Program Looping

It used to execute a part of a program a certain number of times.

**FOR** variable=start **TO** end, step-size

**statements**

**NEXT** variable

**Example 1:**

FOR NUMBER = 1 TO 3

PRINT “This is loop number”; NUMBER

NEXT NUMBER

END

The output will be:

This is loop number 1
This is loop number 2
This is loop number 3

**Example 2:**

FOR j = 0 TO 6 STEP 1.5

PRINT j

NEXT j

END

The output will be:

0
1.5
3
4.5
6

**Example 3:**

FOR wg = 4 TO 1 STEP -1

PRINT wg

NEXT wg

END

The output will be:

4
3
2
1

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**Example 4:**

CLS
REM for/Next statements
PRINT "Number", "Square"
FOR number = 1 TO 5
PRINT number, number ^ 2
NEXT
END

The output will be:

<table>
<thead>
<tr>
<th>Number</th>
<th>Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

**Example 5:**

This example illustrates using a negative step to assign decreasing values to a variable.

CLS
REM FOR/NEXT with negative STEP
REM count=counter

FOR count = 10 TO 5 STEP -1
PRINT count
NEXT
END

The output will be:

<table>
<thead>
<tr>
<th>count</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>
The following program uses a READ/DATA statement within a loop. Line numbers are listed to identify individual lines.

```plaintext
5 CLS
10 REM READ/DATA within a Loop
20 PRINT "Numbers:";
30 FOR k = 1 TO 5
40 READ n
50 PRINT n;
60 s = s + n
70 NEXT k
80 PRINT
90 PRINT "Average: "; s / 5
100 DATA 7,10,12,15,6,9,.5
END
```

In this example the following points should be noted:
• Line 60 has the effect of saying "Let the new value of S be the old value of S plus N"
• Not all of the data in line 100 is used. The loop is only executed 5 times so only the first five values from the data statement are read.
• Line 80 is necessary to stop the output from line 90 appearing on the same line as the numbers
• The variable S was not given an initial value so the computer gives S the initial value of 0 (zero).
The following example illustrates the use of an input statement within a loop.

REM Input within a Loop
REM Averaging three Numbers
FOR counter = 1 TO 3
   INPUT "Enter a number: "; num
   sum = sum + num
NEXT counter
PRINT
PRINT "Average of the three numbers= "; sum / 3
END

This program could be modified to let the person running the program choose the number of numbers to be averaged while the program was running. See below:

REM Input within a Loop
REM Averaging three Numbers
INPUT "How many Numbers to Enter:"; k
FOR counter = 1 TO k
   INPUT "Enter a number: "; num
   sum = sum + num
NEXT counter
PRINT
PRINT "Average of the "; k; "numbers= "; sum / k
END

The output will be:
Enter a number: 4
Enter a number: 5
Enter a number: 3
Average of three numbers= 4

The output will be:
How many Numbers to Enter: 3
Enter a number: 4
Enter a number: 5
Enter a number: 3
Average of the 3 numbers= 4
Exercises:

READ A, B, C
FOR N = A TO B STEP C
    P = N * B
    PRINT N; "Times"; B; "="; P
NEXT N
DATA 1,10,3
END

FOR N = 1 TO 5
    READ A
    PRINT A
NEXT N
DATA 2,4,6,8,10,12,14
END

PRINT "N", "N^2", "SQR(N)"
FOR N = 1 TO 4
    PRINT N, N ^ 2, SQR(N)
NEXT N
END

The output will be:

1 Times 10 = 10
4 Times 10 = 40
7 Times 10 = 70
10 Times 10 = 100

The output will be:

2
4
6
8
10

<table>
<thead>
<tr>
<th>N</th>
<th>N^2</th>
<th>SQR(N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>1.414214</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>1.732051</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>2</td>
</tr>
</tbody>
</table>
CLS
a = 4
B = 10
C = 2
FOR N = a TO B STEP C
FOR W = 1 TO 4
P = N * W
PRINT N; "Times"; W; "="; P
NEXT W
PRINT “-----------------------------”
NEXT N
END

The output will be:

4 Times 1 = 4
4 Times 2 = 8
4 Times 3 = 12
4 Times 4 = 16
-----------------------------
6 Times 1 = 6
6 Times 2 = 12
6 Times 3 = 18
6 Times 4 = 24
-----------------------------
8 Times 1 = 8
8 Times 2 = 16
8 Times 3 = 24
8 Times 4 = 32
-----------------------------
10 Times 1 = 10
10 Times 2 = 20
10 Times 3 = 30
10 Times 4 = 40
-----------------------------
\[ S = 0 \]
\[ \text{FOR N = 1 TO 6} \]
\[ \quad \text{READ a} \]
\[ \quad \text{PRINT a;} \]
\[ \quad S = S + a \]
\[ \text{NEXT N} \]
\[ \text{PRINT} \]
\[ \text{PRINT "Total";} S \]
\[ \text{DATA 5,9,-3,7,12,8} \]
\[ \text{END} \]

Write a program to print even numbers up to 20 and find the total?

\[ \text{CLS} \]
\[ \text{total=0} \]
\[ \text{FOR i=0 TO 20 STEP 2} \]
\[ \quad \text{total = total + i} \]
\[ \text{PRINT i ;} \]
\[ \text{NEXT i} \]
\[ \text{PRINT} \]
\[ \text{PRINT "total is ";} \text{total} \]
\[ \text{END} \]
Example: Use FOR…NEXT loop in a program to calculate the sum of the first $n$ terms of the series, then execute the program for $n=4$ and $n=20$:

\[ \sum_{k=1}^{n} \frac{(-1)^k k}{2^k} \]

Solution:

```
INPUT "Enter the number of the terms ="; n
S = 0
FOR k = 1 TO n
S = S + ((-1)^k * k) / (2^k)
NEXT k
PRINT "The summation of the series is ="; S
```

The output:
Enter the number of the terms = 4
The summation of the series is = -0.125
Enter the number of the terms = 20
The summation of the series is = -0.222