**KIT506 Programming Practical 4: Repeat while something is true**

[ [↶ Close all sections](https://mylo.utas.edu.au/content/enforced/214790-AW_EAI_17S2_15468_0_0_0_1_1/kit506_pracs/KIT506_Prac_04.html?d2lSessionVal=dx0bynATNq1YR9mA2AHARswOX&ou=214790&d2l_body_type=3) ] Only visible sections will be included when printing this document.

**Aims:**

* to practise reading **for** loops; and
* to implement a **while** loop.

**∨ 1 Tracing loops (< 10 minutes)**

**1.1 Repeated multiplication**

Read the following C# statements.

const int TIMES = 3;

int n = 1;

**for** (int i = 0; i < TIMES; i++)

{

n = n \* 2;

}

Console.WriteLine("After loop, n is " + n); // After loop, n is 8

How many times will the for-loop be executed?

[**Solution**](javascript:void(0);)

Three times, for i equal to 0, 1 and 2.

What would the output be if the statements were executed?

[**Solution**](javascript:void(0);)

The output is “After loop, n is 8”, because the loop executes three times, each time doubling the previous value of n.

**1.2 Countdown**

Now examine the following code and determine what will be displayed at the end:

const int START = 10; *//countdown starts at 10*

const int END = 0; *//countdown ends on zero*

string output = ""; *//output message we will construct*

**for** (int i = START; i >= END; i--)

{

*//a += b; is the same as a = a + b;*

output += i + ", ";

}

output += "blast off!"; *//add final message*

Console.WriteLine(output);// 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, blast off!

[**Solution**](javascript:void(0);)

First, what’s happening with the loop? It’s counting backwards from 10, all the way down to zero (because the test >=includes the value of END). So i will be 10, 9, 8, …, 0.

What’s happening inside the loop?

[**Solution**](javascript:void(0);)

Each time through the loop it appends the value of i and the text “, ” to the end of output. Here’s how the value of output changes at each iteration:

| **i** | **Value of output after loop body executes** |
| --- | --- |
| 10 | "10, " |
| 9 | "10, 9, " |
| 8 | "10, 9, 8, " |
| … |  |
| 1 | "10, 9, 8, 7, 6, 5, 4, 3, 2, 1, " |
| 0 | "10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, " |

So what is printed in the end?

[**Solution**](javascript:void(0);)

10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, blast off!

Because just after the loop the code also appends the text “blast off!” to the string that it has been constructing.

**∨ 2 While you’re here**

We’re going to adapt the if that you created back in [Programming Practical 2](https://mylo.utas.edu.au/content/enforced/214790-AW_EAI_17S2_15468_0_0_0_1_1/kit506_pracs/KIT506_Prac_02.html?ou=214790#first-if) to place it in a loop. Here’s the starting code, which doesn’t include a loop:

int n;

Console.Write("Enter a positive integer: ");

n = Int32.Parse(Console.ReadLine());

**if** (n % 2 == 0) *//n is even*

{

n = n / 2;

}

**else**

{

n = 3 \* n + 1;

}

Console.WriteLine("The final value of n is " + n);

The modified rules we’re going to apply are these:

* Take any positive integer *n* (provided by the user).
* If *n* is even, divide it by 2 to get *n* / 2.
* If *n* is odd, multiply it by 3 and add 1 to obtain 3*n* + 1. (Which is what you did in Week 3)
* Repeat the process indefinitely, stopping if *n* becomes 1.

The [Collatz conjecture](https://en.wikipedia.org/wiki/Collatz_conjecture) is that no matter the starting value of *n* this sequence will *always* become 1 eventually.

考拉兹猜想--又称为3n＋1猜想、角谷猜想、哈塞猜想、乌拉姆猜想或叙拉古猜想，是指对于每一个正整数，如果它是奇数，则对它乘3再加1，如果它是偶数，则对它除以2，如此循环，最终都能够得到1。

Wrap the if-else is a **while** loop that repeats while *n* is not equal to 1. And add another WriteLine() as the first instruction inside the loop to display the current value of *n*. Run your code with various values of *n* to see what happens.

[**Solution**](javascript:void(0);)

int n;

Console.Write("Enter a positive integer: ");

n = Int32.Parse(Console.ReadLine());

**while** (n != 1)

{

Console.WriteLine("n is " + n);

**if** (n % 2 == 0) *//n is even*

{

n = n / 2;

}

**else**

{

n = 3 \* n + 1;

}

}

Console.WriteLine("The final value of n is " + n);

// my answer

for (int n = 0; n != 1;)

{

Console.Write("Enter a positive integer: ");

n = Int32.Parse(Console.ReadLine());

if (n % 2 == 0)

{

n = n / 2;

}

else

{

n = n \* 3 + 1;

}

Console.WriteLine("The final value of n is " + n);

}

**∨ 3 Next week: test + foreach loops**

At the start of next week’s practical class you’ll do a 20-minute online quiz. After that you’ll do some practical exercises involving an improvement on the **for**-loop that uses simpler syntax to iterate over all the elements of a collection, the **foreach** loop.