

## Problem description

Write two programs that find the starting number below a given limit that has the longest Collatz sequence. The program should be called with a single number as the command line parameter. This number is the upper limit below which the longest chain should be found. Note that intermediate steps may go above this upper limit. Program one will optimise for code simplicity and low memory usage. Program two sacrifices some simplicity and memory for significant reduction in CPU time required.

## Collatz sequence definition

The following iterative sequence is defined for the set of positive integers:

$$n \rightarrow n/2 \text{ (} n \text{ is even)}$$

$$n \rightarrow 3n + 1 \text{ (} n \text{ is odd)}$$

Using the rule above and starting with 13, we generate the following sequence:

$$13 \rightarrow 40 \rightarrow 20 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$$

It can be seen that this sequence (starting at 13 and finishing at 1) contains 10 terms. Although it has not been proved yet (Collatz Problem), it is thought that all starting numbers finish at 1.

## Marking criteria

The code must be C or C++. Follow best practices of the chosen language. Code must run without issues on a standard linux system. Any non-standard configuration or library usage must be noted. Make notes of any restrictions on program usage. Correctness, maintainability, and completeness of the solution are important. For submission send an archive containing all the relevant files. The archive should be named: name\_surname\_collatz\_date.tgz.