

University of Swaziland
Department Of Computer Science
Final Examination 2005

Title of paper: *C under Unix*
Course number: *CS344*
Time Allowed: *Three (3) hours*

Instructions:

- *Each question is worth 25 marks*
- *Answer Questions 1 & 2*
- *Answer any two (2) questions from questions 3 to 6*

This paper may not be opened until permission has been granted by the invigilator

Question 1- 25 marks

(Compulsory)

Translate the following Pascal program into an equivalent C++ program. Your program must use a class template definition (instead of struct).

```

program CircQueue (input, output);

const MaxQueue =10;
type DataType = Integer;
   Queue      = record
       Items : array[1..maxqueue] of DataType;
       Front, Rear : integer;
       Count : integer;           { number of element in queue}
   end;
var Q : Queue;

procedure create (var Q : Queue); {initializes queue}
begin
    Q.Front := 1;
    Q.Rear  := MaxQueue;
    Q.Count := 0;
end;

function IsEmpty ( Q : Queue):Boolean;
begin
    IsEmpty := (Q.count = 0);
end;

function IsFull ( Q : Queue):Boolean;
begin
    IsFull := (Q.count = MaxQueue+1);
end;

Procedure Enqueue (NewElement : Datatype; var Q : Queue);
begin
    if not IsFull(Q) then
    begin
        Q.Rear := (Q.Rear mod MaxQueue)+1;
        Q.Items[Q.Rear] := NewElement;
        Q.Count := Q.Count + 1;
        { Q.Rear := succ(Q.Rear); }
    end;
end;

procedure Dequeue ( var Q : Queue);
begin
    if not IsEmpty(Q) then
    begin
        Q.Front := (Q.Front mod MaxQueue) + 1;
        Q.Count := Q.Count - 1;
    end;
end;

```

```
Function QueueFront ( Q : Queue) : DataType;
begin
    if not IsEmpty (Q) then
        QueueFront := Q.Items[Q.Front];
    end;

    procedure ShowAll (Q : Queue);
    var Temp : Queue;
    begin
        Temp := Q;
        while not IsEmpty(Temp) do
            begin
                write( QueueFront(Temp):5);
                Dequeue(Temp);
            end;
            writeln;
        end;
    end;

begin
    Create (Q);
    Enqueue (30, Q);
    EnQueue (10, Q);
    EnQueue (5, Q);
    ShowAll(Q);
    Dequeue(Q);
    ShowAll(Q);
end.
```

Question 2- 25 marks

(Compulsory)

Assume your Inkhundla wishes to design a database for their small community library. Initial analysis has determined the following information.

Each library book has a title, and author and publisher. The library may have more than one copy of the same book. Each copy of a book is assigned a unique copy number and the purchase date and price are recorded. Users may borrow copies of a book. For each copy of a book on loan the issue date and return date are recorded. Overdue books attract an overdue charge of 50 cents a day for Adult users and 10 cents for children. Users of the library have library cards which contain information about the user. This information include the name and address of the library user. There are two types of library users: *Adults* and *Children*. Every child library user must have exactly one Adult sponsor who must also be a library user. For each child, the age and class grade are recorded.

- i. Using UML notation draw an OOA class diagram for the library system described above. Your diagram must show all classes, data members, member functions, instance connections, message connections and structures (Sub classes and Aggregation) 20 marks
- ii. Using UML notation draw a OOD class diagram for the library system described above. (Hint: Do not re-draw the diagram, instead just Add design details to class diagram obtained in (1) above, including accessibility of the members. 5 marks

Question 3- 25 marks

Based on the UML diagram obtained in question 2 above, write C++ class definitions for all the classes and structures shown in your diagram. Do not write the actual code for the member functions.

Question 4- 25 marks

90

- i. Fill in the blanks in the following. (Note : Just write down the missing words)

15 marks

- a. Every C++ program begins execution at the function _____.
- b. Every statement ends with a _____.
- c. All programs can be written in terms of three types of control structures : _____, _____ and _____.
- d. Class members are accessed through the _____ operator in conjunction with the name of an object of the class or via the _____ operator in conjunction with a pointer to an object of the class.
- e. Members of a class specified as _____ are accessible only to member functions of the class and to friends on the class.
- f. Member functions of a class are normally made _____ and data members are normally made _____.
- g. The keyword _____ is used in a function header to indicate that a function does not return a value.
- h. A function that calls itself is called a _____ function.
- i. If class **Alpha** inherits from class **Beta**, then class **Alpha** is called the _____ class and **Beta** is called the _____ class.
- j. A class definition that contains at one or more pure virtual functions is called an _____ class.

- ii. State whether the following statements are true or false. If False explain why it is false.

10 marks

- a. All variables must be given a type when they are declared.
- b. **cin** is a predefined object of class **ifstream**.
- c. A class may have more than one destructor function.
- d. An array can store many different types of values.
- e. Private members of a base class are visible to derived classes.
- f. If **class A** is a friend of **class B**, this implies **class B** is a friend of **class A**.
- g. An object is an instance of a class.
- h. The name of an array is a constant pointer to the first element of the array.
- i. The extraction operator (>>) can be overloaded.
- j. A function template provides overloaded template functions.

Question 5- 25 marks

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- i. Write C++ code segments to perform the following 15 marks
- a. Display the value of the fourth element of character array **T**.
 - b. Write three different statements that increments the value integer **x** by 1.
 - c. Using a **for** loop, Display all the elements in float array **B**, containing **N** values.
 - d. Determine the smallest value in integer array **W** containing **N** values.
 - e. Using a **while** loop, display all elements in single linked list **L**.
- ii. Distinguish between the following 10 marks
- a. Base class and Derived class.
 - b. Private and Protected inheritance.
 - c. Abstract and Concrete class.
 - d. A class and an object
 - e. Inclusion and operation polymorphism

Question 6- 25 marks

- i. Write the C++ syntax and draw the flow charts for the following statements.
- a. **if –else** statement 3 marks
 - b. **while** statement 3 marks
 - c. **for** statement. 4 marks
- ii. Write a C++ program that generates the following figure. Your program must read the height of the figure from standard input. 15 marks

```
      *
     ***
    *****
   ********
  **********
 **********
```