UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, DEC 2006

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

2. $P = p_0 e^{-kt} + O(h)$

3. $F = aSin(m\theta) + bCos(n\theta)$

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 = 6;

Type Work_Days = (su, mo, tu, we, th, fr, sa);

Var  Tr: integer;  Off_Line: boolean;
     Comp_Ch : char;
     End_day, Holi_day : set of  Work_Days;
```

1. `Off_Line := A * X  +  B * Y + C = 0;`

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

3. `Tr := C div 3 - B mod 3 - 2;`

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

(8 marks)

Q2. Write a program to compute the average height of students in a class. The program should read the ages of students in an array of real numbers (in meters) from the keyboard interactively. The sentinel age should be given as zero. Use appropriate interactive messages and output lay out on the screen. Declare a function sub program to compute the average. The formal argument list should include – an array of real numbers and the count of values in the array.

(10 + 6 marks)

Q3. Write a complete program which declares and tests two temperature conversion functions as follows -

Celsius_to_Fahrenheit – Returns Fahrenheit (F) of a given Celsius (C) value using

$$F = 5.0 / 9.0 * C + 32.0$$

Fahrenheit_to_Celsius – Returns Celsius (C) of a given Fahrenheit (F) value using.

$$C = 5.0 / 9.0 * (F - 32.0)$$

The main program should interactively read appropriate test data from the keyboard and display test results of both the functions of Q3 (a) on the screen with proper layout.

(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

     N1, N2, N3, N4, I, J : integer;
     Total_Pay, Tax: real;
     Answer, Grade : Char;
     P : array [1..1000] of real;
```

Write only executable statements in Pascal with proper syntax (not a complete program) to perform **any five** of the following tasks independently.

(i). Exchange the values of N1 and N2 only if N3 > N4.

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

Tax is 30 % of Total_Pay, if Total_Pay is 120000 or above,
Tax is 20 % of Total_Pay, if 50000 < Total_Pay < 120000 ,
Tax is 10 % of Total_Pay, if Total_Pay is less than 50000 and
There is no Tax if Total_Pay is 30000 or less.

(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 array P which lie in [10, 100] or [1000, 1090]. Assume P has 500 values.

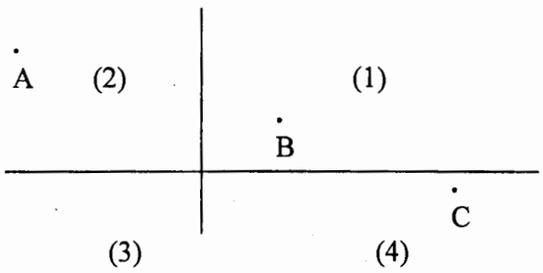
(v). Display the largest value among N1, N2, N3 and N4.

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

(20 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 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_2006;
Const Size = 3;
Type  id = 0 .. 6000;
var   ST, TEMPST : id;
      i,j,digit, count, sumdigits : integer;

Begin

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

end.
```

Assume that the data entered at run time is :

```
2660
3246
1428
```

OR

```
2409
2550
1618
```

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

(15 marks)

(End of Examination Paper)