

NATIONAL UNIVERSITY OF IRELAND, GALWAY
OLLSCOIL NA hÉIREANN

SEMESTER II, SUMMER 2000 EXAMINATION

HIGHER DIPLOMA IN APPLIED SCIENCE
(SOFTWARE DESIGN & DEVELOPMENT)

CT862 GUI AND OBJECT ORIENTED PROGRAMMING

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

Time allowed: 3 hours

Answer any 2 questions from section A *and* any 2 questions from section B

Section A (Object Oriented Programming)
Code in this section is to be written in C++

Q.1.

(i) 10 marks

What is a “class”, and why is it essential to object-oriented programming? What is the meaning of the term “class inheritance”? Explain the difference between deriving a class using the keyword **public** and deriving a class using the keyword **private**.

(ii) 5 marks

What are class constructors and destructors? Write 2 constructor functions for a **date** class: (a) for initialising member data from code; (b) for initialising member data from user input. Assume that the class has 3 integer member variables: day, month, year.

(iii) 5 marks

Finish these partial class declarations for two C++ classes (implementation of functions not required):

```
class student
{
protected:
    // member data : name, ID, year
public:
    // member functions: constructor, print
};

class postgrad_student : public student
{
    // additional member data: fellowship, department, thesis title
public:
    // member functions: constructor, print
};
```

Q.2.

(i) 5 marks

Explain the meaning of the C++ term “operator overloading”. Write two simple overloaded operator functions, one for a unary operator and one for a binary operator.

(ii) 6 marks

Examine the following declaration of a class for handling text strings:

```
class string
{
    // member data
    char str[50];
    int len;
public:
    // member functions
    string(const char* s); // constructor
    print( );              // print out "str" character array
};
```

Write an implementation for the following 3 overloaded operators:

```
// 1. output string
ostream& operator<<(ostream& os, string& s);

// 2. concatenate 2 strings & return result
string& operator+(string &a, string &b);

// 3. return the character at position pos in s's char array
char operator[](string s, int pos);
```

(iii) 9 marks

Prototype and implement a **BankLoan** class which has:

- three pieces of member data: (1) initial loan amount, (2) year in which the loan was taken out, and (3) amount paid off the loan to date;
- two public member functions: (1) to pay an amount of money off the loan, and (2) to enquire the current balance - this function requires as input the current year, and should apply interest at 25% per year that has elapsed since the loan was taken out.

Overload the + (plus) operator to pay money off the loan, and the << (stream output) operator to print out the current balance.

Q.3. 20 marks

A weight in the Imperial system is measured in stones, pounds, and ounces (14 pounds per stone, 16 ounces per pound).

Prototype and implement an **imperial weight** class. The class should involve the following elements:

- Member data to store stones, pounds, and ounces
- 2 constructor functions, of the following forms:
`imperial::imperial();`
`imperial::imperial(int st, int lb, float oz);`
- Overloaded input and output operators
- Overloaded addition and subtraction operators. For subtraction you may assume that the result will be positive
- Overloaded multiplication and division operators. It is assumed that an imperial weight will be multiplied or divided by a regular integer, i.e. the overloaded * operator will be of the following form:

```
imperial operator*(imperial &i, int j);
```

Q.4.

Write notes on four of the following, providing code fragments to illustrate your answers where appropriate (5 marks each):

- (a) The copy constructor, and an example of when its explicit definition is required.
- (b) Overloaded function names
- (c) Inline functions and friend functions
- (d) Static member variables
- (e) Abstract base classes and virtual functions

Section B (GUI Programming)

Code in this section is to be written in Visual Basic (VB)

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
BARTHOLOMEGABRIELLE.CIRCULAR RD GALWAY.....764456
CONROY....EAMONN....ENNIS ROAD GORT CO GALWAY654456
```

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 Grid control prior to further processing. The Grid should have 5 columns, labelled as follows: Number; Surname; First name; Address; Phone number.

Q.6.

(i) 10 marks

Describe the process by which the Data Control is used to manipulate external database files from VB. Explain, illustrating your answer with code fragments, how specific database records can be searched for according to user-defined search criteria.

(ii) 10 marks

A database with a Visual Basic user-interface is used by a food distribution company for keeping track of its stock levels. The form shown on the next page is used to access one of the tables in this database. A Data Control (captioned "Food Records") is used to navigate through the records, while the fields of the current record are displayed in 3 text boxes. The different types of food are categorised as Fruit, Vegetables, etc. You are required to write the code necessary to allow the user to find the amount of stock (in KG) for an entire category of food. This code should be executed when the "Inventory by Type" button is clicked, and should involve the user being asked for the category that they are interested in.

Stock Management System

Description
Oranges

Type In Stock (KG)
Fruit 76

Inventory by Type

Food Records OK

For example, if the user needed to know what the total stock of vegetables was, they would click the “Inventory by Type” button, and then type **Vegetables** when prompted.

Q.7.

(i) 6 marks

What do the terms *property* and *method* mean? With regard to the VB combo box control, identify which of the following are properties and which are methods: Name, ListCount, AddItem, Clear, Click. Briefly describe the use of each of these properties and methods.

(ii) 14 marks

The following form is used as part of a larger program. It allows the user to pick a date by typing a year number into a text box, then picking a month from a combo-box, and finally picking a day number from another combo-box:

Date Picker

Year
2000

Month
February

Day
22

OK

Identify the appropriate event procedures and write the code necessary to:

- Ensure that only numbers are typed into the Year text box
- Populate the Month combo box with the names of the 12 months
- Clear and re-populate the Day combo box with the correct day numbers in the specific month chosen by the user. Note that if February is the chosen month, you will need to calculate whether the current year is a leap year. The rule for this is: a year is a leap year if it is divisible by 4, but not if it is also divisible by 100. However, a year that is divisible by 400 *is* a leap year.

Q.8.

Answer any four of the following short questions (5 marks each):

- (a) What is a VB Class Module? Explain how the following Object Oriented Programming features are implemented in Class Modules:
(i) Public Methods, (ii) Private Member Data.
- (b) What is the *common dialog* control used for? Write the VB code necessary to (a) use a common dialog control to allow the user to select a colour, (b) apply that colour to the *BackColor* property of a text box. Your code should deal correctly with a situation where the user clicks the Cancel button in the colour dialog box.
- (c) 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.
- (d) With regard to a variable's scope and lifetime, explain the keywords Dim, Static, Private, and Public. When would you declare a variable in the Declarations section of a code module? Describe the *Variant* data type in VB.
- (e) What is *Visual Basic for Applications* (VBA), and what are some of the benefits of using it? Briefly explain the process of **macro recording** followed by **VBA code editing** in Excel or Word.
- (f) 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.