UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, DEC 2007

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

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

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

4. $\dfrac{dy}{dx} = \dfrac{3Sin(x) + 2xyCos(y)}{6xy}$ **(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, sa] + [pred (mo)] + [succ (fr)];

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

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

(8 marks)

Q2. Write a program to display the count of students and the smallest 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 smallest value. The formal argument list should include – an array of integer numbers and the count of values in the array.

(10 + 6 marks)

Q3. Write a complete well documented and well indented program to create a linear list, CLASS, implemented as an array of student records. The student record has the following fields –

- a six digit student id number,
- count of courses the student is registered and
- course codes of all the courses for which the student is registered.

Assume that the above data is read from a line of a text file- 'F:\STUDDTA.TXT' with sentinel data having the student id as zero. Your program should display the count of students in CLASS and the above data in a good tabular lay out on a disk file. Write three correct records of 'F:\STUDDTA.TXT'.

(6 + 9 + 3 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

     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 and N3 with N4 only when all of them are non zero and positive.

(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 120000 or above.

(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] or [1000, 1090]. Assume P has 500 values.

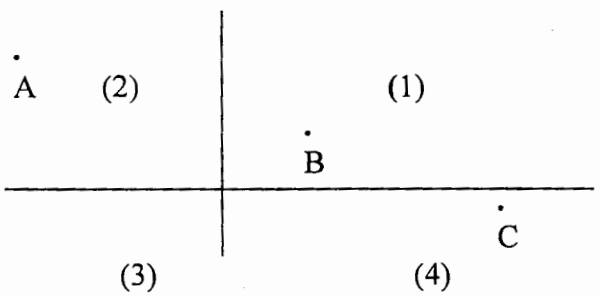
(v). Display the largest value among N1, N2, N3 and N4.

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

(25 marks)

Q5. 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 and a program in PASCAL to solve the above problem. Include suitable comments and proper indentations in your program. Assume that x-y coordinates of a point are two integers and that no point lies on any axis.

(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_Exam_Dec_2007;
Const Size = 3;
Type  id = 0 .. 6000;
var  ST, TEMPST : id;
     i,j,digit, count, Sum : integer;

Begin

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

end.
```

Assume that the data entered at run time is :

```
2653
3718
5409
```

OR

```
2413
5976
1009
```

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

(10 marks)

(End of Examination Paper)