

OLLSCOIL NA hÉIREANN, GAILLIMH
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER II SUMMER EXAMINATIONS 2000/2001

Master's Degree in Applied Science (Software Design & Development)

CT520: GUI AND OBJECT ORIENTED PROGRAMMING

Prof. D. Bell
Prof. G. Lyons
Dr. M. Madden
Dr. S. Redfern

Time allowed: **three** hours

Answer **two** questions from **each** section

All questions carry **equal** marks

Use a separate answer book for each section

Section A

1. (a) Explain the terms **composition** and **inheritance** as used in object-oriented programming. Discuss the similarities and differences between them. Use code examples to illustrate your answer. (5)
- (b) Explain, in your own words, Liskov's Substitutability Principle. (3)
- (c) Angles are traditionally measured in degrees, minutes and seconds, with 60 seconds in a minute, 60 minutes in a degree and 360 degrees in a full circle. Write the code for a C++ **Angle** class, with private integer members for storing degrees, minutes and seconds. Include a constructor for the class that allows the degrees, minutes and seconds to be specified. (You should verify that the seconds and minutes are in the range 0-59, and the degrees is in the range 0-359.) Also include definitions of functions **getDegrees**, **getMinutes** and **getSeconds**, and a function **getTotalSeconds** that returns the total number of seconds in the angle. (For example, an angle of 0 degrees, 10 minutes and 5 seconds is equivalent to a total of 605 seconds.) (4)
- (d) Add overloaded ++ and -- operators to the **Angle** class you have defined. The ++ operator should increase the number of seconds by one, and the -- operator should reduce the number of seconds by one. Both should also adjust the minutes and seconds if required. Ensure each of the functions returns a reference to the **Angle** object. (5)
- (e) Overload the << operator for the **Angle** class that you have defined, so that it outputs the angle in a format like "0 deg., 10 min., 5 sec." Ensure the function returns a reference to the output stream. (3)

2. Discuss in detail **all** of the following five C++ programming topics, using code examples for illustration:
- (1) Default function parameters
 - (2) Function overloading
 - (3) Abstract classes
 - (4) Static class members
 - (5) Inline functions (both members and non-members of classes) (20)

3. (a) Western Ireland Personal Organisers Ltd. has employed you as part of a team to develop software for their new product, the MiniWipo.

Write a C++ class called **PhoneNumber** with three private integer member variables, for storing the country code, region code and local code of a phone number. Include the following public member functions in the class:

- (1) A **constructor** that takes one parameter, specifying the country code. This should have a default value of 353.
- (2) A function called **setNumber** that takes two parameters, specifying the region code and local code.
- (3) A function called **setCountry** that takes one parameter, for specifying a new country code.
- (4) Functions for accessing the components of the number, called **getCountry**, **getRegion** and **getLocal**.
- (5) A function called **display** that displays the phone number on the standard output stream in a format like "+353-91-111111". (7)

- (b) Using composition, write a C++ class called **Contact** with four private members: a 50-character array (called **name**) and three **PhoneNumber** objects (called **home**, **work** and **mobile**). The character array is for storing the contact's name. The **PhoneNumber** objects are for storing the contact's home, work and mobile phone numbers.

Also, write a **constructor** that takes two parameters, specifying the contact's name and a country code. The country code must be passed to the constructors of the home, work and phone number objects. The contact's name must be copied into the character array. (Use the function **strcpy**, declared in **string.h**, for this.) (5)

- (c) For the **Contact** class, add the following additional public member functions:

- (1) Functions called **setHomeNumber**, **setWorkNumber** and **setMobileNumber**, each of which takes two parameters (a region code and a local code). Each of these functions should call the **setNumber** function of the appropriate **PhoneNumber** object.
- (2) A function called **setCountry**, that takes a parameter specifying the country code and sets this for the home, work and mobile numbers.
- (3) A function called **displayName** that displays the contact's name on the standard output stream.
- (4) Three functions called **displayHomeNumber**, **displayWorkNumber** and **displayMobileNumber**, each of which works by calling the **display** function of the appropriate **PhoneNumber** object.
- (5) A function called **displayAll** that lists the contact's name, home number, work number and mobile number on the standard output stream. (8)

Section B -- Visual Basic (VB)

Q.4.

(a) 10 marks

Describe the use of the VB Timer control, referring to the properties *Interval* and *Enabled* in your answer. Write a VB "stopwatch" program that provides an on-screen countdown from a user-specified number of seconds down to 0. When 0 is reached, the user should be informed that the stopwatch has finished.

(b) 5 marks

What causes the *keypress* event of a *text box* to occur, and what is its *KeyAscii* argument used for? Write code that could be used in a *keypress* event procedure in order to automatically capitalise the first letter typed in, and automatically ensure that all subsequent letters are lower case.

(c) 5 marks

Briefly explain each of the following VB string-handling functions, using at least one example to illustrate each:

```
Len(a$)
Right$(a$, x)
Mid$(a$, x, y)
Instr(a$, b$)
Instr(x, a$, b$)
```

Q.5. 20 marks

The data below is an extract from a set of many thousands of records held in an old database system; it contains important name, address, and phone number information required by a certain company. The company is now modernising its information systems: this involves the development of a Visual Basic (VB) record-keeping system running in Windows.

```
ADAMS;ARNOLD;12 SHOP STREET GALWAY;523235
BARNICLE;PATRICK;FERRIS LANE BUNCRANA;875876
BARTHOLOME;GABRIELLE;CIRCULAR RD GALWAY;764456
CONROY;EAMONN;ENNIS ROAD GORT CO GALWAY;654456
```

You are required to write a VB program that will read in the thousands of records (which are currently stored in an ASCII Text file), and to display them in a FlexGrid control prior to further processing. The FlexGrid should have 5 columns, labelled as follows: Number; Surname; First name; Address; Phone number.

Q.6.

(a) 4 marks

What is the difference between an *event procedure* and a *general procedure*? Give examples of when you would use each of these two types of procedures.

(b) 6 marks

What is the *common dialog* control used for? Write the VB code necessary to (i) use a common dialog control to allow the user to select a printer and number of copies to print, (ii) send the chosen number of copies to the printer. The content of each copy should be the words "BLANK PAGE".

(c) 5 marks

What are *Windows Dynamic Linked Library (.DLL)* files? Briefly describe **why**, and **how**, Visual C++ is used to write DLL export functions which can then be called from a Visual Basic application.

(d) 5 marks

What is *run-time error handling*? Provide a code fragment illustrating its use.

CT520 VB Information Page - attach to exam paper

Object	Important Properties	Important Events & Methods
Check Box	Value	Click
Clipboard		GetText; SetText; Clear
Combo Box	Sorted; Text; List(index); ListCount; SelStart; SelLength; SelText	AddItem(item, index); RemoveItem(index); Clear
Command Button	Caption	Click
Common Dialog	FileName; Filter; Color; Flags; FontBold; FontItalic; FontStrikeThru; FontUnderline; FontName; FontSize; Copies; FromPage; ToPage	ShowOpen; ShowSave; ShowColor; ShowFont; ShowPrinter
Form	Caption; BackColor; AutoRedraw	Show; Hide; Load
Frame	Caption	
Grid	Rows; Cols; FixedRows; FixedCols; Row; Col; Text; ColWidth(index)	KeyPress(KeyAscii As Integer)
Image	Picture	
Label	Caption; AutoSize; WordWrap	
List Box	Sorted; List(index); ListCount; Columns; MultiSelect; Selected(index)	AddItem(item, index); RemoveItem(index); Clear
Menu item	Caption; Enabled; Checked	Click
OLE Container	Class; SourceDoc; SourceItem	Update; SaveToFile; ReadFromFile
Option Button	Value	Click
Printer		Print; EndDoc
Scroll Bar	Value; Max; Min; LargeChange; SmallChange	Change; Scroll
Text Box	Text; MultiLine; ScrollBars; BackColor; ForeColor; FontBold; FontItalic; FontStrikeThru; FontUnderline; FontName; FontSize; SelStart; SelLength; SelText	KeyPress(KeyAscii As Integer); Change
Timer	Interval; Enabled	Timer

Miscellaneous Object Events:

GotFocus; LostFocus; Enabled; Visible; TabIndex; MouseUp(Button As Integer, Shift As Integer, X As Single, Y As Single); MouseDown(Button As Integer, Shift As Integer, X As Single, Y As Single); MouseMove(Button As Integer, Shift As Integer, X As Single, Y As Single)

Miscellaneous Object Methods:

SetFocus; Move(x, y); Line (x1,y1) - (x2,y2)

Miscellaneous Object Properties:

Width; Height; Left; Top