University of Swaziland
Department Of Computer Science
Final Examination
May 2008

Title of paper: *C under Unix*

Course number: *CS344*

Time Allowed: *Three (3) hours*

Instructions:

- *Answer questions 1 and 2.*
- *Answer any other two (2) questions from questions 3 to 6*
- *Each question carries 25 marks*

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

Question 1 - 25 marks - Compulsory

(a) State whether each of the following is true or false. If false explain [*6 marks*]

(i) All variables must be declared before they are used.

(ii) All variables must be given a type when they are declared.

(iii) C++ considers the variables **number** and **Number** to be identical.

(iv) Variable declarations can appear almost anywhere in the body of a C++ program.

(v) The default case is required in the **switch** selection structure.

(vi) An array may store many different types of values.

(b) Write a C++ statement(s) to accomplish each of the following

(i) Declare variables **c**, **thisnumber**, **q234** and **number** to be of type integer. *2 marks*

(ii) Declare an double precision pointer y, set it to point to some arbitrary memory location, and initialize the value of this location to be 7.4 *2 marks*

(iii) Print the value 333.546372 in a field of 15 characters with precision of 3. *3 marks*

(iv) Sum the odd integers between 1 and 99 using a **for** loop; *2 marks*

(v) Declare an array of 10 integers called **scores** and initialize the first 5 components to 8, 10, 12, 100, 56 *2 marks*

(vi) Print the sum of all elements of a floating-point array **c** of 100 elements. *4 marks*

(vii) Declare a structure to store personal records containing the firstname, lastname and age of each person. *4 marks*

Questions 2 & 3 are based on the following Pascal program

```
Program Sample (Infile, Outfile, input, Output);
var Infile : Text; outfile : text;
    Name : string[14]; Id   : string[6];
    Test1, Test2, Test3, Exam, StudCount : Integer;
    CA, OverallMark, TotalCA, TotalOV, TotalExam : Real;

    Function Grade ( g : Real):char;
    begin
        if g >= 80 then Grade := 'A'
        else if g >= 70 then Grade := 'B'
        else if g >= 60 then Grade := 'C'
        else if g >= 50 then Grade := 'D'
        else if g >= 40 then Grade := 'E'
        else Grade := 'F';
    end;

    begin
   Assign (Infile, 'Student.txt');
   reset (Infile);
   Assign (OutFile, 'Report.txt');
   rewrite (outfile);
   CA := 0;
   StudCount := 0;
   TotalCA := 0.0;
   TotalExam := 0.0;
   TotalOV := 0.0;
   Header;
   While not eof (Infile) do
   begin
     Read (Infile, Name, Id, Test1, Test2, Test3, Exam);
     CA := (Test1+Test2+Test3)/3;
     OverallMark := 0.4*CA + 0.6*Exam;
     Write( Outfile, Id:10, Name:15, CA:9:2, Exam:5, OverallMark:9:2,
               Grade (OverallMark):10);
     Readln (Infile);
     Writeln (Outfile);
     Writeln (Outfile);
     StudCount := Succ (StudCount);
     TotalCA := TotalCA + CA;
     TotalOV := TotalOV + OverallMark;
     TotalExam := TotalExam + Exam;
   end;
   Writeln (Outfile);
   Writeln (Outfile,'NUMBER OF STUDENT        = ', StudCount);
Writeln (Outfile,'AVERAGE CA MARK       = ', TOTALCA/STUDCOUNT:5:2);
Writeln (Outfile,'AVERAGE EXAM MARK     = ', TOTALEXAM/STUDCOUNT:5:2);
Writeln (Outfile,'AVERAGE OVERALL MARK  = ', TOTALOV/STUDCOUNT:5:2);
close (infile); close (outfile); readln;

end.
```

Question 2-25 marks - Compulsory

Translate the Pascal program given above into an equivalent C++ program. *25 marks*

Question 3 -25 marks

Draw a structure diagram for the given Pascal program. *25 marks*

Question 4-25 marks

(a) Write a C++ function, void **WriteChar** (char CH , int N), that takes a character CH and an integer N and displays the specified character (CH), N times on standard output. 5 marks

(b) Consider the following figure

Using function **WriteChar** above, write a C++ program **DrawFig** *(H:Integer)*, that produces the above figure. The program should be general enough such that it can be used to produce any other figure, bigger or smaller, of the same pattern (shape). *Show all your working from analysis to design and implementation.* *20 marks*

Question 5 – 25 marks

Write a program that implements an array, L [0..N] of linked lists. The program must read a sequence of integers from a text file. For each integer X read from the text file the program must insert X into linked list L[I] only if X is a multiple of I. Once the program has read all the integers from the text file it must display all the values in each linked list on standard output.

Assume type **LinkedList** is already defined with the operations

- *LinkedList(L)* – initializes list L to an empty list.
- *Insert (e, L))* – Inserts new element e into linked list L. For example Insert (10, L) inserts the value 10 into linked list L.
- *Delete (e,L)* – Delete element e from the linked list L.
- *Show(L)* – Displays all the elements in linked list L. 25 *marks*

Question 6– 25 marks

A complex number has the form, $X + iY$, where X is the real part and Y is the imaginary part of the complex number.

(a) Define a data type, called **Complex**, that can be used to declare complex numbers.

3 marks

(b) Using your type definition in (a), write the following functions:

- *Re(Z)* - takes a complex number Z and returns its real part

4 marks

- *Im(Z)* - takes a complex number Z and returns its imaginary part .

4 marks

(c) Using Your definitions in (i) and (ii) above, write the following functions.

- *Sum (Z1, Z2)* - takes two complex numbers, Z1 and Z2 and produces the sum of the complex numbers, in the form X + iY. *7 marks*

- *Product (Z1, Z2)*- takes two complex numbers, Z1 and Z2 and produces the Product of the complex numbers, in the form X + iY. *7 marks*