LOOPING STATEMENTS

Looping means repeated execution of a statement or a set of statements.

Example

Lets understand with the help of an example - Suppose your instructor orders you to take 10 rounds of a ground to warm up yourself. The very first thing which you will do, will be, to fix a starting point and then start running. On reaching the starting point again, you complete a round. Then you take second round and so on. This way you keep track of number of rounds until the process is completed. The process which goes in your mind is that you set a value (control variable) in your mind and keep on incrementing it until the process is completed.

For example: Let's say the control variable is C, which starts fresh from the starting number. This number is usually 0 or 1. When you complete the first round, value of C becomes 1, after second round its value becomes C = C + 1, i.e., 1 + 1 = 2 and so on. This value has to be incremented every time the required process is repeated. After incrementing, the control variable (counter) has to be checked against the maximum limit of the number of the repetitions required.

The advantage of using looping technique in programming is that it reduces the number of instructions and also the memory space. Consider the following examples:

```
10    LET A$ = "GOD BLESS YOU"
20    PRINT A$
30    LET B$ = "GOD IS GREAT"
40    PRINT B$
50    GOTO 20
60    END
```

The output will be printed infinite times.

Example

Now, look at the following example, which prints 'THANK YOU' 10 times by using counter.

```
10    A=1                          (Initializing the counter)
20    LET X$ = "THANK YOU"
30    PRINT X$
40    A=A+1                        (Incrementing the counter)
50    IF A < =10 THEN GOTO 30      (Checking for the maximum limit)
60    END
```

THE FOR...NEXT LOOP

The process of using multiple counters in large programs is very tedious. The process of repeating a program segment in a loop can be simplified and controlled by using FOR ... NEXT statement. This also reduces the length of a program.

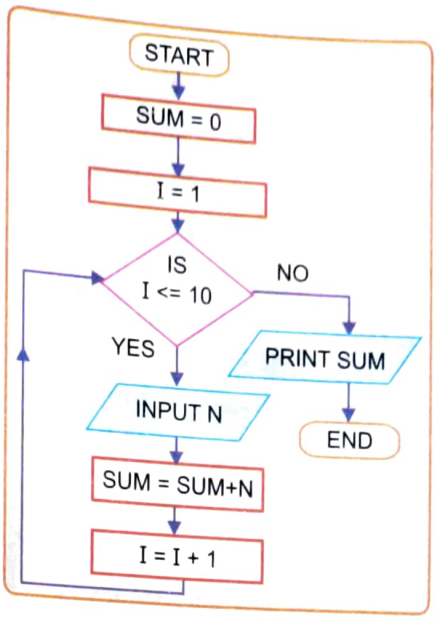
Syntax: LINE NO. FOR <control variable>=<initial value> To <final value>

{Statement}

NEXT< control variable>

Program to find sum of 10 numbers.

```
REM CALCULATE SUM OF 10 NUMBERS
CLS
SUM=0
FOR I = 1 TO 10
INPUT N
SUM = SUM + N
NEXT I
PRINT SUM
END
```



Let Us Recall

What are the relational operators of QBasic?

following steps are involved in executing the FOR...NEXT statement:

The control variable is assigned an initial value and a final value. The difference between the final and the initial value specifies the number of times the loop will be executed.

The set of statements between the FOR...NEXT statement is executed.

The NEXT statement increments the value of the control variable by one and shifts the program control back to the FOR statement.

The new value of the control variable is compared against the final value specified in the FOR statement. If it is still less, then the whole process is repeated.

If the value of control variable exceeds the final value, the statement after the NEXT statement is executed.

Let's Know More

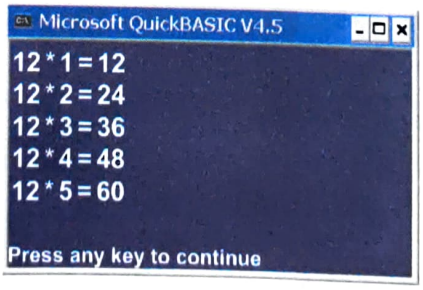
An **Accumulator** is a variable that stores the sum of the numbers entered during the execution of a loop.
E.g., Sum= Sum+N

Quick Quiz

Which basic statement causes the control to shift from one point to another?

Program to print table of 12 (upto 5 times only).

```
CLS
FOR A=1 TO 5
PRINT "12 * "; A; " = "; 12*A
NEXT A
END
```

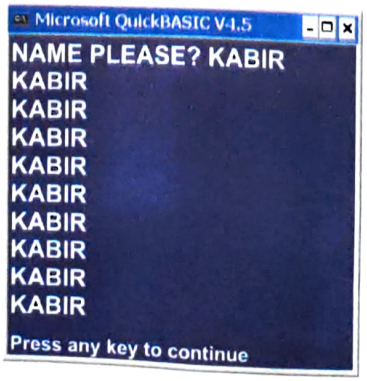


Let's Know More

A **Counter** is a variable that keeps track of the 'number of times' a particular instruction or a set of instructions has been executed in a loop. It is also called Control Variable.

Program to display your name nine times on the screen.

```
CLS
REM PRINT YOUR NAME
INPUT "NAME PLEASE"; N$
FOR X=1 TO 9
PRINT N$
NEXT X
END
```

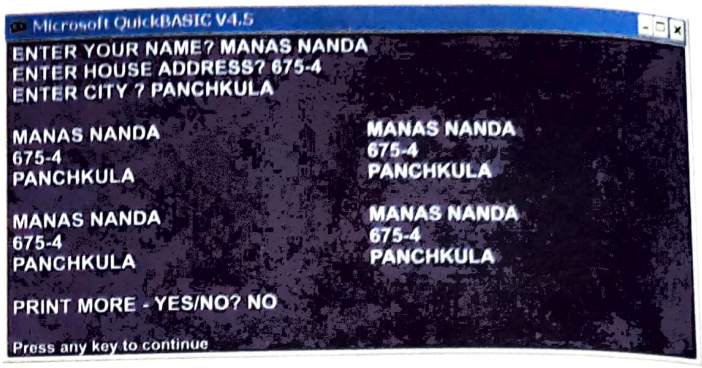


Let Us Recall

Finite
vs
Infinite Loop

Program to create multiple address labels.


```
10    REM PROGRAM TO PRINT MULTIPLE ADDRESS LABELS
20    INPUT "ENTER YOUR NAME";A$
30    INPUT "ENTER HOUSE ADDRESS";B$
40    INPUT "ENTER CITY";C$
50    PRINT
60    FOR N=1 TO 2
70    PRINT A$; TAB(40); A$
80    PRINT B$; TAB(40); B$
90    PRINT C$; TAB(40); C$
100   PRINT
110   NEXT N
120   INPUT "PRINT MORE - YES/NO";Y$
130   IF Y$="YES" THEN 20
140   END
```



FOR...NEXT WITH STEP

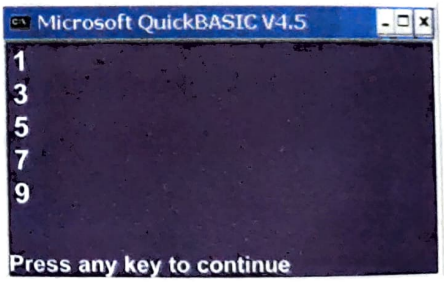
By default, the NEXT statement increments the value of the control variable by 1, but we can increase or decrease the value as per our choice using STEP statement. STEP value is optional and can either be positive or negative.

Syntax:

FOR <CONTROL VARIABLE> = <INITIAL VALUE> TO <FINAL VALUE> STEP <n>

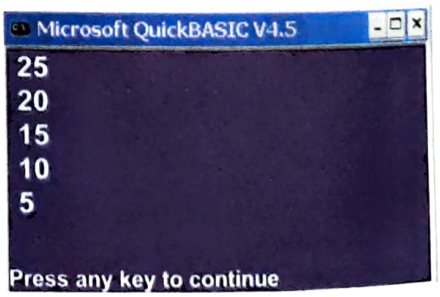
Program to print first five odd numbers.


```
CLS
FOR  L =1 TO 10 STEP 2
PRINT L
NEXT L
END
```



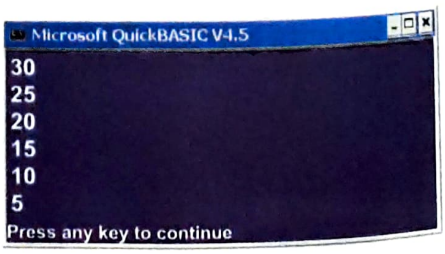
Program to print numbers between 25 and 5 with a decreasing step of 5.


```
CLS
FOR N=25 TO 5 STEP -5
PRINT N
NEXT N
END
```



Program to print numbers starting from 30 and then with a decreasing value of 5.


```
10    CLS
20    B=-5
30    FOR X=30 TO 1 STEP B
40    PRINT X
50    NEXT X
60    END
```



In this case, B is assigned the value -5, hence the values are decreased in step of 5.

NOTE

While using a negative number with the STEP statement, the initial value in FOR statement should be more than the final value as shown in the examples.

Let's Know More

Mod function is used to find the remainder after division. E.g.,
5 MOD 2 = 1
and 4 MOD 2 = 0

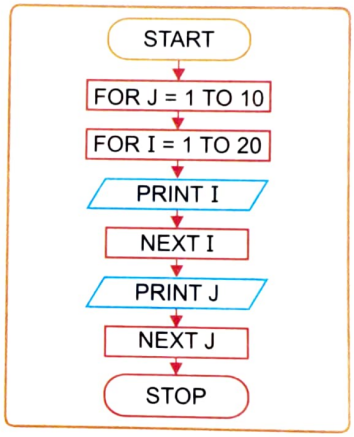
NESTED-FOR...NEXT

The use of a FOR...NEXT statement within another FOR...NEXT statement is known as nested FOR...NEXT statement. The FOR...NEXT which lies outside or encloses the second FOR...NEXT statement is called Outer Loop. The one, which lies inside is called Inner Loop.

- You can have maximum of 9 loops within a loop and every loop should be defined completely within the outer loop.
- The same control variable cannot be used in different loops.
- Firstly, the innermost loop will be executed and then the outer loop.

Syntax:

```
FOR J = 1 TO 10
FOR I = 1 TO 20
PRINT I
NEXT I
PRINT J
NEXT J
```

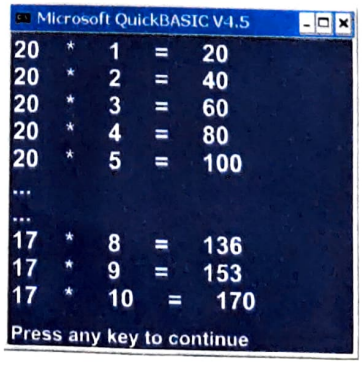


Quick Quiz

What is the use of STEP in FOR...NEXT loop?

Program to print the tables from 20 to 17.


```
FOR I=20 TO 17 STEP -1
FOR J=1 TO 10
PRINT I;"*"; J; "="; I * J
NEXT J
PRINT
NEXT I
END
```



WHILE...WEND STATEMENT

Sometimes, a loop has to be executed repeatedly while a given condition remains true. In such cases, WHILE...WEND statement is used.

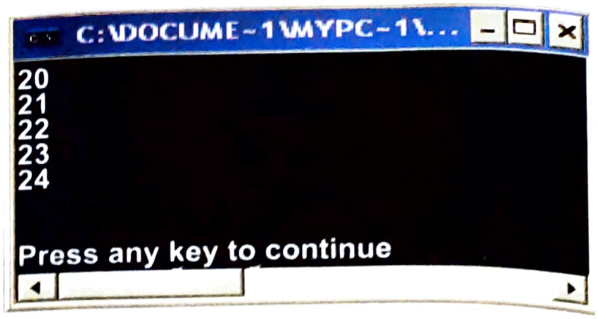
Syntax : WHILE condition

```
{
Statement(s)
}
WEND
```

Let's Discuss

FOR...NEXT
vs
Nested
FOR...NEXT


```
10 CLS
20 X = 20
30 WHILE X < 25
40 PRINT X
50 X  = X + 1
60 WEND
70 END
```



1. To begin with, the value of X is 20. The condition (X < 25) will be checked.
2. Since the condition is true, the current value of X will be displayed.
3. The value of X becomes 21, as it has been incremented by one.
4. WEND statement shifts the control back to the WHILE statement.
5. The condition (X < 25) will be checked again. If the condition is true, the control repeats the statements No. 40 & 50 but if the condition is false, the control shifts to the next statement after WEND.

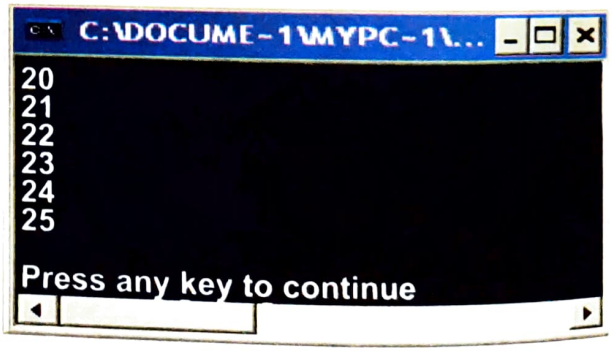
DO UNTIL STATEMENT

Sometimes, a loop has to be executed repeatedly while a given condition remains false, or becomes true. In such cases, DO UNTIL statement is used.

Syntax :

```
DO UNTIL condition
{
Statement(s)
  }
LOOP
```


```
10 CLS
20 X = 20
30 DO UNTIL  X> 25
40 PRINT X
50 X  = X + 1
60 LOOP
70 END
```



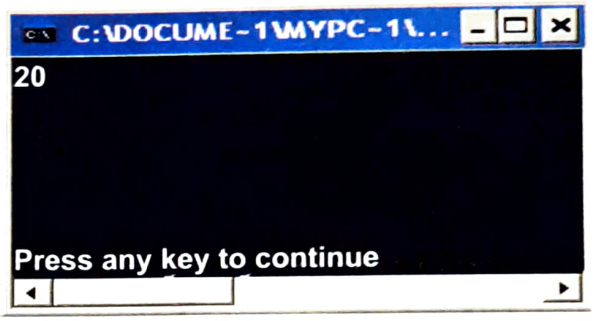
1. To begin with, the value of X is 20. The condition (X > 25) will be checked.
2. Since the condition is false, the current value of X will be displayed.
3. The value of X becomes 21, as it has been incremented by one.
4. LOOP statement shifts the control back to the DO UNTIL statement.
5. The condition (X >25) will be checked again. If the condition is false, the control repeats the statements no. 30 & 40 but if the condition is true, the control shifts to the next statement after LOOP.

Sometimes, we wish to execute a set of statements once and then repeat these statements only if the given condition is true. **DO...LOOP WHILE** statement is used in this scenario.

Syntax:

```
DO
{
statement(s)
}
LOOP WHILE condition
```


```
10 CLS
20 X = 20
30 DO
40 PRINT X
50 X  = X + 1
60 LOOP WHILE X > 25
70 END
```



- This program will print the value of X **once**, then check for the condition. If the condition is true, it will repeat the statement within DO Loop. If the condition is false, it will not repeat the statements.
- The point to be understood here is that, although the condition was false, it executed the statement once.
- Change the condition to X < 25. Run the program and notice the result.

- Looping means repeated execution of a statement or a set of statements in a program.
- For...Next statement reduces the length of a program.
- The control variable is assigned an initial value and a final value.
- Using STEP statement, we can increase or decrease the value as per our choice.
- WHILE...WEND statement is used, when a loop has to be executed repeatedly while a given condition remains true.
- DO UNTIL statement is used, when a loop has to be executed repeatedly while a given condition remains false, or becomes true.
- Mod function is used to find the remainder after division.

Brain DEVELOPER

A. Fill in the blanks:

1. ..... means repeated execution of a set of statements in a program.
2. The ..... variable keeps track of the number of times a process is executed.
3. The Control variable is assigned an ..... and ..... value in FOR...NEXT statement.
4. FOR statement is always used along with the ..... statement.
5. All the statements, which are to be executed in a loop, come in between ..... statements.
6. The ..... statement increments/decrements the value of the control variable.

HINTS FOR...NEXT · Looping · Initial · STEP · NEXT · Counter · Final

B. State True or False:

1. Looping technique reduces the number of instructions.
2. For statement increments the value of the control variable by one.
3. The same control variable can be used in different loops.
4. In Nested loop, the innermost loop will be executed first then the outer loop.
5. There can be maximum of 9 loops within a loop.
6. WEND clause is used with FOR statement.
7. STEP value can never be negative.
8. The condition in If...Then ... Else statement is given by the relational operators.

C. Application Based Questions:

1. Ritu is making a program using FOR...NEXT statement. She wants to give increment to the counter by the value 5 but she is not able to apply the clause. Which clause will you suggest to her to use with FOR...NEXT?

.....

2. Raman's teacher asked him to name the variable, which keeps count of the number of repetitions performed in a loop but he is unable to recollect the same. Help Raman to answer this query.

.....

3. The teacher asked Priya to make a program in QBasic and print the series 2, 5, 10, ... 101. She wants that the program should run for 10 times. What logic will you suggest to her to apply to get the desired output?

.....

D. Multiple Choice Questions:

1. Which variable keeps track of the 'number of times' a particular instruction has been executed in a loop?
   a. CONTROL b. NEXT c. FOR
2. Which value is optional and can either be positive or negative?
   a. FOR b. STEP c. NEXT
3. Which statement combines the initialization and checking steps of counters in a single statement?
   a. DO b. WHILE c. FOR
4. Which statement gives the increment to control variable, and directs the program control back to FOR statement?
   a. NEXT b. FOR c. STEP
5. Which statement shifts the control back to the WHILE statement?
   a. WHILE b. WEND c. DO

E. Answer the following:

1. Explain the term looping.

2. Define the FOR...NEXT looping statement.

3. What is the use of STEP statement in FOR...NEXT?

4. What is nested loop?

5. What is the difference between WHILE...WEND and DO UNTIL?

6. Which variable stores the sum of the numbers entered during the execution of a loop?