

**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, (SEM-I) DEC 2010**

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.

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

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

$$3. F = a\sin(m\theta) + b\cos(n\theta)$$

$$4. \frac{dy}{dx} = \frac{3\sin(x) + 2xy\cos(y)}{6xy}$$

(8 marks)

Q1(b). Find the values of left hand side identifiers in the following assignment 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; 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)] + [su] + [succ (fr)] + [sa];
3. Tr := C div 3 - B mod 3 - (A + 2);
4. Comp_Ch := Chr ((A + ord('C')));

(8 marks)

Q2. Write Input, Process and Output, pseudocode and a complete PASCAL program to compute the average age and count of students in a class. The program should read the ages of students (in years as two digit integers) from the keyboard interactively. The sentinel age should be given as a negative integer. Use appropriate good interactive messages and output lay out on the screen.

(10 + 6 marks)

Q3. Write the following three programs in PASCAL –

Q3(a). Write two function subprograms to convert temperature from Celsius to Fahrenheit and from Fahrenheit to Celsius 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.

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

Q3(b). Write a main test program that interactively reads appropriate test data from the keyboard and displays test results of both the functions of Q3 (a) on the screen with a good layout.

How do you use the two function subprograms for automatically self testing purposes ?

(4 + 4 + 10 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;
Answer, Grade : Char;
CA, EXAM_MARK, FINAL_MARK: real
P : array [1..1000] of real;
```

Q4(a). Write only executable statements in Pascal with proper syntax (not a complete program) to perform **any four** of the following tasks independently.

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

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

(iii). Display all the values in array P which lie in [10, 100] or [1000, 1090]. Assume P has 500 values.

(iv). Count and display all the negative values in array P Assume P has 500 values.

(v). Display 'IN ORDER' only if $(N1 > N2 > N3 > N4)$ or $(N1 < N2 < N3 < N4)$ otherwise display 'NOT IN ORDER'

Q4(b). Compute GRADE from FINAL_MARK, which is 40 % CA and 60 % EXAM_MARK, according to the following rules –

GRADE is 'A' if FINAL_MARK is greater than or equal to 80.
 GRADE is 'B' if FINAL_MARK is greater than or equal to 70 but less than 80.
 GRADE is 'C' if FINAL_MARK is greater than or equal to 60 but less than 70.
 GRADE is 'D' if FINAL_MARK is greater than or equal to 50 but less than 60.
 GRADE is 'E' if FINAL_MARK is greater than or equal to 40 but less than 50.
 GRADE is 'F' if FINAL_MARK is less than 40.

But,

GRADE is 'F' if CA is less than 30 and
 GRADE is 'E' or lower if EXAM_MARK is less than 30.

(12+8 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.

A point is in quadrant one if both xy-coordinates of the point are positive, it is three if both xy-coordinates are negative, it is four if x is positive and y is negative and it is two if x is negative and y is positive.

Write the analysis (Input, Process and output), pseudo code and a program in PASCAL and your test data to solve the above problem. Write the results that your program will be producing when executed. Include suitable comments and proper indentations in your program. Assume that no point lies on any axis.

(3+3+3+4+2 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_2010;
Const Size = 5;
Type id = 0 .. 6000;
var ST, TEMPST : id;
    i,j,digit, count, checksum : integer;

Begin

  for i := 1 to Size do
    begin
      write (' Enter value number ');
      readln(TEMPST);

      Count := 0;
      Checksum := 0;

      While TEMPST <> 0 do
        Begin
          j := TEMPST div 10;
          Count := count + 1;
          digit :=TEMPST mod 10;
          Checksum := checksum + digit;
          TEMPST := j;
          Writeln ( ' NO ',TEMPST:6,' D ',digit:6,
            ' LOOP ', count:6,' CHECKSUM ', checksum:6);
        End;
      end;
    end.

```

Assume that the data entered at run time is:

2660
3246
1428
2222
1234

OR

2409
2550
1618
1111
1234

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

(15 marks)

(End of Examination Paper)