Zambia Centre for Accountancy Studies

NCC Diploma in Computing – Level 4

DDOOCP Mock Examination Solutions

Question 1

(a) Describe the process by which a compiler converts program instructions into machine code and give ONE (1) advantage of compilation. (4 marks)

A compiler takes the whole program (1 mark) and converts it into machine code (1 mark) which can be executed directly by the computer (1 mark). Using a compiler means that you do not have to make the source code available which makes it harder for a competitor to reverse engineer your software (1 mark for any suitable advantage).

(b) Java is an interpreted language which runs on the Java Virtual Machine. Explain what is meant by the term Virtual Machine and how its use differs from platform-dependent interpretation and compilation. (6 marks)

A virtual machine interprets byte-code (1 mark), which is produced when a Java program is compiled (1 mark). It differs from platform-specific compilation in that a dedicated virtual machine must be written for a platform (1 mark), and the byte code is deployed there rather than on the platform (1 mark). The result of this is that code written for one platform will run (in most cases) on any platform (1 mark). Virtual machines usually incorporate some form of compilation, so they run faster than interpreted code (1 mark)

Question 2

(a) Define the terms class and object and explain the relationship between them. (4 marks)
A class defines the methods and variables for a particular class of object (1 mark) and an object defines the state of those variables (1 mark). An object is an instantiation of a class (1 mark), and the class acts as the blueprint for the object (1 mark).

(b) When an object is instantiated, the constructor method is called. Give an example of a constructor method for an Employee class which contains these attributes: empID, name jobTitle and salary. The constructor method should take in the values for these attributes. (6 marks)

```
public Employee(String id, String n, String j, double s) {
        empID = id;
        name = n;
        jobTitle = j;
        salary = s;
}
```

(2 marks for correct format of constructor, 1 mark for handling each of the parameters)

Question 3

(a) Explain the role of a Panel in setting up a user interface in Java. (5 marks)
A panel is a specialisation of a GUI widget (1 mark) and groups objects together so they can moved about as a unit (1 mark)

(b) Re-use is an important element in software development. Discuss the feature(s) of Java that enhance the reusability of classes and objects. (5 marks)
Inheritance is an important feature of reusability (1 mark) as it allows for classes to include general functionality and then extend (1 mark) or specialise (1 mark) it as appropriate. Encapsulation (1mark) also allows for reuse by limiting the impact of change (1 mark)

Question 4

(a) Show example program code of:

i. An integer value being cast to a double type.

```
double d;
int i = 9876;
d = (double)i;
```

(2 marks for the above – 1 mark off for each mistake)

ii. A double value being cast as a String type.

```
double d = 7845.98;
String s = "";
s = Double.toString(d);
```

(2 marks for the above – 1 mark off for each mistake)

(b) Consider the following program code:

```
package l4.ncc.ddoocp.mock;
import java.awt.*;
import javax.swing.*;
public class Q4b {
        public static void main(String[] args) {
                Q4b MyQ4b = new Q4b();
                MyQ4b.go();
        }
        public void go() {
```

```
                Q4bGUI q4BGUI = new Q4bGUI();
        }
        class Q4GUI extends JFrame {
                public Q4GUI() {
                        this.setSize(400, 400);
                        this.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
                        this.getContentPane().setBackground(Color.RED);
                        this.setVisible(true);
                        this.add(new PaintSurface(), BorderLayout.CENTER);
                }
        }
        private class PaintSurface extends JComponent {
                public PaintSurface() {
                }
                public void paint(Graphics g) {
                        Graphics2D Myg = (Graphics2D)g;
                        g2D.drawLine(0, 0, 300, 300);
                }
        }
}
```

i. Describe the output that this program code would produce. (2 marks)

A rectangular frame filled with red colour and a black diagonal line drawn from the top left hand corner.

ii. Explain the purpose of the statement:

import javax.swing.*; (2 marks)

Makes all the functionality (e.g. classes and thus methods) of the swing GUI technology (package) available for use in the program

iii. Describe the implication of void. (2 marks)

Prevents a method having a return type.

Question 5

(a) Describe the nature and the purpose of an Event Listener. (2 marks)

> It is derived from a class encapsulated in the awt package.

> It is an interface object that is often instanced by a GUI class that has inherited from a JFrame

> A Listener object is notified when an event has occurred.

(1 mark for each bullet point up to a maximum of 2 marks)

(b) Distinguish between the swing component classes Jbutton and JtextArea. (2 marks)

> A button object is generally clicked to initiate the execution of a specific block of program code. (1 mark)

> A text-area object is generally for inputting and/or displaying multiple lines of text from a single string. (1 mark)

(c) State TWO (2) reasons for using an instantiated JcomboBox swing component. (2 marks)

> To display a list of text items. (1 mark)

> To have the facility to select an item from a displayed list. (1 mark)

(d) A combo box object does not support a sort method. Describe how the facilities of the Java language can be used to sort a list of names displayed in a combo box into alphabetic order without programming a sort method. (4 marks)

A simple array structure has a sort method hence a process could be:

> Copy all the names in the combo box into a simple string array. (1 mark)

> Sort the contents of the array using its sort method. (1 mark)

> Remove all the items from the combo box. (1 mark)

> Repopulate the combo box with the elements of the array. (1 mark)

Question 6

(a) Describe what is meant by defensive programming. (3 marks)

The programmer identifies which blocks of code could fail in unusual circumstances (1 mark); e.g. in any block that involves numeric division or array index arithmetic (1 mark). The programmer inserts extra code to trap such situations OR insert a try – catch structure OR both (1 mark).

(b) Describe an example situation where the value of a data item could be valid but not correct. (1 mark)

> 12/10/2005 is a valid date but the user should have entered 21/10/2005.

(c) Describe how the sensible use of certain swing components to design a GUI could eliminate the need to be concerned with data validation. (3 marks)

> Any swing component that displays a list of predefined valid options (2 marks)

> with no opportunity for the user to select any other option. (1 mark)

(d) Explain why some programmers may choose to enclose the program code of every method with a try-catch structure that would identify the method should an exception occur. (3 marks)

This is a particularly useful approach during the development of a program as the execution is not halted at the first exception (1 mark) thus increasing the

possibility of more than one location of erroneous code being detected per run (1 mark). Also useful in an operational program to prevent intelligible system messages being displayed. (1 mark)

Question 7

(a) Explain what is meant by the term inheritance. (4 marks)

Inheritance is the process by which a class can extend another class (1 mark) and then specialise (1 mark) it as appropriate. A class which extends a parent class will inherit the attributes and methods of the parent class (1 mark) but can overload these if required (1 mark).

(b) A program has a Pet class with the following attributes and methods. (6 marks)

Pet
#name: String
+Pet() +getName(): String +setName(String n): void +play(): void +walk(): void

Write the skeleton code for a Fish class which extends the Pet class.

The Fish class should inherit the name attribute of the Pet class, and play, getName and setName methods. It's constructor should call the parent Pet class constructor. The Fish class should override the walk method with its own specialised walk method which prints a message explaining that fish cannot walk. It should have its own swim method. The swim method has a void return type and does not take in any parameters.

```
package l4.ncc.ddoocp.mock;

public class Fish extends Pet {
	public Fish() {
		super();
	}
	public void walk() {
		System.out.println("Fish cannot walk.");
	}
	public void swim() {
		// code goes here
	}
}
```

1 mark for extends Pet, 1 mark for not creating a new name attribute, 1 mark for not overloading the getName, setName and play methods. 1 mark for correct call to parent constructor method, 1 mark for overloading the walk method with a relevant message. 1 mark for specialising with a swim method (skeleton only: there is not enough info for them to know what the code should be).

Question 8

(a) Explain what is meant by the term 'excapsulation'. (2 marks)

Encapsulation is the OO principle of locating data along with the methods that act upon it (1 mark), and ensuring that data is accessible only through predefined accessor methods (1 mark).

(b) Explain what is meant by the term 'accessor method', and provide a code example of accessor methods in use. (4 marks)

An accessor method is the public interface (1 mark) to a variable that has been made private or protected (1 mark). 2 marks for an example.

(c) Describe what is meant by 'public' and 'private' visibility, and give an example of when each would be appropriate. (4 marks)

Public visibility means that any code that can get access to the object can access the variable or method (1 mark), whereas private visibility means that only objects of the class in which the method or variable is defined can gain access (1 mark). Private visibility is appropriate for attributes in a class (1 mark), and public visibility is appropriate for accessor methods (1 mark)

Question 9

(a) Outline the steps required in order to read in text from a file on disk. (6 marks)

Firstly, a FileReader must be constructed (1 mark) that links to the file on disk (1 mark). This is then fed into a BufferedReader (1 mark). Text is read from the BufferedReader until the end of file is reached (1 mark), at which point the reader is closed (1 mark). All of this is done within a try-catch block because of the checked exception (1 mark).

(b) Explain what is meant by an exception and give TWO (2) examples of behaviour in Java that would throw an IOException. (4 marks)

An exception is any event in Java where an exceptional event has occurred (1 mark) that requires the developer to handle (1 mark). Possible causes of IOExceptions include: trying to read from a file when there is no file with that name in the location you are trying to read from (1 mark) or trying to write to a hard drive location that you do not have permission to write to (1 mark). (Award

marks for any other suitable causes of IOExceptions, up to a maximum of 2 marks)

Question 10

(a) Explain what is meant by an 'IDE' and what the benefits are of using one. (4 marks)

An Integrated Development Environment (1 mark) is an application which integrates all the tools required to develop a piece of software such as a text editor and compiler (1 mark). IDEs make the development process easier to manage (1 mark) and usually provide additional support that is not available with standalone tools (1 mark) such as debuggers and packaging.

(b) Provide an overview of the code needed to create a button in a Java application and have it change the contents of a textbox when clicked. Provide code examples to support your answer. (6 marks)

First the button must be instantiated (1 mark) and the class in which it is situated must be made to implement ActionListener (1 mark). The button must have the object in which it is situated registered as an event listener (1 mark), and then the actionPerformed method must change the text when it is clicked (1 mark). 2 marks for a suitable example.