QBasic Expressions

Expressions

- QBasic Expressions
  - mathematical formulas
  - follows the format you know
Numeric Operators in QBASIC

<table>
<thead>
<tr>
<th>Operator</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>^</td>
<td>Exponent</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication</td>
</tr>
<tr>
<td>/</td>
<td>Division</td>
</tr>
<tr>
<td>+</td>
<td>Addition</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction &amp; Unary Minus</td>
</tr>
</tbody>
</table>

Precedence Levels:
Highest to Lowest

<table>
<thead>
<tr>
<th>Operators</th>
<th>Precedence Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(...)</td>
<td>Sub expression</td>
</tr>
<tr>
<td>^</td>
<td>Exponent</td>
</tr>
<tr>
<td>* /</td>
<td>Multiplication &amp; Division</td>
</tr>
<tr>
<td>+ /</td>
<td>Addition &amp; Subtraction</td>
</tr>
</tbody>
</table>
Calculate Results

<table>
<thead>
<tr>
<th>PRINT</th>
<th>11 * 2 + 8 * 4 - 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>22 + 8 * 4 - 7</td>
</tr>
<tr>
<td>PRINT</td>
<td>22 + 32 - 7</td>
</tr>
<tr>
<td>PRINT</td>
<td>54 - 7</td>
</tr>
<tr>
<td>PRINT</td>
<td>47</td>
</tr>
</tbody>
</table>

Calculate Results #2

<table>
<thead>
<tr>
<th>PRINT</th>
<th>5 + 18 / 3 ^ 2 * 2 - 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>5 + 18 / 9 * 2 - 1</td>
</tr>
<tr>
<td>PRINT</td>
<td>5 + 2 * 2 - 1</td>
</tr>
<tr>
<td>PRINT</td>
<td>5 + 4 - 1</td>
</tr>
<tr>
<td>PRINT</td>
<td>9 - 1</td>
</tr>
<tr>
<td>PRINT</td>
<td>8</td>
</tr>
</tbody>
</table>
Calculate Results #3

PRINT 7 + 32 / 2 ^ 4 * (3 - 1)
PRINT 7 + 32 / (2 ^ 4) * 2
PRINT 7 + 32 / 16 * 2
PRINT 7 + 2 * 2
PRINT 7 + 4
PRINT 11

Calculate Results With Variables

LET X = 10
LET Y = 2
PRINT X * 3 + -Y
PRINT X * 3 + -2
PRINT 30 + -2
PRINT 28
Calculate Results

Using the Order of Operations

The Order of Operations

1. Evaluate expressions within parentheses first.
2. Perform all powers.
3. Complete all multiplication and division, working from left to right.
4. Perform addition and subtraction last, working left to right.

Example: \[ 2 \cdot 3^2 - 3 \cdot 5 + 4 \]

\[ 2 \times 3^2 - 3 \times 5 + 4 \]
\[ 2 \times 9 - 3 \times 5 + 4 \]
\[ 18 - 15 + 4 \]
\[ 3 + 4 \]
\[ 7 \]

1. Exponents are executed first.
2. Then multiplications.
3. Next subtraction.
4. Then addition

Example Program 1

```
DIM X, Y, Z
LET X = 10
LET Y = 6
LET Z = X * 2 - 12 / Y
PRINT "The result:"; Z
```

Example Program 1
Output

The result: 18

Example Program 2

DIM X, Y, Z
LET X = 2
LET Y = 5
LET Z = X*Y-(7-4)/3
PRINT "The result is"; Z

Example Program 2
Output

The result is 9
Example Program 3

```
DIM T1, T2, Ans
LET T1 = 5
LET T2 = 4
LET Ans = T1*T2 + 5 - 6/3
PRINT "Answer:" ; Ans
```
Of all of high level languages, BASIC (Beginners All purpose Symbolic Instruction Code) is probably the easiest to learn. The beginning user soon discovers that small programs can be written and quickly entered into the computer, producing interesting results. The goal of our study is to learn how to write computer programs in QBASIC Language.

**QBASIC** language Contents

The following Contains are used by QBASIC System:

2. Digit Numbers ( 0,1,2……………….9).
3. Characters and Symbols( +,-,* , /, =,^, ( ),<=, =>,<>,@,#,!,?,",% ).
4. Special Words ( go to, if , read, print, input).

**Constants In QBASIC**

Constants In QBASIC division into two types:

1. **Numeric Constants**: there are two types of numeric constants:
   - **Real**: the numbers used may be written in decimal form such as(6.9,-52.76,0.095, -3269.0)
   - **Integer**: Whole numbers may be written without the decimal point such as (89,-132,7698)
   - **Exponential Form**: this form requires a number fallowed by the letter E, such as (2.8E05,0.57E-03,0.07E-9, and 29.8E7).

**String Constants**: a string consists of a sequence of characters enclosed in double quote marks. strings usually consist of names or address or cities such as "Computer", "Baghdad".

**Variables In QBASIC**

Again Variables in QBASIC division into two types:

1. **Numeric Variables**: the variables used to represent numbers are the letters of the alphabet .these may followed by a digit or letter. including 0 .for example: (A,b,c…..,A0,b1,c2,Ab,ba,bv,zx).

2. **String Variables**: a string variables must consists of a letter of the alphabet followed by the $ character, such as (A$,BC$,A2$,ZW$).

**Arithmetic Expressions**

Expressions are used in QBASIC in order to perform calculations. in general ,an expression may consist of a single constant or a single variables, or of arithmetic operation involving two or more constants or two or more variables ,or of any arithmetic combination of constants and variables. Although complicated mathematical expressions will not occur frequently, some skill is required to translate mathematical expressions into QBASIC expressions. in performing this task ,it is necessary to know that the QBASIC compiler using the following order of precedence in performing arithmetic operations:
<table>
<thead>
<tr>
<th>Order</th>
<th>Symbol</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>first</td>
<td>( )</td>
<td>Operations within parentheses are performed first.</td>
</tr>
<tr>
<td>second</td>
<td>^</td>
<td>Exponentiation is performed before other arithmetic operations.</td>
</tr>
<tr>
<td>third</td>
<td>*, /</td>
<td>Multiplication and division are equal in order of precedence.</td>
</tr>
<tr>
<td>forth</td>
<td>+ , -</td>
<td>Addition and subtraction are performed last and are equal in order of precedence.</td>
</tr>
</tbody>
</table>

**Example-1**

Suppose (a=5, b=4, c=2, i=2, j=1) Execute the following expressions in order of precedence:

1. a + b + c / 12
2. (a + b + c) / 12
3. a + b / (c – I * j + a ^ 2)
4. a * b – c / I + j + a ^ b + c ^ 3
5. a * j ^ b – I / c * j + 20
6. j / (I + c)
7. j / I + c
8. (a ^ (b + 1) * c) ^ 2
9. j + I * (b / c – a ^ 2) + i
10. (I + j) / a
11. I + j / a
12. (j * (a ^ 2 – 10)) / 2
13. i + j ^ 2 – 3 * a
14. ((I + j) / 3 * a) ^ 2 / 2

**Example-2**

Write following expressions in appropriate formula in QBASIC language:

1. \( Y = a \cdot b - r \cdot s + r^2 \)  
   \( \rightarrow Y = A \cdot b - R \cdot S + R^2 \)

2. \( P = (x+y)(x-y)/x^2 \)  
   \( \rightarrow P = (X+Y)(X-Y)/X^2 \)

3. \( Y = x^2-2x-4 \)  
   \( \rightarrow Y = X^2-2*X-4 \)

4. \( Y = x+r^2 + s\cdot r - b \)  
   \( \rightarrow Y = X+r^2/(C*B)+S*R-B \)

5. \( T = t(1-d).y-t.(1-d)y \)  
   \( \rightarrow T = t*(1-d)*Y-t*(1-d)*Y \)

6. \( A = s \cdot r - y \cdot z + x/5 \)  
   \( \rightarrow A = S*R-Y*Z+X/5 \)

7. \( A = s \cdot r - y \cdot z + x \)  
   \( \rightarrow A = (S*R-Y*Z+X)/5 \)

8. \( A = s+r^2-sr + 7 \)  
   \( \rightarrow A = S+R^2-S*R/S+7 \)
\[
\frac{A = s + r^2 - s \cdot r}{S + 7} \quad \rightarrow \quad A = S + R^2 - S \cdot R / (S + 7)
\]

\[
A = (s(x-2))(s^2 - 1) \quad \rightarrow A = (S \cdot (X-2)) \cdot (S^2 - 1)
\]

\[
A = \frac{PQ}{CB} \quad \rightarrow A = P \cdot Q / (C \cdot B)
\]

\[
A = \frac{PQ \cdot B}{C} \quad \rightarrow A = P \cdot Q / (C \cdot b)
\]

\[
A = \frac{(d-r)^2}{(d+r)} \quad \rightarrow A = (d-r)^2 / (d+r)
\]

\[
P = a + b \cdot s - d \quad \rightarrow P = A + B \cdot S / J - d
\]

\[
P = a + b \cdot s \quad \rightarrow P = A + B \cdot S / (J - D)
\]

\[
Q = i^2 - b \cdot a - a \quad \rightarrow Q = i^2 - B \cdot A - A / i
\]

\[
Q = \frac{i^2 - B \cdot A - A}{I} \quad \rightarrow Q = i^2 - B \cdot A / I - A
\]

\[
A S = b / (j - a) \quad \rightarrow AS = B / (J - A)
\]

\[
A S = B - A \quad \rightarrow AS = B / J - A
\]

\[
R = \frac{(s + b)(a + d)}{B} \quad \rightarrow R = (S + B) \cdot (A + D) / B
\]

\[
R = \frac{(S + B) \cdot (A + D)}{B} \quad \rightarrow R = (S + B) \cdot ((A + D)) / B
\]

\[
T = (a + b) \cdot S \quad \rightarrow T = (A + B) / M \cdot S
\]

\[
T = \frac{(A + B)}{M \cdot S} \quad \rightarrow T = (A + B) / (M \cdot S)
\]
Library Functions

Each basic interpreter has within it the capability of calculating certain special functions, sometimes called library functions. These functions are indicated by three letters naming the function, followed by argument enclosed in parentheses. The argument may be either a number, a variable, or an expression. In the following table library functions as might be found in most basic interpreters.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description of function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS(x)</td>
<td>Absolute value of x ,</td>
</tr>
<tr>
<td>SGN(x)</td>
<td>=(-1 or 0 or 1) for (x&lt;0 or x=0 or x&gt;0).</td>
</tr>
<tr>
<td>SQR(x)</td>
<td>Square root of x.</td>
</tr>
<tr>
<td>INT(x)</td>
<td>The largest integer not exceeding x.</td>
</tr>
<tr>
<td>RND(x)</td>
<td>Create random number value between 0 and 1.</td>
</tr>
<tr>
<td>Sin(x)</td>
<td>Sin of x, x in radians</td>
</tr>
<tr>
<td>Cos(x)</td>
<td>Cosine of x, x in radians</td>
</tr>
<tr>
<td>Tan(x)</td>
<td>Tangent of x, x in radians</td>
</tr>
<tr>
<td>Atn(x)</td>
<td>Arctangent of x, x in radians</td>
</tr>
<tr>
<td>Exp(x)</td>
<td>The value of $e^x$</td>
</tr>
<tr>
<td>Log(x)</td>
<td>The natural logarithm of x , ln(x)</td>
</tr>
<tr>
<td>Mod</td>
<td>Modulus-Rest of division. Ex: 10 mod 3 = 1</td>
</tr>
<tr>
<td>Div</td>
<td>Integer division. Ex: 10 div 3 = 3</td>
</tr>
</tbody>
</table>

Example

Convert following mathematical expressions in appropriate formula QBASIC language:

\[ S = \sin(x)^2 + \cos^3(x) \quad \rightarrow S = \sin((x \cdot 3.14/180)^2) + \cos(x \cdot 3.14/180)^3 \]

\[ D = \log(x) - \log(x^2) \quad \rightarrow D = \log(x)/\log(10) = \log(x^2)/\log(10) \]

\[ R = \left| \frac{d-s}{n} \right| \quad \rightarrow R = \text{abs}(d-s)/n \]

\[ Y = \frac{1-e^x}{1+e^x} \quad \rightarrow Y = (i-\exp(x))/(1+\exp(x)) \]

\[ Y = s\sqrt{s+4} \quad \rightarrow Y = s*sqr(s)+4 \]

\[ Y = \log_b - \sin(x) + dr \quad \rightarrow Y = \log(b)/\log(10) - \sin(x \cdot 3.14/180) = d * r \]

\[ P = \left| \frac{x-y}{r+1} \right| \cdot c - 3(y-x)(z-r) \quad \rightarrow P = \text{abs}(x-y)*c-3*(y-x)*(z-r)/(r+1) \]

\[ B = \ln x + b \ln y + b \ln x^2 \quad \rightarrow B = \log(x)+b*\log(y)+b*\log(x^2) \]

\[ D = \log(x)-b \quad \rightarrow D = \log(x)/\log(10)-b \]

\[ V = \log(m)-\log(k)/\log(10) \quad \rightarrow V = \log(m)/\log(10) - \log(k)/\log(10) \]
\[ Y = \frac{\cos(x)}{2} - \sin^2(x) \quad \rightarrow Y = \frac{\cos(x \cdot \frac{3.14}{180})}{2} - \left(\sin(x \cdot \frac{3.14}{180})\right)^2 \]

\[ A = \frac{\sin(x) \cdot \cos(x)}{\cos^2(x)} \quad \rightarrow A = \frac{\sin(x \cdot \frac{3.14}{180}) \cdot \cos(x \cdot \frac{3.14}{180})}{\cos(x \cdot \frac{3.14}{180})^2} \]

\[ Z = \left| \frac{3m - 1}{\sqrt{n+1}} \right| \quad \rightarrow Z = \frac{\text{abs}(3m-1)}{\sqrt{n+1}} \]

\[ Z = \left| \frac{3m - 1}{\sqrt{n}} \right| + 1 \quad \rightarrow Z = \frac{\text{abs}(3m-1)}{\sqrt{n}} + 1 \]

\[ B = \tan(x) \cdot \sec(x) \cdot \cos(x) \quad \rightarrow B = \tan(x \cdot \frac{3.14}{180}) \cdot x \cdot \frac{1}{\sin(x \cdot \frac{3.14}{180})} \cdot \cos(x \cdot \frac{3.14}{180}) \]

\[ W = 3 \cdot e^x \cdot \sqrt{1 + e^x} \quad \rightarrow W = 3 \cdot \exp(x) \cdot \sqrt{1 + \exp(x)} \]

\[ C = \frac{e^{x/a} + e^{-x/a}}{e^{x/a} - e^{-x/a}} \quad \rightarrow C = \frac{\exp(x/a) + \exp(\frac{-x}{a})}{\exp(x/a) - \exp(\frac{-x}{a})} \]

**Flow Charts**

Flow charts are drawing diagrams illustrates series steps must the program follows to Result the outputs. following the figures used in flow charts:

- The start and end of program symbol
- Input and output symbol
- Arithmetic operation symbol
- Decision symbol
- Reparative symbol
- Link symbol
- Direction traffic
The QBasic language statement:

**The REM Statement**

The general form of the REMARK statement is:

`REM[remark]`

Where remark may be any remark the programmer chooses to make to describe the program, to identify various parts of program, or even to serve as a blank line between parts of the program. For example:

- REM this program is named calculate
- Rem program written in 2010-03-30
- Rem input modul
- Rem output modul

**Print Statement**

The general form of the Print statement is:

`Print expression (, or ;) expression etc.`

Where expression is any number, any string of words, any variable, or any combination of numbers and variables in an algebraic expression. Commas or semicolons must be used to separate expressions. For example:

- Print
- Print X
- Print a,b,c
- Print s; t; u; r; v
- Print "the sum is"; s9
- Print a$, B$, c$

Remark: the symbol " " use in print statement for print strings.

**Input Instructions**

There are three types of input instructions include:

1. Let statement.
2. Input statement.
3. Read / Data statement.

**Let statement.**

The general form of the Let statement is:

`Let variable = expression`

Where variable may be either a numeric variable or a string variable and expression may be either an arithmetic expression or a string expression. Strings cannot be placed into numeric variables, or vice versa. The following are examples of let statement:

- Let X=25
- Let A$="computer"
- Let R3=5*x*(X-9)
- Let M$=N$
Example-1
Write a program to compute the following functions:
\[ A = X^2 + Y^2 \]
\[ B = A^2 + XY \]
\[ C = (A+B)^2 \]

Solution
Let \( x = 5 \)
Let \( y = 7 \)
\[ A = X^2 + Y^2 \]
\[ B = A^2 + X*Y \]
\[ C = (A+B)^2 \]
Print a,b,c

Example-2
Write a program to compute the area and circumference of triangle it sides \( x=4, y=3, z=5 \).

Solution
REM Program for compute triangle area and circumference
\[ x=3, y=4, z=5 \]
\[ C = x+y+z \]
\[ S = C/2 \]
\[ Ar = \text{sqr}(s*(s-x)*(s-y)*(s-z)) \]
Print "the circumference is";C
Print "the area is";AR

Example-3
Write a program to find horizontal component and vertical component and for force =70N slope 45° from x-axis.

Solution
REM Program to force components
\[ F = 70 \]
\[ Th = 45*3.141592/180 \]
\[ Fx = F*cos(th) \]
\[ Fy = F*sin(th) \]
?Fx,Fy
**Input statement**

The general form of the input statement is

**Input variable [variable...]**

Where variable stands for any suitable variable chosen by the programmer. Also it is the programmers option to use more than one variable, separating them by commas, in order to enter additional values. When the program is running and control comes to an input statement, the computer print question mark (?) and pauses so that the user may enter the proper value for that variable. This opportunity to enter a value makes the program very flexible. The following are examples of Input statement:

**Input X**
**Input A, B, C**
**Input A$, R$**
**Input M$, E$, F$, N**

**Example-1**
Write a program to compute the real roots of an equation \(AX^2+BX+C=0\)

**Solution**

```plaintext
REM Program for compute roots of equation
Input A,B,C
X1=(-b+ SQR(b^2-4*a*c)) /(2*a)
X2=(-b-SQR (b^2-4*a*c)) /(2*a)
Print" the first root is";X1
Print " the second root is";X2
```

**Example-2**
Write a program to compute the area and circumference of a circle its radius \(R\).

**Solution**

REM Program for compute circle area and circumference
```plaintext
Pi = 3.141592
Input "radius of circleis";R
A=R^2*Pi
C= 2*pi*r
Print" the area is";A
Print"the circumference is";C
```
Example-3
Write a program to input the length, width, and height of a wall then compute the number of bricks in the wall, if you know the brick sides is (24x8x12cm).

Solution
REM Program for compute bricks number
Input "the wall length"; L
Input "the wall width"; W
Input "the wall high"; H
V=L*W*H
N=V/(24x8x12)
?"bricks number is" N

Read / Data statement.
The general form of the Read and Data statements are:

Read variable [,variable] etc.
Data datum [,datum] etc.

Where variable is any valid numeric variable or string variable and datum is any valid number or string constant. The following are examples of Read / Data statements:

Read X, Y, Z
Data 12.7, 35, -29.75

Read A, NS, MS, T
Data 7.4, "address", "telephone", 66.7

Example-1
Write a program to read student name and 6 degree then compute and print the average of student degree.

Solution
Read A$, a, b, c, d, e, f
S=a+b+c+d+e+f
AV=S/6
Print A$, AV
Data Ali, 50, 65, 87, 97, 90, 70

Example-2
Write a program to read 4 variables then compute arithmetic mean and geometric mean.

Solution
Read x1, x2, x3, x4
Ar= (x1+x2+x3+x4)/4
Ge=(x1*x2*x3*x4)^(1/4)
Print "arithmetic mean is" ; ar
Print "geometric mean is" ; ge
Data 50, 67, 80, 77
The Restore Statement

The general form of the restore statement is:

```
Restore
```

Whenever control executes the restore statement, the system restores the data block pointer to the first item of data. Then the next read statement starts the process of reading the data all over again from the very first data statement.

Example

```
Read a,b,c
Restore
Read x,y,z
Data 5,7,9
```

The x,y,z have the values 5,7,9

Control Statements

Control statements include:

1. **Go To statement**
2. **If Then statement**
3. **If Go To statement**
4. **On Go To statement**

1. The Go To Statement

The general form of the Go To statement is:

```
Go To Line number
```

Where line number represents the next line number to which control will go instead of the following line number. The following are examples of the go to statement: Go to 10, Go to 5. This statement is sometimes called the unconditional go to statement.

Example-1

Write a program to compute the average of 6 subjects for number of students.

**Solution**

```
10 Input N$,S1,S2,S3,S4,S5,S6
   AV=(S1+S2+S3+S4+S5+S6)/6
   Print N$,AV
   Go To 10
```

```
start

Input N$,S1,S2,S3,S4,S5,S6

AV=(S1+S2+S3+S4+S5+S6)/6

Print N$,AV

end
```
2. The IF … THEN Statement

The general form of the If … then Statement is:

**IF Condition THEN Line Number**

Where condition has the form:

<table>
<thead>
<tr>
<th>Arithmetic expression</th>
<th>relation</th>
<th>Arithmetic expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>String expression</th>
<th>relation</th>
<th>String expression</th>
</tr>
</thead>
</table>

And relation represents one of the symbols from the following table:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>A=B</td>
</tr>
<tr>
<td>&lt;</td>
<td>A&lt;B</td>
</tr>
<tr>
<td>&gt;</td>
<td>A&gt;B</td>
</tr>
<tr>
<td>&lt;=</td>
<td>A&lt;=B</td>
</tr>
<tr>
<td>&gt;=</td>
<td>A&gt;=B</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>A&lt;&gt;B</td>
</tr>
</tbody>
</table>

**Example-1**

Write a program to compute the Summation (S) of values from 1 to 100 where: $S = 1+2+3+\ldots\ldots+100$.

**Solution**

```
S=0 : I=1
5 S=S+I
    I=I+1
    If  I <= 100 then 5
Print S
```

**Example-2**

Write a program to compute the summation for even numbers from 0 to N.

**Solution**

```
Input N
S=0 : I=0
5 S=S+I
    I=I+2
    If  I < N then 5
Print S
```

**Example-3**

Write a program to compute Y value where:

- $Y=A+B$ if $A \leq B$
- $Y=A*B$ if $A > B$

**Solution**

```
Input A,B
If A> B then Y= A*B
If A<= B then Y=A+B
Print Y
```
Example-4
Write a program to compute Summation of X values from list of 10 different numbers.

Solution

I=1
5 Read X
   S=S+X
   I=I+1
If I<= 10 then 5
Print "sum=",S
Data 5,12,15,18,20,30,7,5,57,75

Example-5
Write a program to compute S value where :S=1-1/3+1/5-1/7+…………1/n.

Solution

Input N
I=1
J=1
5 T=1/I
   S=S+T*j
   I=I+2
   J=-J
If I <=N then 5
Print S

Example-6
Write a program to compute the summation of following series (use 20 terms)
S=-3/5+7/10-11/15+15/20-……………….

Solution

N=1: K=-1: i=3: j=5
5     T=i/j
     S = S + T*k
     N=n+1: k=-k: i=i+4: j=j+5
If n<=20 then 5
Print S

Example-7
Write a program to input any number then determine if the number is odd or even.

Solution

Input X
If (x/2)= int(x/2) then print "x is even"
If (x/2) < > int(x/2) then Print "x is odd"
Or
Input X
If x mod 2 =0 then print "x is even"
If x mod 2 <> 0 then print "x is odd"
Example-8
Write a program input any number then determine if the number is integer or not.

Solution
Input $X$
If $x = \text{int}(x)$ then print "$x$ is integer"
If $x国情 int(x)$ then Print "$x$ is not integer"

Example-9
Write a program to compute the result of following series ,if you know the program stop when the term value less than $10^{-4}$

$Y = 1 - X^3 + 5 X^7 - 9 X^{11} + \ldots$ \quad \text{if } X \geq 0$

$Y = X^2 + 3 X^6 + 5 X^{10} + 7 X^{14} + \ldots$ \quad \text{if } X < 0$

Solution
Read $X$
If $X < 0$ then 20
I = 1 : K = -1 : Y = 1
10 T = K * I * X ^ (I + 2)
If abs(T) > $10^{-4}$ then
Y = Y + T
I = I + 4
K = - K
Go to 10
If $X < 0$ then
I = 1
20 T = I * X^ (2*I)
If abs(T) > $10^{-4}$ then
Y = Y + T
I = I + 2
Go to 20
Print Y
Data 1

Example-10
Write a program ask about point axis and circle radius ,it is center the original point, then compute if the point is inside, or on or outside the circle.

Solution
Input $x,y \ ,r,m1,m2$
D = \sqrt{(x-m1)^2+(y-m2)^2}$
If $d < r$ then print "Point inside the circle"
If $d > r$ then print"Point outside the circle"
If $d = r$ then print"Point on the circle"
Example-11

Write a program that read 5 forces in point with angle to x-axis, then compute the resultant of these forces in x and y axis if you know that \( R = \sqrt{R_x^2 + R_y^2} \)

**Solution**

1. \( I = 1 \)
2. \( 10 \) Read \( F, \theta \)
   - \( R_x = F \times \cos(\theta \times 3.14 / 180) \)
   - \( R_y = F \times \sin(\theta \times 3.14 / 180) \)
   - \( S_1 = S_1 + R_x \)
   - \( S_2 = S_2 + R_y \)
   - \( I = I + 1 \)
   - If \( I \leq 5 \) then \( 10 \)
   - \( R = \sqrt{S_1^2 + S_2^2} \)
   - Print \( S_1, S_2, R \)
3. Data 50, 30, 70, 45, 60, 90, 80, 180, 50, 270

Example-12

(12) Concrete cube be tested (cubic side 150x150x150) by reign power( P) on cubic. Write a program for read P values then compute and print number of successful model and it is percentage, if you know the cubic be successful in test if the stress equal or more than 20N/mm², and the stress equal the power divided by cub area.

**Solution**

1. \( I = 1 \)
2. \( 10 \) Read \( P \)
   - \( F = P / (150 \times 150) \)
   - If \( F > 20 \) then \( X = X + 1 \)
   - \( Y = Y + 1 \)
   - \( I = I + 1 \)
   - If \( I \leq 12 \) then \( 10 \)
   - \( N = X / 12 \times 100 \)
   - Print "successful model is"; \( X \)
   - Print "the percentage is"; \( N \)
3. Data
Example-13
for compute stress (Fc) of concrete cub it is side X, reign Power to cubic surface it is value (P), write a program to compute and print the average for stress when reign different value of powers (100,150,200,………,500),if you know Fc=P/A.

Solution
Read X
A = X*X
S=0
P=100
10 Fc = P / A
S = S + Fc
I= I + 1
P = P + 50
If  P <= 500 then 10
AV = S / I
Print "the average is"; AV
Data 10

Example-14
Write a program to compute A value: \[
\sqrt{A} = \sum_{x=1}^{10} \left| \frac{x^2 - 3x}{x + \cos(x^3)} \right|
\]

Solution
X=1
10 S=S+abs((X^2-3*X)/(X+cos(x*3.14/180)^3)))
X=X+1
If X<=10 then 10
A=S^2
? A

3.The IF … Go To Statement
The general form of the If … go to Statement is:

IF Condition Go To Line Number

Example-1
Write a program to compute the average of 50 students have 6 subjects.

Solution
REM this program for compute the average
I=0
10 Input N$,S1,S2,S3,S4,S5,S6
AV=(S1+S2+S3+S4+S5+S6)/6
Print N$,AV
I=I+1
If I < 50 go to 10
End
Example-2
Write a program to compute the ( N! ) value.
where N!=1*2*3….N

Solution
REM this program for compute the factorial
Input N
I=1
F=1
5 F=F*I
I=I+1
If I<=n go to 5
Print F

Example-3
Write a program to compute the sum and count of positive and negative numbers from list of (30) number.

Solution
K=0: j=0
5 Read A
  If A > 0 go to 10
  SN=SN+A
  J=j+1
  Go to 20
10 SP=SP+A
  K=k+1
20 If j+k < 30 go to 5
  Print "Positive numbers" ;SP,k
  Print "negative number" ;SN, j
Data 30,60,-70,,9,-5,………………
Example-4
Write a program to compute the sum and count of odd and even and summation of all values from list of (N) numbers.

Solution
\[
J=0 : k=0 : SE=0 : SO=0 : SX=0
\]
1. Read N
2. Read X
   \[Y=X/2\]
   If Y=INT(Y) go to 10
   \[SO = SO + X\]
   \[J=j+1\]
   Go to 20
3. \[SE = SE + X\]
4. \[K =k +1\]
5. \[SX=SX+X\]
   If k+j < N go to 5
   Print " sum of odd number is "; SO, "count of odd number is"; j
   Print " sum of even number is "; SE, "count of even number is"; k
   Print "sum of all numbers is "; SX

Data 10, 12,6,9,7,8,5,56,77,3,99

Example-5
Write a program to compute Y value from the following series, use 15 terms only.

\[
\frac{Y^2}{\pi} = \frac{X^3 + 30}{2!} - \frac{X^5 + 29}{4!} + \frac{X^7 + 28}{6!} - \frac{X^9 + 27}{8!} + \ldots \]

Solution
1. Read X
2. \[p = 3.14\]
3. \[I = 2: j = 30: l = 1: n = 1\]
4. \[f = 1\]
5. \[k = 1\]
6. \[f = f * k\]
   \[k = k + 1\]
   If k <= i Go To 10
   \[t = ((x ^ (i + 1) + j) / f) * l\]
   \[s = s + t\]
   \[i = i + 2\]
   \[j = j - 1\]
   \[l = - l\]
   \[n = n + 1\]
   If n <= 15 Go To 5
   \[Y= SQR (3.14*S)\]
   Print Y

Data 1
Example-6
Write a program to compute S value from following series, use 20 terms.
\[
S = 1 - \frac{2 \times 1}{3} + \frac{5 \times 3}{7} - \frac{8 \times 7}{11} + \frac{11 \times 15}{15} - \text{.........}
\]

Solution
\[
N=1
\]
\[
S=1
\]
\[
L=-1
\]
\[
I=2 : J=3 : K=1
\]
10 \[T= (I * K) / J\]
\[
S=S+T
\]
\[
I= i+3
\]
\[
J=j+4
\]
\[
K= 2 * k+1
\]
\[
L=-L
\]
\[
N=N+1
\]
If \(N \leq 20\) go to 10

Example-7
Write a program to find y value from the equation \(y = x^2 - 4x + 6\) for X value from 0-10.

Solution
\[
X=0
\]
5 \[Y= X^2-4*X+6\]
?"X=",X,"Y=",Y
\[
X=X+1
\]
If \(X \leq 10\) go to 5

Example-8
Write a program to compute reaction of steel cable (R) to temperature (T) that equal \((293,313,333,353)\) using the following equation:
\[
R = 8.85 \times 10^{-8} [1 + 6.5 \times 10^{-3} (T - 237)]
\]

Solution
\[
T=293
\]
10 \[R=8.85E-8(1+6.5E-3*(T-273))\]
PRINT R
\[
T=T+20
\]
If \(T \leq 353\) go to 10

Compound IF ... then
The general form of compound if ...then is:

**Simple relation (and, or) simple relation**

The most logical operators are in following table:

<table>
<thead>
<tr>
<th>Logical operators</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 and X2</td>
<td>True if x1 and x2 are true other wise false.</td>
</tr>
<tr>
<td>X1 or X2</td>
<td>True if either x1 or x2 or both true otherwise false.</td>
</tr>
</tbody>
</table>
Example-1
Write a program to compute the Y value where:
\[ X = \frac{(A+B)}{2} \]
\[ Y = \begin{cases} X^2+X-3 & \text{if } A=1 \text{ or } B=3 \\ X^2+3X+5 & \text{if } A>2 \text{ and } B>4 \\ X^3+2X^2+X & \text{otherwise} \end{cases} \]
Execute the program to N from A,B values.

**Solution**
```
Print " A   B   X   Y": print "------------------"
Read N
I=1
5  Read A,B
X=(A+B)/2
   If A=1 or B=3 go to 10
   If A>2 and B>4 go to 20
   Y=X^3+2*X^2+X
   Go to 30
10 Y= X^2 +X-3
   Go to 30
20 Y=X^2+3*X+5
   print A;" ";B;" ";X;" ";Y
30 I=I+1
   If I<=N go to 5
Data 5,1,3,2,4,3,5,1,2,5,4
```

Example-2
Write a program to input 3 numbers then find the maximum one.

**Solution**
```
Input a,b,c
Max=a
   If b>a and b>c then max=b
   If c>a and c>b then max =c
Print "the maximum is";max
```

Example-3
Write a program ask about triangle sides ,and determine if it is right triangle, and compute it is area and circumference.

**Solution**
```
Input x,y,z
   If x+y>z and y+z>x and x+z>y then ? "right triangle"
   C=x+y+z
   S=C/2
   Ar=sqr(s*(s-x)*(s-y)*(s-z))
Print "the circumference is"C
Print "the area is"ar
```
Example-4

Write a program to compute the F(x) value where:

\[ F(x) = \begin{cases} 
0.5 \times & \text{if } x < 1 \\
0.5(3-x) & \text{if } 1 \leq x \leq 2 \\
0.5 & \text{if } x > 2 
\end{cases} \]

Run the program for N of X values.

Solution

| Print "X Fx": Print "-----------" |
| Read N |
| I=1 |
| 5 Read X |
| If X<1 go to 20 |
| If X>= 1 and X<=2 go to 10 |
| Fx=0.5 Go to 30 |
| 10 Fx=1/2*(3-x) Go to 30 |
| 20 Fx=x/2 Print x,fx |
| 30 I=I+1 If I < N go to 5 |
| Data 10, 2,1,3,6,-2,3,1,2,6,7 |

4. The ON … Go To Statement

the general form of the on … go to statement is

\[ \text{ON expression Go To Line number[, line number]} \text{ etc.} \]

Where expression may be a single variable or any combination of variables and numbers. this expression must be evaluated, must be a positive number, and then must be truncated to a positive integer. if the integer is 1, then control goes to the first line number following the go to, if the integer is 2, then control goes to the second line number following the go to, and so on. an expression less than 1 or greater than the number of line numbers given constitutes an error that will stop the program.

Example-1

Write a program to find Z value where:

\[ Z = \begin{cases} 
2 & \text{k=1} \\
2k^3 - 3 & \text{k=2} \\
-2 & \text{k=3} \\
K & \text{k<1 or k>3} 
\end{cases} \]
Solution
Read K
On K go to 10,20,30
Z=k
Go to 40
10  Z=2
   Go to 40
20  Z=2k^3-3
   Go to 40
30  Z=-2
40  Print K,Z
Data 2

Example-2
Write a program to compute Q value where:
Q=\left|X^2 + 1\right| \quad \text{if } k=1
Q=\sqrt{X^2 + Y} \quad \text{if } k=2
Q=\log(Y^2 + 3X) \quad \text{if } k=3
Solution
Read X,Y
Read K
On K go to 10,20,30
10  Q=\text{ABS}(X^2+1)
   Go to 40
20  Q=\text{SQR}(%2+Y))
   Go to 40
30  Q=\log(Y^2+3X)
40  Print Q
Data

Example-3
Sample taken from engineering students college departments, Building and construction, Software, Architecture, Material, write a program to classify the students by their departments, the size sample is( n),and the symbol for each department as follows:
K=1 for Building and construction students
K=2 for Software students
K=3 for Architecture students
K=4 for Material students
Solution

```
S1=0:S2=0:S3=0:S4=0
Input n
I=0
5   Input k
   On k go to 10,20,30,40
10  S1=S1+1
    Go to 50
20  S2=S2+1
    Go to 50
30  S3=S3+1
    Go to 50
40  S4=S4+1
    Go to 50
50  I=i+1
    If i < n go to 5
    Print S1,S2,S3,S4
```

The For and Next Statements

The general form of the for and next statements are:

\[
\text{For loop variable = exp1 to exp2 [step exp3]}
\]
\[
\text{Next loop variable}
\]

Where loop variable is a numeric variable, and must be the same variable in both of the statements. The expressions denoted by exp1, exp2, and exp3 may consist of numeric constants or variables, or combinations of numeric variables and constants with one condition. That is the value of exp3, when added repeatedly to exp1, must finally go beyond exp2. If the step has been omitted, then exp3 is set equal to 1.

The purpose for the companion for and next statements is to guide control through the set of statements located between the for and next statements.

Example-1

Write a program to print the summation and multiplication of the numbers from 1 to 50.

Solution

```
S=0:P=1
For n=1 to 50
    S=S+n
    P=P*N
Next n
Print "the summation is" S
Print the multiplication is" P
```
Example-2
Write a program to compute P value where: \( P = (1)^2 + (3)^2 + (5)^2 + \ldots + (25)^2 \).

**Solution**

\[
P = 0 \\
\text{For } i = 1 \text{ to } 25 \text{ step } 2 \\
P = P + i^2 \\
\text{Next } i \\
\text{Print } P
\]

Example-3
Write a program to find the maximum value from list of 10 numbers.

**Solution**

REM Program for find maximum value
READ x
MX = X
For i = 2 to 10
Read X
If X > MX then MX = X
Next i
Print "the maximum is"; MX
Data 20, 3, 27, 98, 70, 54, 1, 60, 34, 90

Example-4
Write a program to find the summation of 10 different numbers.

**Solution**

REM Program for find the summation
For i = 1 to 10
Read X
S = S + X
Next i
Print "summation is"; S
Data 5, 8, 90, 67, 45, 3, 2, 88, 6, 1

Example-5
Write a program to compute the \( N! \) value where \( N! = 1 \times 2 \times 3 \ldots N \)

**Solution**

REM Program for find factorial value
Input N
F = 1
For i = 1 to N
F = f * i
Next i
Print "the factorial is"; f
Example-6

Write a program to compute the summation of the series  \( S = \sum_{x=1}^{30} \frac{x}{x + 1} \)

**Solution**

For  \( x=1 \) to 30
\[ S = S + \frac{x}{x+1} \]
Next \( x \)

?S

Example-7

Write a program to compute the mean and ST where:

\[
\text{Mean} = \frac{\sum X_i}{n}, \quad V = \frac{\sum X_i^2 - (\sum X_i)^2}{n-1}
\]

**Solution**

Input \( N \)
For i=1 to n
Input \( x \)
\[ S = S + x \]
\[ SS = SS + x^2 \]
Next i
\[ \text{Me} = S/n \]
\[ \text{V} = (SS - S^2/n)/(n-1) \]
ST=SQR(V)
Print "mean=";Me
Print "var=";V
Print"STA=';ST

Example-8

If \( N \$ \) represent student name and \( X \) represent student degree, write a program to print names and averages of the successful students only, if you know the successful degree 50% and the number of subject (5) and the number of students(150).

**Solution**

For i=1 to 150
Input "name";NS$
S=0
For K=1 to 5
Input X
If X<50 go to 10
\[ S = S + X \]
Next K
\[ M = S/5 \]
Print "mean=';m
10 Next i
Example-9
Write a program to compute the summation of the series \( S=1 +x+x^2/2!+x^3/3! \).

**Solution**

Read \( x \)
For \( i=0 \) to 3
\( F=1 \)
For \( j=1 \) to \( i \)
\( F=f*j \)
Next \( j \)
\( S=S+x^i/f \)
Next \( i \)
Print \( S \)

Example-10
Write a program to compute the summation of following series (use 20 term)
\( S=1+1/2!+1/3!+1/4!+1/5!+\ldots \)

**Solution**

\( N=1 : k=1 \)
\( 5 \ f=1 \)
For \( i=1 \) to \( k \)
\( F=f*i \)
Next \( i \)
\( S=S+1/f \)
\( K=k+1 \)
\( N=n+1 \)
If \( n<=20 \) then 5
? \( S \)

Example-11
Write a program to compute \( \cos x \) from the series :
\( \cos(x)=1-x^2/2!+x^4/4!-x^6/6!+\ldots \), the program is stop when term value less than or equal \( 10^{-5} \).

**Solution**

Read \( X \)
\( X=X*3.141592/180 \)
\( K=1 : i=0 \)
\( 5 \ F=1 \)
For \( j=1 \) to \( i \) : \( f=f*j \) :next \( j \)
\( T=x^i/f \)
If abs(\( t \)) >= 10^-5then
\( S=S+T*k \)
\( I=i+2 : k=-k \)
Go to 5
Print \( S \)
Data 3
Example-12
Write a program read x value then compute S value from the following series:

\[
S = \left( \frac{X-1}{X} \right) + \frac{1}{2} \left( \frac{X-1}{X} \right)^2 + \frac{1}{3} \left( \frac{X-1}{X} \right)^3 + \ldots + \frac{1}{10} \left( \frac{X-1}{X} \right)^{10}
\]

Repeat the procedure to 4 of x values.

**Solution**

I=1
10 Read X
   N= (x-1)/x
   For j=1 to 10
      S=S+n^j
   Next j
   Print X,S
   I=I+1
   If I<=4 then 10
   End
Data 4

Example-13
write a program read x value then compute z value from the following series(use 20 term):

\[
Z = X - \frac{X^2}{4!} + \frac{X^4}{8!} - \frac{X^6}{12!} + \ldots
\]

**Solution**

N=2 : j=1:k=1
Read X
10 F=1
   For i=1 to n
      F=f*i
   Next i
   T=x^(n/2)/f
   Z=Z+T*k
   N=n+2
   j=j+1
   k=-k
   If j <=20 then 10
   Print Z
Data 5
Example-14

Dam contain water with width(W) and high (H) change from 0 to 100 m increase 5 m. Write a program to compute force water FW and moment MO, if you know:

\[ FW = \theta \cdot W \cdot G \cdot H^2 / 2 \]
\[ MO = FW \cdot H / 3 \]

Where \( G = 9.8 \), \( \theta = 1 \)

**Solution**

\[ G = 9.8 \quad \theta = 1 \]

Read W

For H=0 to 100 step 5

\[ FW = \theta \cdot W \cdot G \cdot H^2 / 2 \]
\[ MO = FW \cdot H / 3 \]

F=F+ FW

M= M+MO

Next H

Print "The Force is";F

Print "The Moment is";M

data