UNIVERSITY OF SWAZILAND
MAIN EXAMINATION (SEM-I), DEC 2009

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 to find Z, P, R and X. Use suitable identifiers.

1. $C = \sqrt{\frac{1}{(x+y)^n}}$,

2. $Z = \left[\frac{\sin(2n\pi+\beta)}{2\pi n+\beta}\right]$

3. $P = (a+b)^m + (c-d)^n$

4. $\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2}$

(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;
```

i. `On_Line := A * X  =  B * Y + C ;`

ii. `Holi_day := [su, sa] * ([pred (we)] + [sa]);`

iii. `Tr := (X + B + 10) div (X + B mod A);`

iv. `Comp_Ch := Chr ( (B + ord('B')) );`

(8 marks)

Q2. Write Input, Process, Output, Pseudo code and a complete well documented and indented program to create and display a list of registered students in a class, implemented as an array of student records. The student record has the following fields –

- a six digit student id number (similar to UNISWA student),
- count of courses the student is registered (maximum six courses are allowed) and
- codes of courses for which the student is registered (similar to UNISWA course code).

Your program should display the total count of students and average of count of courses registered by students in the class and the above data in a good tabular lay out on a disk file. Assume that the above data is read from a text file- 'F:\STUDDTA.TXT' with sentinel data having the student id as zero. Write atleast six correct records of 'F:\STUDDTA.TXT'. Also write the exact result that will be produced by your program.

(6 + 9 + 9 marks)

SECTION-B

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

Q3. Assume that reading is from a KBD and display is on the screen and following declarations are already given -

```
Var
     Range1Count, Range2Count,
     N1, N2, N3, N4, I, J, K,Temp : integer;
     Salary, Tax: real;
     Answer : Char;
     Pay : array [1..1000] of integer;
```

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). Display 'IN DESCENDING ORDER' when N1 <= N2 <= N3 <= N4 or 'IN ASCENDING ORDER' when N1 => N2 => N3 => N4.

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

There is no Tax if Salary is 36000 or less.
Tax is 10 % of Salary, if Salary is 65000 or less,
Tax is 20 % of Salary, if 65000 < Salary < 120000 and
Tax is 30 % of Salary, if Salary is 120000 or above.

(iii). Using a case statement, display 'YES', if Answer is 'Y' or 'y'. Display 'NO' if Answer is 'N' or 'n'. Display 'INCORRECT ANSWER' otherwise.

(iv). Display all the values in the array Pay which lie in [0, 5000]. Assume Pay has 500 values.

(v). Display the largest and smallest values among N1, N2, N3 and N4.

(vi). Display the counts of numbers in P that are in range1 and range2. Assume P has 500 values and range1 numbers are in [10, 1000] and range2 numbers are in [1010, 1110]. Use a case statement for deciding the range. Do not use any if statement.

(25 marks)

Q4. Information about the three lines is known as their slopes (m) and intercepts (c). It is required to find out the intersecting points of these lines, if they exist. The display should include the

1. Equation of lines
2. Coordinates of the points of intersection if they exist or
3. A text message that lines do not intersect.

Use your own layout. The intersection point of two lines should be found using a procedure subprogram.

Write the analysis (Input, Process and output), pseudo code and a program in PASCAL to solve the above problem. Include suitable comments and proper indentations in your program.

(20 marks)

Q5. Read the following Pascal program very carefully and write the **exact** display produced on the user screen when the program is executed.

```
Program CS243_Exam_Dec_2007;
Const Size = 3;
Type  id = 0 .. 6000;
var  TEMPST : id;
     i,j,digit, count, Sum, Prod : integer;

Begin

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

end.
```

Assume that the data entered at run time is :

```
1234
5678
9801
```

OR

```
2345
6789
1023
```

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

(15 marks)

(End of Examination Paper)