

Write-up Document - Getting Acquainted with Unix and C

Lev Teytelman

January 11, 2022

Plot 1 - Collatz Sequence Lengths

For this first plot, I needed to get the length of the sequence, which in the script was an array. Therefore, I printed out the array and piped it to the `wc` (word count) command. This counted the number of steps taken to get to 1 and added it to the `lengths` array.

After adding all 9,999 lengths to the array, I printed each value, new-line-separated, and put it into a `.dat` file. This file was later used by `gnuplot` to plot the points on the graph.

Plot 2 - Maximum Collatz Sequence Value

For the second plot, I needed to get the highest value out of the sequence. For this, I first printed and piped the array `printf '%s\n' "${nums[@]}"`, then sorted it numerically and in reverse using `sort -rn`, and finally selected the first one via `head -n 1`. I did the same as the first graph with the resulting array, piping it into a file and later using it to create the plot on the PDF.

Plot 3 - Collatz Sequence Length Histogram

The third plot used the data from the first plot, but interpreted it differently. After piping the array into an inverse sort (`sort -rn`), I was able to count the number of unique occurrences of each length using `uniq -c`. Unfortunately, the data was in the wrong order for the histogram, so I used `awk` to invert it with `awk '{print $2 " " $1}'`. I pointed this into a file and continued on my way. After setting the boxwidth to 0, I was able to use `with boxes` to draw my histogram.

Takeaways

When starting this assignment, I had already had quite a bit experience with scripting - I use Linux on a daily basis, after all. However, I had never used `gnuplot` - this was new

to me. Using what I knew, I was luckily able to figure out the script structure relatively quickly. Specific concepts I learned while doing this assignment include:

- Using `printf` to split an array (or anything space-separated, for that matter) back onto separate lines
- Redirecting standard output to a file
- Using `gnuplot` to visualize and plot data
- Using `awk` to manipulate an incorrectly ordered line of input
- Counting unique occurrences of a value with `uniq`
- Effectively using LaTeX to create PDFs neatly

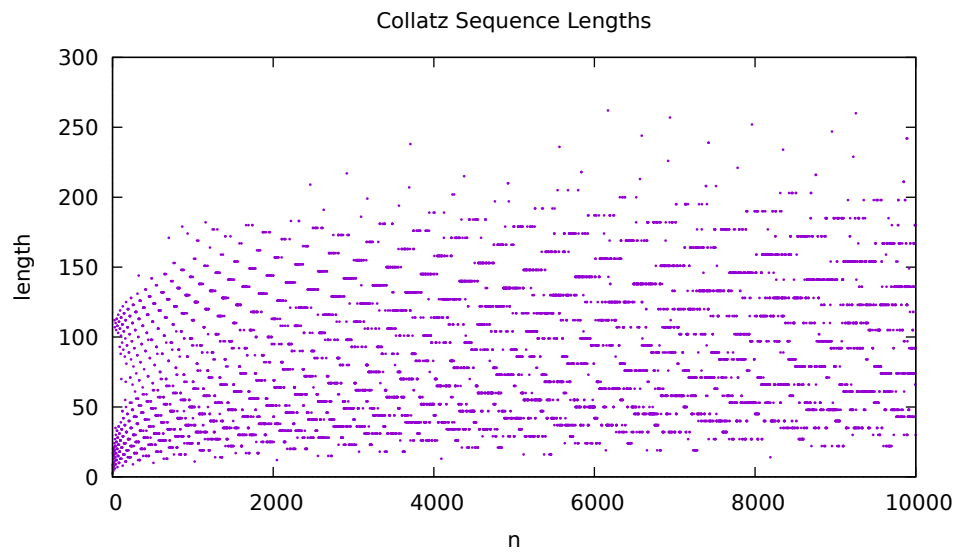


Figure 1: The pattern of growing sequence lengths

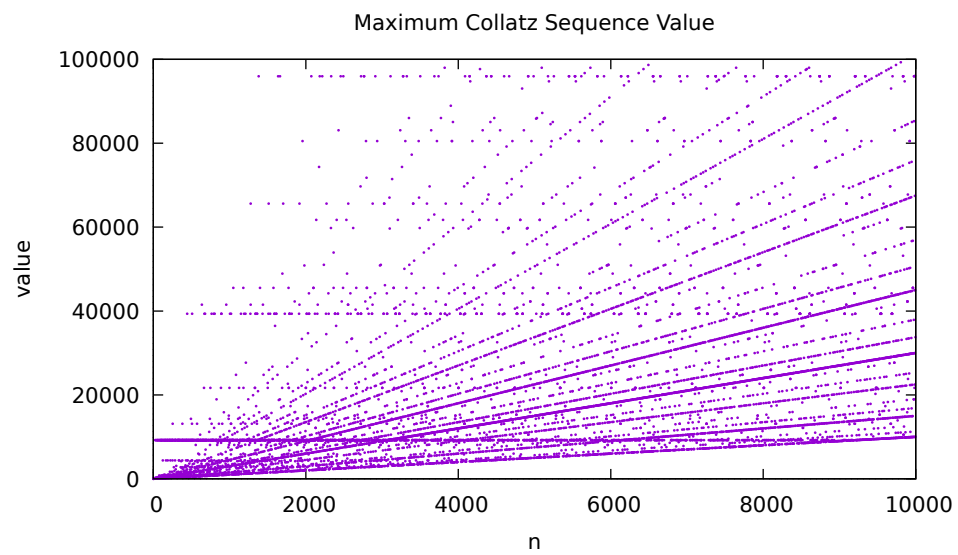


Figure 2: The maximum values of each sequence

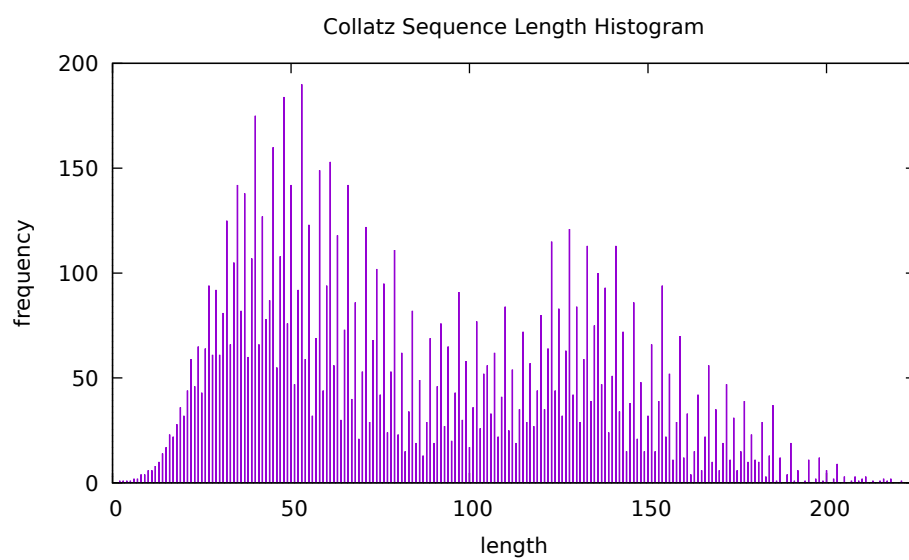


Figure 3: The frequency of each sequence length