UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 2010

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

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

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

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

(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 := [su]*[pred (mo)] + [succ (fr)]*[sa];`

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

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

(8 marks)

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

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

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. Write a complete program that interactively reads three integers and displays the three integers read, smallest and largest integer on the user screen in your own layout.

Your program should include a declaration of a procedure sub program that returns the smallest and largest integer values from three given integers.

Write the exact output produced when your program is executed with the three integer data values as – 152, 68, 553.

(4 + 10 + 4 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;
     X : 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). Circulate N1, N2, N3 and N4 values to right, i.e. the values of N1 goes to N2, N2 goes to N3, N3 goes to N4, and N4 goes to N1.

(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 X which lie in [2009, 2010]. Assume X has 500 values.

(v). Display the count of non zero positive values in X. Assume X has 500 values.

(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 C1 can be -

'P-NOT-IN-C', if P is outside C and 'P-IN-C' otherwise.

The point is known by its coordinates and the circle is known by its centre and its radius.

The output should consist, equations of circles and status of the given point with respect to each of the circles.

Write the analysis (Input, Process and output) and pseudo code. 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 SUPP_CS243_Exam_JULY_2010;
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 :

```
20
30
50
10
15
```

OR

```
10
70
10
40
50
```

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

(10 marks)

(End of Examination Paper)