UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 2008

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

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 := []*[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 –

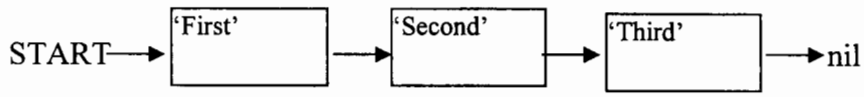
$$VAR = \sum_{i=1}^{n} (\overline{X} - X_i)^2$$

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 to create a linear chain of box records as follows -



The box is a record which has two fields – a ten character box name and the other is a pointer of box pointer type. The address of the first box in the chain should be at START and the last box should point to nil. Other boxes have names and links as shown above.

Write executable statements to remove 'First' box from the chain using only START.

(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;
     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 the 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 P which lie in [1000, 1090]. Assume P has 500 values.

(v). Display the Smallest value among N1, N2, N3 and N4.

(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.

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_2008;
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)