrace?
   b) What is a message? (with respect to a thrown exception)
   c) Write a basic code snippet that throws a new exception and displays “Exception thrown Example 2” as a message utilising the throw key word.

   (2 marks)

3. In the context of an event and handling events, answer the following questions:

   a) What is an event?
   b) Give two examples of typical events – that require event handling.
   c) How is a button click aligned to a method?

   (4 marks)
4. With reference to the concept of *static*, answer the following related questions:

a) What is a static variable?

b) Do static variables exist if no instance of the static variables class exists?

c) Given the code snippet below, write a code snippet that utilises the ‘*GetID()*’ method to get the variable *ID*, via ClassB.

d) Given the code snippet below, write a code snippet that retrieves the value of the *AuditID* and stores it in a variable *valueAuditID*.

(4 marks)

```java
public class ClassA
{
    public static int GetID()
    {
        return 74123;
    }
}

public class ClassB extends ClassA
{
    public static int AuditID = 84123;
    public ClassB()
    {
        // Constructor
    }
}

Question 4: Static method code snippet.
```

5. Given the jumbled database [line numbered] code snippet below: rewrite the code snippet line numbers [only] in the correct order; so the simple database code executes correctly.

(4 marks)

```java
1. stat.execute("CREATE TABLE Test (Name CHAR(20))");
2. Connection conn = SimpleDataSource.gertConnection();
3. stat.execute("INSERT INTO Test VALUES ('Romeo')");
4. ResultSet result = stat.executeQuery("SELECT * FROM Test");
5. Statement stat = conn.createStatement();
6. conn.close();
7. result.next();
8. stat.close();
9. System.out.println(result.getString("Name"));
10. String DatabaseProperties = "database.properties";
11. result.close();
12. SimpleDataSource.SimpleDataSource(DatabaseProperties);
13. stat.execute("DROP TABLE Test");

Question 5: Database code snippet.
```
6. Reflection is utilized by Java. State the three steps required in order to perform reflection – i.e. in order to use the Reflection API’s methods. (2 marks)

7. Java provides support for web applications. State four ways to embed web based applications – i.e. name four technologies that enable Java to support web content. (2 marks)

8. When interacting with a graphics user interface (GUI) Java provides a wide selection of controls. The diagrams depicted in the diagram below show three types of control: name all the controls depicted. (2 marks)

![Diagram of GUI controls]

**Question 8:** Three (a., b., & c.) GUI controls used by Java.

9. Given the code snippet of an abstract class for a class shape, in the diagram below, write a typical code snippet for a square class that inherits from the abstract class Shape. (2 marks)

```java
public abstract class Shape
{
    public String ShapeName = "No Shape ADT defined";
    public abstract String getNameOfShape();
}
```

**Question 9:** Abstract method code snippet.

10. In the context of support standards, managing information, providing tools, and facilitating efficient information exchange that provides a safe and reliable system a web application has to deal with approximately six issues, name the six issues. (4 marks)

11. What are streams? What advantages do `BufferedInputStreams` have over plain `InputStreams`? What is the difference between a `BufferedReader` and a `BufferedInputStream`? (4 marks)
12. Suppose you had a file containing the text shown below:

- bacon and eggs: bacon, 3, oz, eggs, 2, null,
- lamb pilao: basmati rice, 3, oz, lamb, 2, lb, onion, 4, null,
- trifle: custard, 1 pt, jelly, 0.5, pt, fruit, 0.5, lb,
- ice-cream: milk, 1, pt, eggs, 2, null, sugar, 4, oz,
- chocolate cake: flour, 0.5, lb, eggs, 3, null, milk, 0.3, pt,

For each line of this file, say whether the regular expression below would match it. For lines that it would match, show the value of each 'capture group', and for lines that it would not match say why it would not match them.

```
\(.+\)s*:\s*(\w*)\s*,\s*(\d*\.?\d*)\s*,\s*(\w*)\s*,\s*
```

(4 marks)

13. What would the following fragment of code do, assuming that `g` is the `Graphics` object associated with some open window on your machine?

```java
for(int i=0; i<200; i=i+1){
    g.drawLine(0, i, 200, i);
}
```

What would you have to do to get it to produce an animation of a line gently falling down the screen? (4 marks)

14. Programs that respond to the user moving and clicking the mouse have to define classes that implement the interfaces `MouseListener` and `MouseMotionListener`. Explain how the concrete classes `MouseAdapter` and `MouseMotionAdapter` make it easier to deal just with the events you are actually interested in. (2 marks)

15. Consider the following class definition:

```java
class Person {
    Person mother, father;
    ArrayList<Person> children;

    Person(Person mother, Person father){
        this.mother = mother;
        this.father = father;
        father.children.add(this);
        mother.children.add(this);
    }
}
```

Why would it be difficult to represent an object that had been created using this constructor in XML? (3 marks)
16. Suppose you wanted to use XML to store information about bird species, where the things that you know about a species can include its habitat (i.e. the kind of place it likes to live), what it eats, what colour it is, and whether it migrates. You do not know all of these facts about every species, so you cannot guarantee that you will have an entry for each topic for each species. Write a DTD that describes a sensible way of encoding what you do know about various species as XML. (2 marks)

17. Normal Java programs have to be compiled before they can be run. When you embed Java code in a JSP file, you do not have to explicitly call the Java compiler in order for the JSP to be executed. How and when does the code in the Java program get compiled if you are using Tomcat as your server? (3 marks)

18. What does a web.xml file do? (3 marks)

19. What would the following fragment of HTML look like in a typical browser, and what would the browser do when you clicked the button? (Note: I am not asking about what any other program does subsequently, just about what the browser does when you click the button)

```html
<p>Which of these would you like to know more about?</p>
<form method="post" action="Action.do">
  <input size="20" name="type" type="text">
  <p><input value="Ask a question" name="name" type="submit"> </p>
</form>
</p>
```

(3 marks)

20. What would the raw HTML produced by the following fragment of JSP look like, and what would this look like when viewed through a typical browser?

```html
<br>
<% for(int i=0; i<10; i++){
  %><%= i %><%= i %>
}%>
<br>

(2 marks)
Section B

Answer ONE question from this section.

B1. Answer all parts.

Exception handling is a mechanism employed in Java. Answer the following questions relating to exceptions in Java.

a) Designer of a class must anticipate that messages it receives (parameters passed to the methods) may be impossible to fulfil or may be inappropriate. Hence, a class designers has a number of exception handling options.

State the designer’s options with respect to dealing with possible exception and what the designer could do to deal with [handle] the exceptions. (5 marks)

b) Given the exception code snippet 1 below, write a code snippet in the appropriate catch [block] that:

i) Prints an appropriate message. The print statement should also include a carriage return line feed at the end; and...

ii) Sets the ExceptionValue to the integer value 2. (4 marks)

```java
public void TestExceptionMethod()
{
    int [] TestArray = new int[4];
    int ExceptionValue = 0;

    try
    {
        int TestInt = TestArray[5];
    }
    catch(ArithmeticException e)
    {
        // Handle exception
    }
    catch(java.lang.IndexOutOfBoundsException e)
    {
        // Handle exception
    }
    if(ExceptionFlag==0)
    {
        // Handle exception
    }
}
```

(Question B1 continues on the following page)
c) Given the code segment that you have just written for section B question 1 subsection b above, state why the exception was thrown. (2 marks)

d) Given the code snippet below, write a code snippet that fulfils the following requirements (R#1-4):

R#1: Encloses the code snippet “int a = 3/0; ” in the appropriate try and catch block;

R#2: Utilises the appropriate type of exception (catch) from the sub Class Exception. Examples are:

System.Exception
System.SystemException
System.ArithmeticException
System.NotFiniteNumberException
System.OverflowException
System.ApplicationException
System.Reflection.TargetException
System.Reflection.TargetInvocationException;

R#3: Prints an appropriate exception message. The print statement should also include a carriage return line feed at the end; and finally…

R#4: Sets the ExceptionFlag to true – if an exception occurs in the appropriate catch block. (5 marks)

```java
public int GetAvalueTestExceptionMethod()
{
    boolean ExceptionFlag = false;
    int a = 3/0;
    return a;
}
```

Section B: Question B.1.d.: Exception [Code snippet 2]

(Question B1 continues on the following page)
e) Given the code segment that you have just written for section B question 1 subsection d [Code snippet 2] above, fulfil the further requirement (R#5):

R#5: Write a finally clause, for it, that prints a message “GetAvalueTestExceptionMethod completed” in the finally block.

The print statement should also include a carriage return line feed at the end. Then state exactly where the finally clause would be placed in the code segment that you have just written for section B question 1 subsection d [Code snippet 2] above.

(4 marks)
B2. Answer all parts.

Java utilizes reflection, as it allows access to internal information with reference to class metadata. With respect to reflection in Java, answer the following questions.

a) The sequence of steps utilised when undertaking reflection is nominally three. List the three main steps required to perform Reflection in order to use the Reflection API’s methods. (4 marks)

b) A code snippet uses Reflection to retrieve information from another class named BankAccount. Then it retrieves a particular Field reference named balance.

The code snippet is then modified (see Reflection [Code snippet] below) to include temporary place holders: Name1 and Name2.

In your answer rewrite the [Code snippet 1] (below) replacing the temporary place holders: Name1 and Name2 with the correct named class or field in the appropriate positions. (2 marks)

```java
// Step 1
Name1 TestName1Field = new Name1();

// Step 2:
Class ClassInfo = TestName1Field.getClass();

// Step 3:
Field balanceField = ClassInfo.getField("Name2");

Section B: Question B.2.b.: Reflection [Code snippet 1]
```

c) With reference to the code you have just rewritten for section B question 2 subsection b above, answer the following questions:

i) If the balance Field is an integer, which of the Reflection API’s methods would you utilise to obtain its value; (2 marks)

ii) Add a line to the rewritten code to utilise the Field reference “balanceField” to get the value of the balance: again selecting the appropriate Reflection API methods in your answer, given that the balance Field is an integer. (3 marks)
d) With reference to the code you have just rewritten for section B question 2 subsection b above, answer the following questions:

i) If the balance Field is an integer, which of the Reflection API’s methods would you utilise to overwrite its value; (2 marks)

ii) Add a line to the rewritten code to utilise the Field reference “balanceField” to overwrite the value of the balance with the value 100, again selecting the appropriate Reflection API methods in your answer, given that the balance Field is an integer. (2 marks)

e) The following [line numbered] Reflection [Code snippet 2] extract has some errors. Rewrite it correcting all the errors. There are five errors to be found in the code snippet below.

(5 marks)

```java
1. // Step 1:
2. Class ClassInfo1 = Class.forName("java.lang.System");
3. // Step 2:
4. Method method =
5. ClassInfo2.getMethod("currentTimeMillis", new Class [] {});
6. // Step 3:
7. Object retrievegetData = methodReference.invoke(null, null)
```

Section B: Question B.2.e.: Reflection [Code snippet 2]
Section C

Answer ONE question from this section.

C1. a) The program below is supposed to let the user draw a line in a canvas by dragging the mouse around. Describe what would actually happen if you pressed the mouse and dragged it around the canvas using the program as it stands. You should explain which methods get called, what they do, and what leads to their being called.

(8 marks)

b) If you used the current program to draw a line, the effects would not be guaranteed to last if the window were closed and then re-opened, or if it became obscured by another window and then made visible again. Make the changes that would be required to ensure that the canvas looked the same after such events as it had beforehand. You should ensure that if the user draws a line, and then clicks the mouse and draws another line somewhere else, the only line she sees is the line she is currently drawing.

(12 marks)

import java.awt.*;
import java.awt.event.*;
import java.util.ArrayList;

public class ActivePictureX extends Frame {

    Point mouse1, mouse2;

    ActivePictureX(){
        Panel p = new Panel();
        p.setLayout(new FlowLayout(FlowLayout.LEFT));
        add(p);
        MyCanvas c = new MyCanvas();
        c.setSize(200, 200);
        p.add(c);
        addWindowListener(new MyWindowAdapter(this));
        setSize(210, 210);
        setVisible(true);
    }

    class MyCanvas extends Canvas{

        MyCanvas(){
            addMouseListener(new MyMouseAdapter());
            addMouseMotionListener(new MyMouseMotionAdapter());
        }

    }

    class MyMouseAdapter extends MouseAdapter{

        public void mousePressed(MouseEvent me){
            mouse1 = new Point(me.getX(), me.getY());
        }

    }

}

(Question C1 continues on the following page)
class MyMouseMotionAdapter extends MouseMotionAdapter{
    public void mouseDragged(MouseEvent me){
        mouse2 = new Point(me.getX(), me.getY());
        getGraphics().drawLine(mouse1.x, mouse1.y,
                                mouse2.x, mouse2.y);
    }
}

public void paint(Graphics g){
    g.setColor(Color.WHITE);
    g.fillRect(0, 0, 200, 200);
}

public static void main(String args[]){
    new ActivePictureX();
}
C2. Consider the fragment of XML below.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE properties SYSTEM "propertylist.dtd">
<properties>
  <property>
    <type>house</type>
    <subtype>detached</subtype>
    <rooms>8</rooms>
    <address>21 Christchurch Rd</address>
  </property>
  <property>
    <type>flat</type>
    <rooms>4</rooms>
    <address>21 St Martin's Court</address>
  </property>
</properties>
```

Write a DTD that would characterise the data recorded in this file [6 marks], and write an XSL file which would produce the output shown below if viewed through a typical browser. (9 marks)

**Properties for sale or rent**

*house, detached, rooms: 8, address withheld*

*flat, rooms: 4, address withheld*

What would your XSL file have produced if the XML had contained the line

```xml
<addres>21 St Martin's Court</addres>
```
rather than

```xml
<address>21 St Martin's Court</address>
```

(5 marks)

END OF EXAMINATION