

University of Swaziland
Department Of Computer Science
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Title of paper: *C under Unix*

Course number: *CS344*

Time Allowed: *Three (3) hours*

Instructions:

- *Each question is worth 25 marks*
- *Answer Question 1*
- *Answer any three (3) questions from questions 2 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

- 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 3- 25 marks

- 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.

A function template provides overloaded template functions.

Question 4- 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

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

15 Marks

Question 5- 25 marks

Write a C++ function **DoubleSpace** (*ifstream InFile, ofstream OutFile*) that takes an input stream, *InFile*, as input and copies all the contents of *InFile* to an output stream, *OutFile*. The lines in *OutFile* must be double spaced. That is there must be at least one blank line between any consecutive lines in *OutFile*. The figure below shows a sample *InFile* and the expected double spaced *OutFile*.

InFile – Single Spaced

Good Hamlet,
Cast thy nited color
And look like a friend to Denmark

OutFile – double spaced

Good Hamlet,
Cast thy nited color

And look like a friend to Denmark

25 marks

Question 6- 25 marks

- (i) Distinguish between single inheritance and multiple inheritance. 2 marks
- (ii) Using the concepts of classes, subclasses and inheritance, model (use diagram) an account class hierarchy for a banking enterprise. For each account the account number, name of holder (owner) and balance are recorded. Account holders may deposit or withdraw money from the account. A deposit transaction increments the balance by the amount being deposited and withdrawal decrements the balance by the amount being withdrawn. The enterprise has two types of account: A current (cheque) account and a savings account. For each current account the overdraft limit is recorded. The overdraft limit is the amount by which the account holder is allowed to overspend each month. The overdraft limit may be changed from time to time. Each savings account attracts an

annual interest rate. This rate may be changed from time to time. The interest for each savings account is calculated each month and deposited into the account. The following formula may be used for this purpose: $\text{MonthlyInterest} = \text{Annualrate} * \text{balance} / 12$. The details for each account may be printed when necessary. For a current account the account number, name of owner, balance and overdraft limit may be printed. For a savings account the account number, name of owner, balance and interest rate are printed.

10 marks

(iii) Using C++ notation write an implementation of the class hierarchy obtained above. That is define all the classes and write the corresponding code for the member functions in each class.

13 marks

END OF EXAMINATION PAPER