



DUBLIN CITY UNIVERSITY

SEMESTER 2 EXAMINATIONS 1999/2000

COURSE: *M.Eng./Grad.Dip in Electronic Systems
RAE - RACeE*

YEAR: Postgraduate

SUBJECT / MODULE: EE553 – Object Oriented Programming

EXAMINERS: Derek Molloy

TIME ALLOWED: 3 hours

INSTRUCTIONS: Answer **FOUR** questions.
All questions carry equal marks.

- ?? **Before you start – put your name and id-number on the supplied disks!**
- ?? Please use the answer books and the supplied disks to complete your answers to this exam.
- ?? On the disk, please use separate directories for each question attempted, called question1, question2, etc.
- ?? For each question you attempt, please reference your files on the disk related to that question in your answer book.
- ?? **You are responsible for insuring that you have copied all the files that form your answers onto the disk.**

PLEASE DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This booklet contains 4 pages, including the cover sheet.

Question 1.

(a) Answer the following short questions. Keep your answers brief.

- (i) “The keyword *protected* has slightly different meaning in Java and C++”. Explain this statement?
- (ii) Explain the term *event listener*.
- (iii) Explain the use of the *Object* class in Java.
- (iv) How is *scope resolution* performed in C++?
- (v) Explain how JDBC involves using a *ResultSet* object.
- (vi) Describe JINI and a K-Virtual Machine?
- (vii) Explain the *implements* keyword and Java Interfaces.

[14 marks]

(b) What is an **abstract class**? Why is it used? Give an application example of how you might use an abstract class.

[6 marks]

(c) The Java language uses a Java Virtual Machine (JVM). What advantages does the use of a JVM provide when developing Internet based applications?

[5 marks]

Question 2.

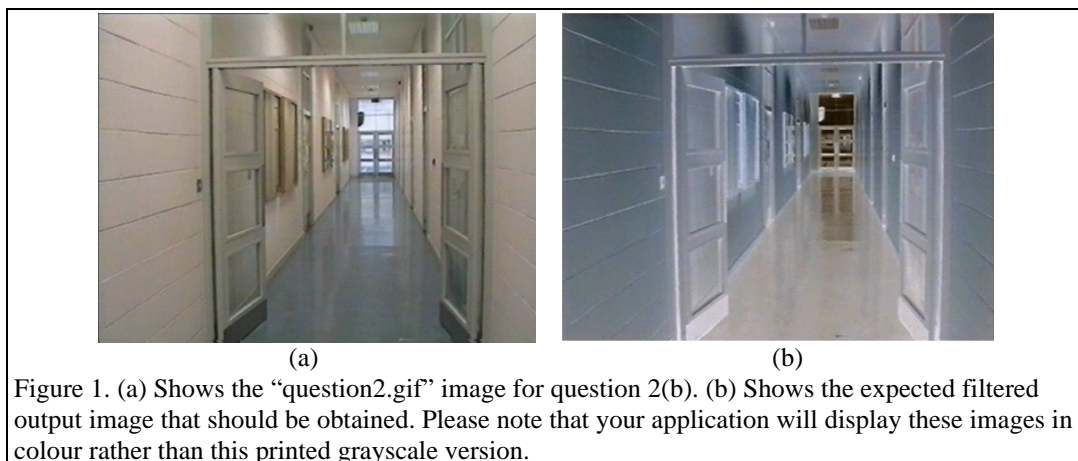
(a) Java can be used very successfully in image processing applications. Describe how Java handles images: How are images loaded? How are images stored? How can we draw lines, circles and rectangles directly onto this image?

[9 marks]

(b) Write a Java applet that loads an image from the local hard disk, performs a colour inversion filter and displays this filtered image. This colour inversion filter should invert each of the RGB colour planes of the image.

(An image is supplied for this section called “**question2.gif**” as in Figure 1.)

[16 marks]

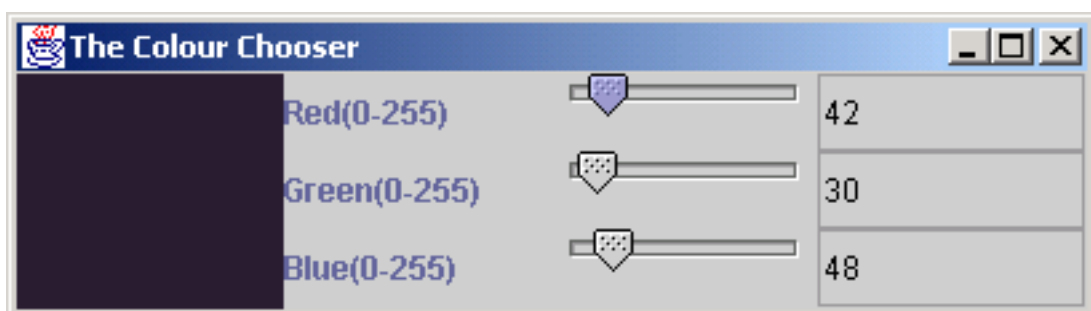


Question 3.

- (a) **Constructors** and **Destructors** are commonly used in C++. Why are they used and what is the C++ syntax for their use? [5 marks]
- (b) **Multiple inheritance** is one aspect of C++ that leads to complications, especially when a defined class inherits from two classes that share a common base class. Describe how you can share (or avoid sharing) this common base class when defining C++ classes, by using the keyword 'virtual'. Explain, with the use of a practical example, why you would wish to share (or avoid sharing) this common base class. [11 marks]
- (c) Write a section of C++ code that demonstrates the use of **separate compilation** when using derived classes. [9 marks]

Question 4.

- (a) Threading is a very powerful aspect of the Java programming language. Explain the two main ways that Java uses to incorporate threading into applications. Also, explain the following terms: *runnable*, *suspend*, *synchronized*, *priority level* and *daemon*. [8 marks]
- (b) Write a section of Java code that uses the Java **Swing** set to create the following **application**. The Colour square can be changed by using the 3 JSliders. The Application window should scale neatly. Hint: rather than using a Canvas for the square, try using a JLabel and setting the background colour. [17 marks]



Question 5.

(a) What does object serialization mean?

[3 marks]

(b) What is Remote Method Invocation (RMI) and how is it used in Java? Explain the terms *skeletons* and *stubs*. What are the limitations of RMI?

[7 marks]

(c) Write a Java client/server pair, where the client sends a string to server. The server encrypts the string and returns back the encrypted string to the client. Note: The encryption technique should be very basic, as simple as adding on 1 to each character in the string. For example:

“Hello World” to the server is returned as “Ifmmp Xpsme”

You have been supplied with three sets of code to handle the basic aspects of this application. These are called

?? **Client.java**,

?? **Server.java** and

?? **ConnectionHandler.java**

These files are in the directory **question5**.

[15 marks]