UNIVERSITY OF SWAZILAND
FINAL EXAMINATION, MAY 2006

Title of Paper   : PASCAL

Course number   : CS245 (I)

Time allowed   : Three (3) hours.

Instructions   : (1) Answer all questions in Section-A. Choose options as given in
                          questions in Section-B.

                      (2) Read all the questions in Section-A and Section-B before you
                          staft answering any question.

                      (3) Show your work on the answer script.

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 compute S, p, R_1 and F. Use suitable identifiers.

$$1. S = \frac{(a+b)(b-c)}{3ab^2}$$

$$2. p = \sqrt{\frac{(2\alpha - 3\beta)}{\sin^2 \alpha - \cos^2 \beta}}$$

$$3. R_1 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$4. \frac{1}{F} = \frac{1}{F_1} + \frac{1}{F_2}$$

(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 = 4 ; R = 5;

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

Var  Today : Work_Days; Holi_day: boolean; r1,r2:boolean;
     Comp_Ch : char; End_day : set of  Work_Days;

1.     r1 :=  sqrt(X * X  +  Y * Y)  -  R > 0;

2.     r2 :=  (pred (R) = succ (X)) and (Y = pred(succ(Y)));

3.     Holi_day := [sun, mon, wed, thu] * ([sat, sun] + [thu] );

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

(8 marks)

Q2. Write a complete program to compute the value of SD as follows –

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (\overline{X} - X_i)^2}{n}}$$

Your program should get the values of *n* and an array of real numbers *X* interactively from KBD. The average of X_i values is computed as $\overline{X}$.

You should be declaring a subprogram, *average* (a function or a procedure) to compute the average of given *n* real numbers in an array *X*. Assume that *n* is a nonzero positive integer number.

(12 + 10 marks)

Q3. Write a complete program to create a linear chain of box records which looks as follows -
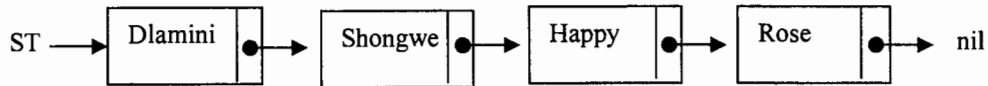
The box is a record which has two fields – a seven character box name and the other is a pointer of box pointer type. The address of the first box in the chain should be at ST and the last box should point to nil. Other boxes have names and links as shown above.

(12 marks)

＊ SECTION-B

Q4. Assume that reading is from KBD and display is on screen and the following declarations are already given -

```
Var
        Name: string[15]; Result:String[4];
        ID, N1, N2, N3, I,J : integer;
        Height, Mark: real;
        Gender, Answer, Grade : Char;
        P : array [1..1000] of real;
```

Write only executable statements in Pascal (not a complete program) to perform **any four** of the following tasks independently. Do not use any other declarations.

(i). Display your ID as a four 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 -

```
ID = ---- HEIGHT = ----.- NAME = --------------- GENDER = -
```

(ii). Circulate left the values in N1, N2 and N3 so that the value in N2 goes to N1, the value in N3 goes to N2 and the value in N1 goes to N3.

(iii). Compute the Result and letter Grade from Mark according to the university rules –

Grade is A if Mark > 79, it is B if $79 \geq$ Mark > 69, it is C if $69 \geq$ Mark > 59, it is D if $59 \geq$ Mark > 49, it is E if $49 \geq$ Mark > 39 and it is F otherwise.
Result is 'PASS' if Mark > 49 and 'FAIL' otherwise.

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

(v). Display 'CORRECTLY SORTED IN DESCENDING ORDER' if $P_i \geq P_{i+1}$ for all i. Assume P has 500 values.

(marks 20)

3

Q5. Information about a horizontal rectangle - coordinates of the lower left and upper right corners are given. The x and y coordinates of three points, A,B and C are also given.. It is required to find out the status of each point where the status of a point can be 'INSIDE' or 'NOT INSIDE' the rectangle.

The display layout should be exactly as follows -

```
The rectangle is -

     Lower left corner  = (__._ , __._)

     Upper right corner = (__._ , __._)


     Point A = (__._ , __._), Status = _____


     Point B = (__._ , __._), Status = _____


     Point C = (__._ , __._), Status = _____
```

Write the complete analysis, Input, process, output, pseudocode and a program in PASCAL to solve the above problem. Include suitable comments and proper indentation in your program.

(marks 15)

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

```pascal
Program Exam2006;
Const Size = 6;
Type  id = 0 .. 6000;
      Class_List = array [1 .. 100] of id;

var  CS245    : Class_List; small, Temp : id;
     i, j, small_position : integer;

Procedure Show_List (M : integer; A : Class_List; );

  var i : integer;

  begin
    for i := 1 to M do Write(A[i]:6);
    writeln;                     •
  end;

Begin
  writeln (' Enter ', Size:2, ' values of id type');
  for i := 1 to Size do readln(CS245[i]);

  Show_List(Size, CS245);
  For i := 1 to Size-1 do
    begin
      small := CS245[i]; small_position := i;
      for j := i+1 to Size do
        if (small < CS245[j]) then
          begin
            small_position := j;
            small := CS245[j];
          end;
      Temp := CS245[i];
      CS245[i] := small;
      CS245[small_position] := Temp;
      Writeln(small_position:6, small:6);
      Show_List(Size, CS245);
    end;
end.
```

Assume that the data entered at run time is :

(a). 152 136 118 121 131 129 <enter>

OR

(b). 402 552 611 782 212 198 <enter>

Give the exact display for either of the above showing all your work.   **(marks 15)**

(End of Examination paper)