UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, DEC 2011

Title of Paper   : STRUCTURED PROGRAMMING - I

Course number   : CS243

Time allowed   : Three (3) hours.

Instructions   : (1) Read all the questions in Section-A and Section-B
                      before you start answering any question.

                    (2) Answer all questions in Section-A. Choose options
                      as given in questions of Section-B.

                    (3) Maximum mark is 100.

                    (4) Use correct notations and show all your work on the script.

                    (5). All programs should be well documented and indented.

This paper should not be opened until the invigilator has granted permission.

Q1 (a) (marks 8). Write equivalent single assignment statement corresponding to each of the following mathematical relations. Use suitable identifiers.

1. $C = \sqrt{\dfrac{x^2 + y^2 + 2xyz}{(x+y)^Z}}$

2. $P = p_0 e^{-k(t_0 - t)} + \varepsilon$

3. $\dfrac{1}{F} = \dfrac{1}{F_1} + \dfrac{1}{F_2}$

4. $\dfrac{dy}{dx} = \dfrac{3Sin(x) + 2xyCos(y)}{6xy}$

Q1 (b) (marks 8). Find the values of left hand side identifiers in the following statements. Assume that the following declarations are already given.

```
Const  X = 3 ; Y = 2 ; A = -2; B = 3; C = 0;

Type Work_Day = 1 .. 7;

Var  Tr: integer;  On_Line: boolean;
     Comp_Ch : char;
     Holi_day : set of  Work_Day;
```

1.   On_Line := A * X + B * Y + C <> 0;

2.   Holi_day := [6, 7] + [pred (2)] + [succ (6)];

3.   Tr := B div (3 - B mod 3 - 1);

4.   Comp_Ch := Chr ((X + ord('A')));

Q2 (marks 10 + 6). Write pseudo codes and programs to find and display the count of students and the average height of students in a class. The program should read the heights of students in an array of integer numbers (in cms) from the keyboard interactively. The sentinel height should be given as zero. Use appropriate interactive messages and output lay out on the screen. Declare a function sub program to find the average value. The formal argument list should include – an array of integer numbers and the count of values in the array.

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Q3(a) (marks 6 + 6 + 6). Write a complete well documented and well indented program to create a linear array of UNISWA student records as CLASSLIST and a subprogram to search for the information of a certain given Id number as follows -.

The student record has six fields – IDnumber, name, gender, study year, program of study and faculty. Your program should read each field of the record from KBD interactively and create an array, named, CLASSLIST of all the records read. Your program should also count the number of records in the array. The sentinel record has the ID number as zero.

Q3(b). Include a complete subprogram SEARCH, that displays all the record information of a certain student whose ID number is provided as an argument. It should display an appropriate error message if the given Id number is not in the CLASSLIST.

Q3(c). Write statements in your main program to test the SEARCH subprogram.

SECTION-B

NOTE: Select options in this section as given with the questions.

Q4 (marks 25). Assume that reading is from the keyboard and display is on the screen and the following declarations are already given -

```
Var

        N1, N2, N3, N4, I, J, Temp : integer;
        Sales, Commission: real;
        Gender : Char;
        P : array [1..1000] of real;
```

Write executable statements in Pascal with proper syntax (not a complete program) to perform **any five** of the following tasks independently. Use the above declarations only.

(i). Exchange the values of N1 with N2 only when N3 and N4 are both non negative.

(ii). Compute Commission according to the following rules –

   There is no Commission if Sales is 3000 or less.
   Commission is 10 % of Sales, if Sales is 5000 or less,
   Commission is 20 % of Sales, if 5000 < Sales < 12000 and
   Commission is 30 % of Sales, if Sales is 12000 or above.

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(iii). Using a case statement, display 'MALE', if Gender is 'M' or 'm'. Display 'FEMALE' if Answer is 'F' or 'f'. Display 'INCORRECT GENDER' otherwise.

(iv). Display all the values in array P which lie in [10, 100] . Assume P has 1000 values.

(v). Display the smallest value in array P.

(vi). Display 'ORDERED' only if (N1 > N2 > N3 > N4) or (N1 < N2 < N3 < N4).

Q5 (marks 6 + 4 + 5). Information about the xy-coordinates of several points is known. It is required to find out the quadrant number in which each point lies. Also the display should include the count of points lying in each quadrant. The sentinel point is the origin.

All the information is to be given interactively from the keyboard, The xy-coordinates of points are to be displayed along with the quadrant number on the screen according to your own layout. For example, points A, B and C are shown in the following figure :
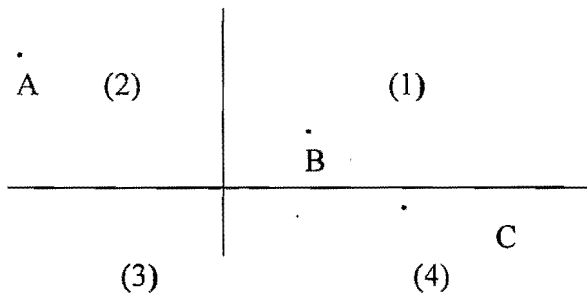
The point A is in quadrant number 2, the point C is in quadrant number 4 and B is in quadrant number 1.

Write the analysis (Input, Process and output), pseudo code (declarations and action steps). Assume that x-y coordinates of a point are two integers and that no point lies on any axis.

Q6 (marks 10). Read the following Pascal program very carefully and write the **exact** display produced on screen when the program is executed.

```
Program CS243_Exam_Dec_2011;
Const Size = 4;
Type  id = 0 .. 6000;
var  ST, TEMPST : id;
     i,j,digit, count, prod : integer;

Begin

  for i := 1 to Size do
    begin
      write (' Enter value number ', i:2, ' of id type- ');
      readln(ST);
      TEMPST := ST;
      Count := 0;
      prod := 1;
      writeln('DATA  DIGIT COUNT PRODUCT');
      Writeln (TEMPST:6);
      While TEMPST <> 0 do
        Begin
          Count := count + 1;
          digit :=TEMPST div 10;
          prod := prod * digit;
          Writeln ( TEMPST:6,digit:6,count:6, prod:6);
          TEMPST :=  TEMPST - digit*10;
        End;
    end;

end.
```

Assume that the data entered at run time is :

2653
3718
5409
1111
OR

2413
5976
1009
2222

Give the exact display for either of the above input data values.

(End of Examination Paper)