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 either fed directly into the gnuplot command, or further manipulated (as is the case with the Max Value and Histogram plots) and then fed into gnuplot. 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
Run Collatz Executable with desired sequences, placing data into Collatz.dat
Begin the here-document to be sent to the gnuplot command
#Code for Length Plot#
    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)
    Create a loop to calculate the length of each Collatz sequence
        Create a loop to read and store the starting value of each Sequence
            Iterate over each data point, storing each value into “Sequence.dat”
            Stop when the number “1” appears
        Collect the first number in the sequence
    Calculate the length of the individual sequence
    Feed the length and starting value into gnuplot as X, Y values.
    Store plots into “results.dat”
#Code for Max Value Plot#
    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)
    Create a loop to calculate the largest number in each Collatz sequence
        Create a loop to read and store the starting value of each Sequence
            Iterate over each data point, storing each value into “Sequence.dat”
            Stop when the number “1” appears
        Collect the first number in the sequence
        Sort “Sequence.dat” file numerically
        Read the maximum number of each file
        Feed Data into plot algorithm
    Store plots into “results.dat”
#Code for Histogram plot#

Create the plot environment, labeling the X Axis as “Length” and the Y axis as “Frequency” (how often that length appears
Create a loop to calculate the length of each Collatz sequence
Create a loop to read and store the values of each Sequence
Iterate over each data point, storing each value into “Sequence.dat”
Stop when the number “1” appears
Collect the length of each sequence
Add data to “length_totals.dat”
Feed Data into plot algorithm
Store plots into “results.dat”

#Code for Total Value Plot#

Create a new plot environment, labeling the axes as “Starting Value” and “Total Value”
Create a loop to calculate the total added value of every number in each Collatz sequence
Iterate over each data point, adding the value to a running total
Once the sequence is iterated through, add Starting value and total value as an X,Y pair to GNUPLOT
Add created plot to “results.dat”

Exit here-document
Terminate Program