PASCAL PROGRAMMING

INTRODUCTION TO PASCAL:

Pascal is a general-purpose, high-level programming language.

Pascal was named in honor of **Blaise Pascal (1623-1662),** the brilliant French scientist and mathematician whose many accomplishments include the invention of the worlds first mechanical calculating machine.

Structure of a Pascal Program:

Every Pascal program contains a header and a block. The header begins with the word PROGRAM, followed by some additional information that may be required.

The block has two main parts- the declaration part and the statement part. The declaration part defines the various data items that are used within the program. The statement part contains the actual statements that cause actions to be taken. At least one statement must be present in every Pascal program.

The overall program structure is outlined below in detail.

1. Header

2. Block, consists of

   (a) Declarations, which include

      Labels

      Constants

      Variables

   (b) Statements

It should be understood that all the declaration items need not be present in any single program. Those items that are present, however, must appear in the order shown above.

For example, we write an elementary Pascal program, called circle that reads in the radius of a circle, calculates its area and then writes out (i.e. displays) the area.

```
PROGRAM circle;
(* Area of a circle*)
VAR r, a: real;
BEGIN
      readln(r);
      a: = 3.14*sqr(r);
      writeln(a);
END.
```

The following features should be pointed out in the above program.

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(1) Some of the words are capitalized. These are <u>reserved words</u> (or key words) that have special <u>predefined meanings</u>.

(2) The first line contains the program name (circle). This is the program header.

(3) The second line is a comment that identifies the purpose of the program. Comments can always be recognized because they are enclosed in special symbols, such as (*   *).

(4) The three lines between BEGIN and END are the program statements. They cause a value for the radius (r) to be entered into the computer, a value for the area (a) to be calculated, and the value of the area to be displayed.

(5) The numerical values for the radius (r) and area (a) are represented by the symbolic names are called variables. They are defined (declared) in the third line of the program.

(6) The symbolic name <u>sqr</u> in line 6 is a <u>standard function</u> that is used to compute the square of the radius (r).

(7) Finally, notice the punctuation at the end of each line. Most line end with semicolons; some have no punctuation and the last line ends with a period.

This is a part of Pascal's syntax.

PASCAL FUNDMENTALS:

THE PASCAL CHARACTER SET:

Letters: A to Z (both upper and lower case)

Digits: 0 to 9

Special symbols: + , - , * , / , : = , = , . , : , ; , ' , < , <= , > , > = , < > , (,) , [,] , { , }

RESERVED WORDS:

There are certain reserved words that have a predefined meaning in Pascal. These reserved words can be used only for their intended(predefined) purpose.

The standard reserved words (some of) are:

AND	DO	LABEL
ARRAY	ELSE	MOD
BEGIN	END	OR
CONST	FOR	PROGRAM
DIV	GOTO	VAR

IDENTIFIERS:

An <u>identifiers</u> a name that is given to (some program elements such as a <u>constant</u>, a <u>variable</u>, <u>procedure</u> or a <u>program</u>.

Identifier consists of letters or digits (alphanumerics), in any order, except that <u>the first character must be a letter</u>. Both upper and lower case letters are permitted.

We will use only lowercase letters for identifiers, however, in order to distinguish them from reserved words (which are shown in uppercase). <u>An identifier can have maximum of 8 characters</u>.

Constants:

The identifier is called a constant if the data item is assigned permanently i.e. <u>if the data item remains the same throughout the program.</u>

A constant must always be defined before it can appear in a Pascal statement.

The general form of a constant definition is

CONST name = value

Where name is an identifier that represents the constant name and value is the actual data item that is assigned to name.

Variables:

An identifier whose value is allowed to change during the execution of the program is called variable. Every variable must be individually declared (i.e. defined) before it can be used in a program. The variable declaration establishes the fact that the identifier is a variable (rather than a constant) and specifies the type of variable.

The general form of a variable declaration is

VAR name1, name2, name3… namen: type

Where name1, name2, name3… namen etc. are identifiers that represent individual variable names and type refers to the data type of variables.

Expressions:

An expression is a collection of operands (i.e. numbers, constants, variables etc.) joined together by certain operators. There are two types of expressions in Pascal.

(a) numerical expressions

(b) boolean expressions.

A numerical expression represents a numerical value where as a boolean expression represents a logical condition which is either true or false.

A typical numerical expression is

(b*b-4*a*c) / (2*a)

The identifiers a, b and c and the numbers 4 and 2 are called operands and the symbols * and / are the corresponding operators (which represent multiplication and division resp.)

An example of boolean expression

pay < 1000.0

In this expression pay is a variable of type real, 1000.0 is a real number and the symbol < is a boolean operator.

Statements:

A Pascal statement is an instruction or a group of instruction that causes the computer to carry out certain actions.

(1) Assign a data item to a variable (Assignment statement)

(2) Transfer program control to another part of the program (GOTO statement).

A typical assignment statement is

tax: = 0.10 * gross;

In this example, it is assume that tax and gross are both variables of real type. Also, it is assume that a real value has been assigned to gross. The assignment statement causes the value of gross to be multiplied by 0.10 and the product assigned to the variable tax.

Notice that the symbol used for assignment is: = (not =). Also, note that the right hand side of the statement (i.e. 0.10*gross) is a numerical expression.

A typical GOTO statement is

GOTO 15;

Thus the next statement to be executed will be the statement that is labeled 15.

Some common Standard Functions:

Function	Purpose	Type of parameter	Type of result
abs(x)	Compute the absolute value of x	Integer or real	Same as x
exp(x)	Compute e^x	Integer or real	Real
ln(x)	Compute the natural logarithm of x(x>0)	Integer or real	Real
sqr(x)	Compute the square of x	Integer or real	Same as x
sqrt(x)	Compute the square root of x(x ≥ 0)	Integer or real	real

<u>Program 1</u>:

Write a Pascal program to calculate simple interest and amount (to be paid or received) at the end of T years.

Description:

Simple interest (I) = PRT/100,

Where

P=Principle

R=Rate of interest (in percent)

T=Term (years)

Amount (to be paid or received at the end of T years) =P+I

PROGRAM interest;

(* calculate simple interest and amount*)

BEGIN

writeln ('Enter Principal);

readln (P);

writeln ('Enter Rate of interest');

readln (R);

writeln ('Enter Term');

readln (T);

I: = (P*R*T)/100;

A: =P+I;

writeln ('Simple interest= ', I);

writeln ('Amount= ', A);

END.

Program 2:

Write an algorithm and Pascal program to find the roots of quadratic equation $aX^2+bX+c=0$, where a, b and c are unknown constants.

Description:

The roots of quadratic equation are:

$$X=\frac{-b\pm\sqrt{\Delta}}{2a} \quad \text{where } \Delta = b^2\text{- 4ac}$$

If Δ = 0 then the roots are <u>equal and real</u>.

$$X_1=\frac{-b}{2a} \quad , \quad X_2=\frac{-b}{2a}$$

If Δ > 0 then roots are <u>distinct and real</u>.

$$X_1=\frac{-b-\sqrt{\Delta}}{2a} \quad , \quad X_2=\frac{-b+\sqrt{\Delta}}{2a}$$

If Δ < 0 then roots are <u>distinct but imaginary</u>.

<u>Algorithm</u>:

Step-1: Input the values of a, b, c.

Step-2: calculate $\Delta = b^2$- 4ac

Step-3: If Δ = 0 then the roots are equal and real

i.e. $X_1=\frac{-b}{2a}$ = X_2

Otherwise if Δ > 0 then the roots are distinct and real

i.e. $X_1 = \dfrac{-b - \sqrt{\Delta}}{2a}$, $X_2 = \dfrac{-b + \sqrt{\Delta}}{2a}$

Otherwise roots are distinct and imaginary.

Step-4: Print (display) the output.

Step-5: Stop.

```pascal
PROGRAM quad;
(* Program to find roots of quadratic equation*);
    LABEL 10;
    VAR a, b, c, D, X1, X2: real;
    BEGIN
        writeln ('Enter the value of a');
        readln (a);
        writeln ('Enter the value of b');
        readln (b);
       writeln ('Enter the value of a');
        readln (c);
        D: =b*b-4*a*c;
        IF (D=0) THEN
                    BEGIN
                        writeln('roots are equal and real');
                        X1:=-b/(2*a);
                        X2:=X1;
                    END
                ELSE
                BEGIN
                    IF (D>0) THEN
                    BEGIN
                        writeln ('roots are distinct and real');
                        X1:=(-b-sqrt (D))/ (2*a);
                        X2:=(-b+sqrt (D)/ (2*a);
                    END
                        ELSE
                    BEGIN
                        writeln ('roots are real and imaginary');
```

```pascal
            GOTO 10;
        END;
    END;
    writeln ('the roots are');
    writeln ('X1= ',X1)
    writeln ('X2= ',X2);
10: END
```