UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION, JULY 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. $Z = \dfrac{12\,a\,b\,c}{(a-b)(c-s)}$

2. $p = \sqrt{\dfrac{(5n-\beta)}{abc}}$

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

4. $F = S(1+R/365)^N + \varepsilon$

(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 ; R = 13;

Type Work_Days = (sun, mon, tue, wed, thu, fri, sat);

Var  Today : Work_Days; Holi_day: boolean; out:integer;
          Comp_Ch : char; End_day : set of  Work_Days;

1.    Out :=  3 * X  +  2 * Y  -  R ;

2.    Holi_day :=  pred (tue) <> succ (sun);

3.    End_day := [tue, wed, thu] * ([tue, wed] + [wed] );

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

(8 marks)

Q2. Write a program to compute the average mark of students in a class. The program should read the marks of students as real numbers (in meters) from the keyboard interactively. The sentinel mark 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.

(6 + 10 marks)

Q3. Write a complete program which declares and tests a function to compute the value of factorial of a given integer, n (n! = 1.2.3 ... n) . Assume that n is a nonzero positive integer. The function name should be *factorial* of real type.

The main program should interactively read three non zero positive integers, *n, r* and *p*. It then computes and displays *ncr* and *rcp* using the function subprogram *factorial*. The *ncr* and *rcp* are defined as follows –

$$ncr = \frac{n!}{r!(n-r)!} \quad , \quad rcp = \frac{r!}{p!(r-p)!}$$ **(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
     Name: string[15];
     Age, N1, N2, N3, N4 : integer;
     Height, Mark: real;
     Gender, 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 and N1 and N2 are unequal.

(ii). Display your age in years as a three digit integer, your height in cms as a real number with one digit after decimal, your name as 15 characters and your Gender as a single character (M or F) as follows -

```
AGE = --- HEIGHT = ----.- NAME = ---------------- GENDER = -
```

(iii). Compute letter grade from Mark according to UNISWA rules.

(iv). Using a case statement, display 'MALE', if Answer is 'M' or 'm'. Display 'FEMALE' if Answer is 'F' or 'f'. Display 'INCORRECT ENTRY' otherwise.

(v). Display 'CORRECTLY SORTED IN ASCENDING ORDER' if all the values in array P are in ascending order (i.e. $P_i \leq P_{i+1}$ for all possible i). Assume P has 500 values.

(vi). Display the count of negative values in the array P. Assume P has 500 values.

(20 marks)

Q5. Information about the xy-coordinates of centers of three circles and their radii are known. It is required to find the pair of circles which touch each other.

All the information is to be given interactively from KBD. The Output should be displayed according your own lay out. But all the three circles should be displayed as three equations of circles.

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.

(15 marks)

Q6. Read the following Pascal program very carefully and write the **exact** display produced on the screen when the program is executed.

```
Program CS243_Exam_July_2007;
Const Size = 3;
Type  id = 0 .. 6000;
var  ST, TEMPST : id;
     i,j,digit, count, proddigits : integer;

Begin

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

end.
```

Assume that the data entered at run time is :

```
2663
3246
5428
```

OR

```
2439
2556
1618
```

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

(15 marks)

(End of Examination Paper)