Revisiting *for* and *while* loops:

*For* loops are better when you need to do something N times.  
*While* loops are better when you have a test condition for breaking the loop.

```plaintext
for  index = initial value : increment size : final value  
     statements, calculations  
end
```

```plaintext
while (test condition)  
     statements, calculations  
end
```

**Example:**

```plaintext
N = 4;  
x = 0;  
for i = 1 : N  
    x = x + 0.5;  
    disp([i, x])  
end
```

After execution:

<table>
<thead>
<tr>
<th>i</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

A *while* loop can do the same task.

```plaintext
i = 1;  
N = 4;  
x = 0;  
while( i <= N )  
    x = x + 0.5;  
    disp([i, x])  
end
```

**Example:**

```plaintext
for x = 0 : 0.5 : 2  
    disp(x)  
end
```
After execution:
0
0.5
1
1.5
2

A **while** loop can do the same task.

```matlab
x = 0;
while( x >= 2 )
    disp(x)
    x = x + dx;
end
```

**Example**: Determine \( y(x) = x^2 \) from \( x=1 \) to \( 2 \) in steps of 0.2.

In the past we would do the following,
```matlab
x = [1 : 0.2 : 2];
y = x.^2;
table = [x ; y];
disp(table')
```

Let’s do the same task but with a **for** loop.

```matlab
for x = 1 : 0.2 : 2
    y = x^2
    disp([x y])
end
```

It gives the same display but doesn’t store the values of \( x \) and \( y \) for later use.

```matlab
i = 1;
for x = 1 : 0.2 : 2
    y = x^2;
    xval(i) = x;
    yval(i) = y;
    i = i + 1;
end
table = [xval ; yval];
disp(table')
```
A **while** loop can do the same task.

```matlab
i = 1;
x = 1;
dx = 0.2;
while(x>=2)
y = x^2;
xval(i) = x;
yval(i) = y;
x = x + 0.2;
i = i + 1;
end
table = [xval ; yval];
disp(table')
```

**Example:** There is a sequence of numbers, 1, 2, 4, 8, 16, 32,…

Calculate the first N numbers of this sequence, store them in memory, and display them to the screen. Notice that the sequence is as follows,

```matlab
number(i) = number(i-1) * 2

number(1) = 1
for i=2:N
    number(i) = number(i-1)*2
end
disp(number')
```

Beware of infinite loops!

```matlab
x = 0;
i = 1;
while( x <= 2 )
i = i + 1;
end
```

This loop will never end. Type ctrl+C to end the program.