UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 2012

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 notation 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.

SECTION-A

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

1. $S = \dfrac{(a+b)(b-c)}{3a^2 b^2}$

2. $p = \sqrt{\dfrac{(2\alpha - 3\beta)}{\sin^2 \alpha - \cos^2 \beta}}$

3. $Root_1 = \dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$

4. $\dfrac{1}{R} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$

(8 marks)

Q1(b). 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_Days = (su, mo, tu, we, th, fr, sa);

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

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

2.   Holi_day := []*[pred (mo)] + [succ (fr)]*[];

3.   Tr := SQRT(SQR(X - Y)) + A + B +C;

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

(8 marks)

Q2. Write a complete program to compute the value of VAR as follows –

$$VAR = \sum_{i=1}^{n} (\overline{X} - X_i)^2$$

2

Your program should get the values of **n** (count of values in array *X*) and values of *X_i* in an array of real numbers *X* interactively from KBD. The average of X_i values is computed as $\overline{X}$.

You should be declaring a subprogram, ***average*** (a function or a procedure) to compute the average of given **n** real numbers in an array *X*. Assume that **n** is a nonzero positive integer number.

(10 + 6 marks)

Q3(a). Write a complete well documented and well indented program to create a linear array of UNISWA student records as CLASSLIST and a subprogram to find 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 FIND, 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 FIND subprogram.

(6 + 6 + 6 marks)

SECTION-B

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

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

```
Var

        Smallest, N1, N2, N3, N4, I, J, Temp : integer;
        Amount, Duration, Interest: real;
        Gender : Char; Smiles: Boolean;
        P : array [1..500] 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). Circulate the values to left, i.e. the values of N4 goes to N3, N3 goes to N2, N2 goes to N1, and N1 goes to N4.

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

> There is no Interest if Duration is less than 1.
> Interest is 10 % of Amount, if Duration lies in [1, 2] and
> Interest is 12 % of Amount, if Duration is more than 2

(iii). Using a case statement, Assign Gender to 'M' if Smiles is true and 'F' otherwise.

(iv). Display the count of values in array P which lie in [1000, 1090]. Assume P has 500 values.

(v). Display the Smallest value among the values of P array.

(vi). Display 'ALL ZERO' only if (N1 = N2 = N3 = N4 = 0).

(25 marks)

Q5. Information about three circles (as center coordinates and radius) is known.

It is required to exactly find out the location of any given point with respect to each of the three circles. The location of a point, P with respect to a circle, C can be

'P NOT IN C', if P is outside C and 'P IN C' otherwise. The point is known by its coordinates.

Write the analysis (Input, Process and output) and pseudo code (declarations and sequence of action steps). Assume that x-y coordinates of any point are two integers.

(15 marks)

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

```
Program CS243_Sup_Exam_2012;
Const Size = 5;
Type  id = 0 .. 6000;
var  ST : id;
     i,j, Sum : integer;

Begin
  Sum := 0; I := 1;
  While I <= size do
    begin
      write (' Enter value number ', I:2, ' of id type- ');
      readln(ST);
      Sum := Sum + ST;
      writeln('DATA, COUNT, SUM -', ST:6, I:6, Sum:6); I := I+1;
    end;
  writeln('DATA, COUNT, SUM -', ST:6, I:6, Sum:6);

end.
```

Assume that the data entered at run time is :

```
2532
3111
5432
1466
1578
```

OR

```
1771
4234
5431
4376
5887
```

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

(10 marks)

(End of Examination Paper)