

DUBLIN CITY UNIVERSITY

SEMESTER ONE EXAMINATIONS 2007/08

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 **FOUR** questions.
All questions carry equal marks

Requirements for this paper

<input type="checkbox"/>	Log Table
<input checked="" type="checkbox"/>	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

Question 1

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

- (i) In C++ what is the usefulness of separate compilation?
- (ii) Strings in Java are immutable; what does mean, and what are the implications?
- (iii) There are no global variables or functions in Java – what can we use instead?
- (iv) What is the Class class used for in Java?
- (v) What is the main difference between abstract classes in C++ and Java?
- (vi) Describe how a “union” structure works in C++?
- (vii) Describe the use of the conditional operator “?” in C++.

[14 marks]

1(b) Discuss **constructors** in C++. Can they be overloaded? Why can they not be virtual? In what order are they called when inheritance takes place? What is the copy constructor and how can it provide specific functionality?

[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) Write an applet that looks like the applet in Figure 2.0. The applet should allow the user to enter text in the text field. When the user presses “Upper case” the string in the box should be converted to an uppercase form – e.g. “Hello” would become “HELLO”. Similarly when the “Lower case” button is pressed the string in the text field should be converted to a lowercase form, e.g. “Hello” would become “hello”. Write an html page to contain this applet.

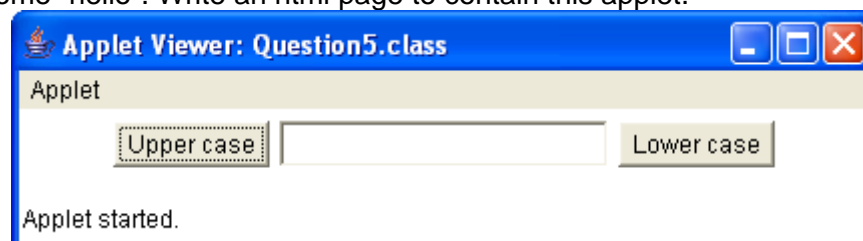


Figure 2.0, The Uppercase/Lowercase applet

[9 marks]

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

[4 marks]

2(c) What are Java interfaces? Why and when are they used? How might you apply user defined interfaces to part 2(a/b), where it describes a window frame that could be called from any other application?

[7 marks]

2(d) 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]

Question 3

- 3(a)** Write an implementation for each of the methods listed in the class definition. Write any other methods that you feel are necessary. Write a main() function that would test the methods of the classes above.

<pre>#include <iostream> class Shape { protected: float area, posX, posY; public: Shape(float, float); void move(float, float); virtual void display(); }; class Circle : public Shape { float radius; public: Circle(float, float, float); virtual void setRadius(float); virtual void display(); ... };</pre>	<pre>class Rectangle : public Shape { float width, height; public: Rectangle(float, float, float, float); virtual void setWidth(float); virtual void setHeight(float); virtual void display(); ... };</pre>
	[10 marks]

- 3(b)** Write a template storage container that is capable of storing a specified number of generic Shape 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)** Explain **multiple inheritance** in C++ - why is a useful feature of the language? How does it lead to difficulties in the design process? In particular, explain the use of the virtual keyword as it relates to multiple inheritance.

[8 marks]

Question 4

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.

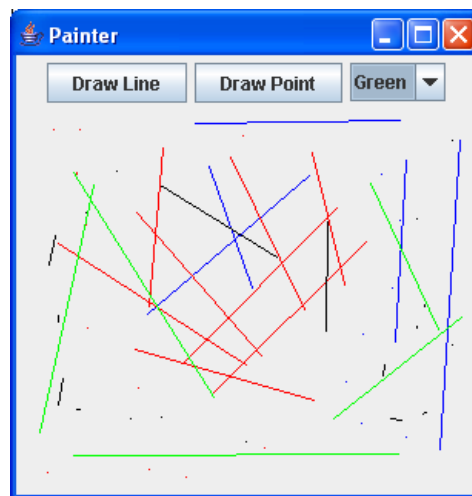


Figure 4.1. The Painter Swing Application (lines are in black, red, green and blue) **[19 marks]**

4(b) List the four C++ explicit casts and describe and explain their uses.

[6 marks]

Question 5.

5(a) Write a section of C++ code to demonstrate the dynamic creation of objects and to demonstrate dynamic binding working with virtual and non-virtual methods.

[9 marks]

5(b) Write a Java client/server pair, where the client sends a Vector (java.util.vector) object containing a number of words to the server and the server sorts the vector alphabetically and sends back a vector with the sorted words. The client should then display the sorted words.

e.g. Send – [“Hello” “World” “Dog” “Cat” “House”] as a Vector and receive back [“Cat” “Dog” “Hello” “House” “World”].

You have been supplied with three sets of code to handle the basic aspects of this application. These are: Client.java, Server.java and ConnectionHandler.java

[16 marks]