General Idea:

Use gnuplot and the Collatz.c program to create graphs of Collatz sequences. Using Bash, generate a set of Collatz sequences and plot them, manipulating the data points to determine things such as the Maximum Value, length, and total value of each sequence.

This program works by running the Collatz program via the Makefile, and parsing through the given data using loops. The data is stored into respective files as X and Y coordinate points, which are then fed directly into the gnuplot command. The resulting plot images are then exported and stored.

Pseudocode:

Initialize program to run using bin/bash
Use the Makefile to compile the Collatz Executable
Begin the here-document to be sent to the gnuplot command
#Code for Length Plot#
    Create a function to output the length and starting value of a given collatz sequence
    Run “Collatz” into a file
        Collect the first number in the sequence
        Calculate the length of the file
    Output as x, y pair
#Code for Max Value Plot#
    Create a function to output the maximum value and starting value of a given collatz sequence
    Run “Collatz” into a file
        Collect the first number in the sequence
        Sort data file numerically, starting with the largest number
        Collect top number (maximum value)
        Filter for outliers
    Output as x, y pair
#Code for Histogram plot#
    Create a function to output the length of a given collatz sequence
    Run “Collatz” into a file
        Calculate the length of the file
    Output length
#Code for Total Value Plot#
    Create a function to output the total added value and starting value of a given collatz sequence
    Run “Collatz” into a file
    Store file data in a variable
    Initialize a running total variable as an integer
    Create a loop iterating over data in variable
        Add current iteration to running total
    Collect the first number in the sequence

Filter for outliers
Assign running total to a variable
Output as x, y pair

DATA COLLECTION

Start a for loop, iterating through all desired collatz sequence starting points
Plug number into Length plot function, outputting to desired file
Plug number into Max Value plot function, outputting to desired file
Plug number into Total Value plot function, outputting to desired file
Start a for loop, iterating through all desired collatz sequence starting points
Plug number into file Length measuring function, outputting to a desired file "length data"
Sort data by counting how often each length in "length data appears"
Format length, Frequency as x, y and output to a file
Sort file numerically to ensure graph readability

Begin the here-document to be sent to the gnuplot command

Create the plot environment, labeling the X Axis as "Starting Value" (the starting value for the Collatz sequence) and the Y axis as "Length" (how many numbers are in the sequence)
Feed the length and starting value into gnuplot as X, Y values.
Store plots into a file.

Create the plot environment, labeling the X Axis as "Starting Value" (the starting value for the Collatz sequence) and the Y axis as "Maximum Value" (The largest number that appears in the sequence)
Feed Data into plot algorithm from respective file
Store plots into a file

Create the plot environment, labeling the X Axis as "Length" and the Y axis as "Frequency" (how often that length appears)
Feed Data into plot algorithm from respective file
Store plots into a file

Create a new plot environment, labeling the axes as "Starting Value" and "Total Value"
Feed Data into plot algorithm from respective file
Store plots into a file

Exit here-document

Delete all the unnecessary files created during runtime

Terminate Program