DUBLIN CITY UNIVERSITY

SEMESTER ONE EXAMINATIONS 2006

MODULE:	Object-Oriented Programming for Engineers - EE553
COURSE:	M.Eng./Grad. Dip./Grad. Cert. in Electronic Systems M.Eng./Grad. Dip./Grad. Cert. in Telecoms. Eng. RAEC – Remote Access to Continuing Eng. Education
YEAR:	Postgraduate (C)
EXAMINERS:	Derek Molloy (Ext. 5355)
TIME ALLOWED:	3 Hours
INSTRUCTIONS:	Please answer <u>FOUR questions.</u> All questions carry equal marks

Requirements for this paper

Log Table X Floppy Disk

THE USE OF PROGRAMMABLE OR TEXT STORING CALCULATORS IS EXPRESSLY FORBIDDEN

• Please use the answer book and the supplied disks to complete your answers to this exam. For each question you attempt partly or completely electronically, please refer to it in the paper answer book.

• On the disk & network, please use separate directories for each question attempted, e.g. question1 etc.

• You are responsible for ensuring that you have copied all the files that form your answers onto the disk and network drive. Please double check that all files are on the disk.

• All files required for the exam are on the network drive. The location will be announced at the beginning of the exam.

Please note that where a candidate answers more than the required number of questions, the examiner will mark all questions attempted and then select the highest scoring ones.

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

1(a) Answer the following short questions (keep your answers concise):

- (i) What is the rationale for passing an object by **constant reference**?
- (ii) Describe the Java equivalent to the C++ member initialisation list?
- (iii) What is the closest Java equivalent to C++ friend methods and classes?
- (iv) When is the garbage collector called in Java?

(v) What is the main difference between abstract classes in C++ and Java?

- (vi) What is a **union** used for in C++?
- (vii) Describe the conditional operator ? in C++.

[14 marks]

1(b) Explain the concept of namespaces in C++. Using a small segment of code, describe how you can create your own namespace and use a class from your namespace outside of the namespace. Why is it good practice not to place the line using namespace std; at the beginning of your header files?

[7 marks]

1(c) Write a short segment of code to explain the various uses of the **this** and **super** predefined variables (note: the code does not need to be complete).

[4 marks]

Question 2

- **2(a)** You have been provided with all the code necessary to draw the clock as shown in Figure 2.1. Write the code to:
 - Make the clock hands move according to the time (including second hand).
 - Move the clock to the location where the mouse button is pressed.
 - When the cursor enters the canvas the clock should stop until the cursor exits. Once the cursor exits the applet, the clock should continue at the correct time.



[15 marks]

2(b) Convert your applet from (a) into a Java application.

[5 marks]

2(c) Discuss the difference between arrays of objects in C++ compared to arrays of objects in Java? In particular, compare SomeClass[] a = new SomeClass[5]; to: SomeClass a[5];

[5 marks]

3(a) Write the implementation for the following class definitions and write a main() function to test them.

class Person { string name_id:	class Lecturer: public Person {
public:	string office;
Person(string, string); virtual void display();	int phoneNum; public:
<pre>virtual string getRole() = 0; };</pre>	Lecturer(string, string, string, int); virtual void display(); virtual string getRole();
class Student: public Person { string programme; int year;	};
public:	
Student(string, string, string, int); virtual void display(); virtual string getRole();	
};	[10 marks]

3(b) Write a template storage container that is capable of storing a specified number of generic objects. It should have the capability to return the number of objects in the store, to return an indexed object and a simple mechanism for adding an object to the end of the store.

[7 marks]

3(c) Use the storage container from (b) to create a Person store that is capable of storing both Student and Lecturer objects. Write code to test this store.

[3 marks]

3(d) Use the STL vector class to perform the same tasks as your storage container and repeat part (c) using the STL vector.

[5 marks]

4(a) Write the Java Swing Application as shown in Figure 4.1. It should allow the user to paint lines or points with the chosen colour as follows:

- The user should be able to choose colours black, red, green or blue through the component on the top right hand side.
- The user can draw a line by choosing the button "Draw Line" and by pressing the mouse button at the starting point, dragging the mouse and releasing it at the end point.
- The user can draw a point by choosing the button "Draw Point" and pressing the mouse.
- Importantly, all the lines and points should remain even if the application becomes covered and uncovered.



Figure 4.1. The Painter Swing Application (lines are in black, red, green and blue)

[20 marks]

4(b) Compare the C++ language to the Java language under the following headings only:

- Destructors
- Nested Classes
- Access Specifiers

[5 marks]

5(a) Write a Java client/server banking application, where the client passes a Transaction object to the server, the transaction operates on an Account object on the server side, and then returns an appropriate response to the client. The basic transactions to be handled are lodgement, withdrawal, balance enquiry and close account. You have been supplied with four classes to handle the basic aspects of this application. These are called:

- Client.java,
- Server.java (Note: this class creates three Account objects)
- ConnectionHandler.java
- Account.java

Files are in the directory **question5**. An example client/server output is shown below:



Figure 5.1 The Client

🗠 Command Prompt - java Server	- 🗆 🗙
An Account, with number:100001 With balance: 200.0 Euro. And owner: Richard Accepted socket connection from client Applying a transaction Applying a transaction	
An Account, with number:100001 With balance: 1200.0 Euro. And owner: Richard Applying a transaction Applying a transaction	
An Account, with number:100001 With balance: 1150.0 Euro. And owner: Richard Applying a transaction	
An Account, with number:100001 This account is closed: Applying a transaction	
An Account, with number:100001 This account is closed:	-

Figure 5.2 The Server

[25 marks]