

Plotter Program

CSC 121 Program #1

Problem Statement
Input/Process/Output
Flow Diagram

Problem Statement

- Create a simple plotter (x-axis runs vertically, y -axis runs horizontally) using command line arguments for a (left end point), b (right end point), and n (number of sub-intervals of $[a, b]$.)

Steps:

- compute maximum and minimum values of the function on $[a, b]$.
- compute scaling factor sf . *For example, does the following accomplish all we need?*
 $sf = \text{graphWidth}/(\text{max} - \text{min})$.
- construct for each point in the interval the required number of spaces (one for each column) preceding the plot (an *)
 $\#cols = sf (f(a +idx) - min)$.

Stepwise Refinement

Points Breakdown

- 0 - doesn't compile
- 20 - Input and output a , b , & n
- 40 - Calculate and print dx
- 60 - Find and print the max & min on $[a, b]$
- 80 - Find and print the scale factor
- 100 - Plot the function x^3 on $[a, b]$ in one program and $1 - x^2$ on $[-1, 1]$ in another. You will be required to demonstrate your program using a test function provided in class on the date delivery is due.

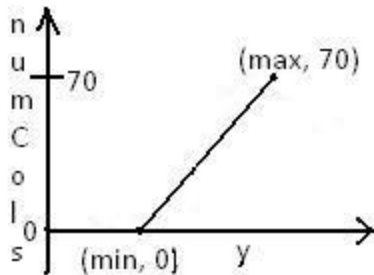
Input	Process	Output
<i>a –the start point</i>	Initialize input variables as doubles and int as appropriate	Show the initialized input variables
<i>b –the end point</i>	Calculate dx –the size of each increment such that $n * dx = b - a$	Show dx
<i>n –number of subintervals on [a,b]</i>	<ol style="list-style-type: none"> 1. Initialize x, min, and max using a known value -the first value on the interval. 2. Calculate the value of each x. $x = a + i * dx$ 3. Calculate y for each x. 4. If y is greater than max, update max. 5. If y is less than min, update min. 	Show min & max over the interval $[a, b]$

Input/Process/Output continued

Input	Process	Output
	Calculate a scale factor, sf , so that the max value will be printable on the available screen (< 80 columns in the Command prompt screen, <160 columns in the Eclipse console output)	Show sf
	For each $x = a + i*dx$ Calculate y .	
	For this value of y determine the number of spaces to print. Print that many spaces . Print an "*" and a newline.	graph

Scaling

- $m = (70 - 0) / (\text{max} - \text{min})$
- Point slope formula: $y - y_0 = m (x - x_0)$



- $x_0 = \text{min}, y_0 = 0,$
- $\text{numCols} = m (y - \text{min})$

Flow Charting

Selection

- Input
- Decision
 - Yes path
 - No path

Statements

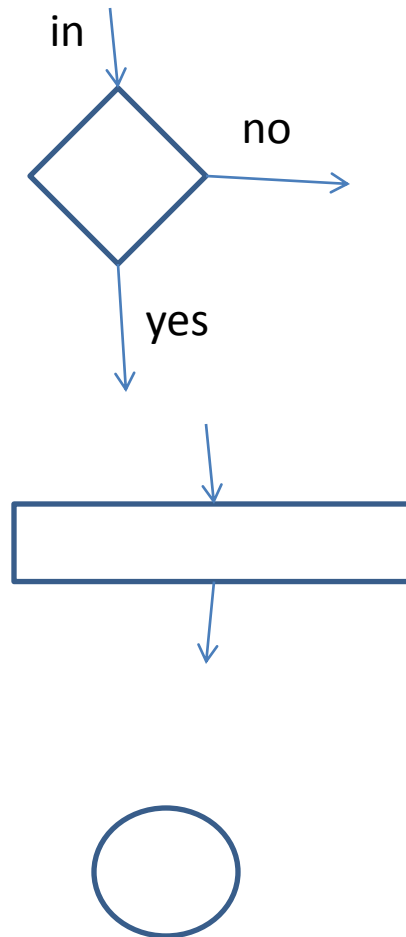
- Sequential
 - One input
 - One output

Flow of control

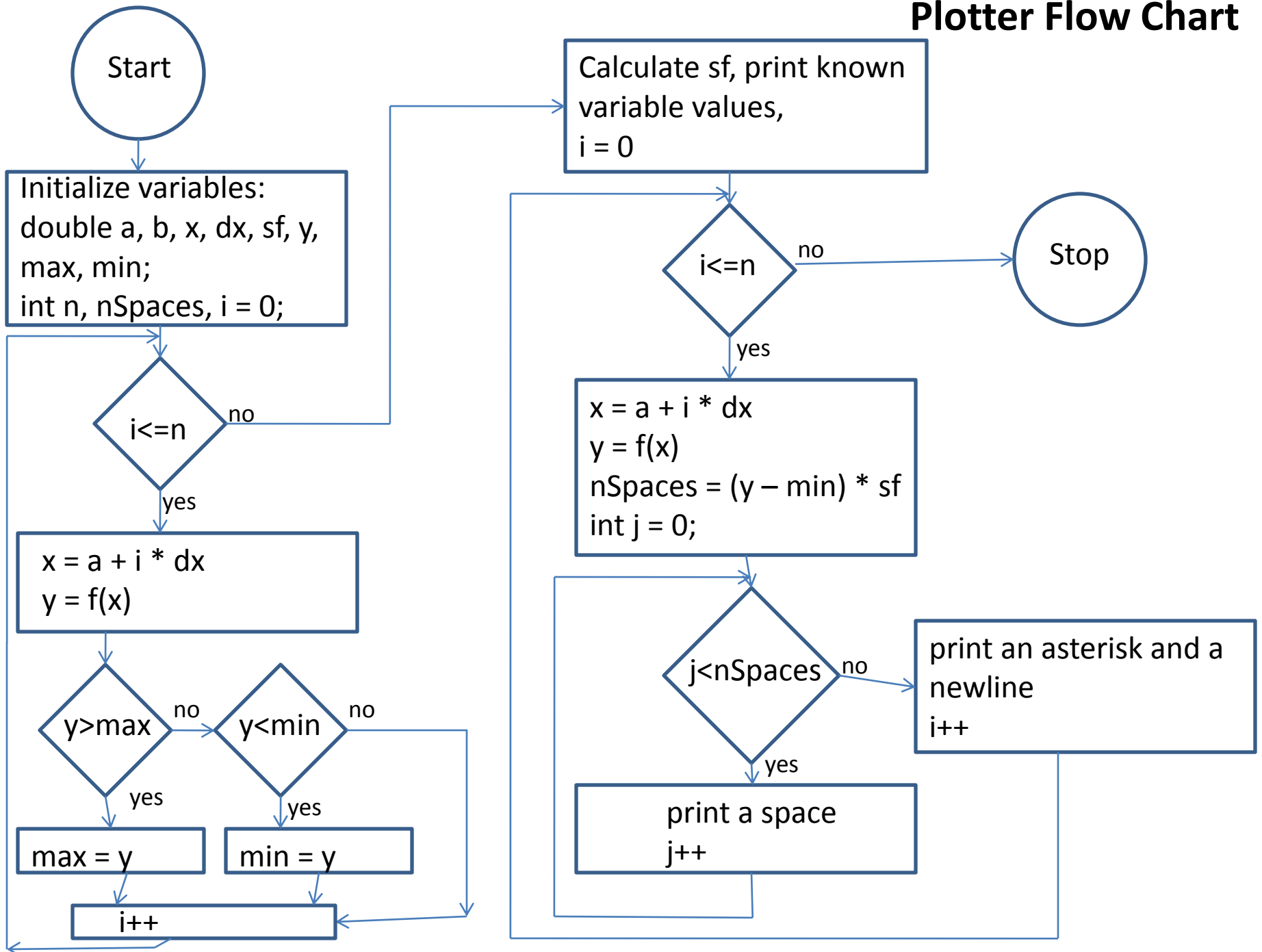
- Follows the line

Path termination

- Start/Stop



Plotter Flow Chart



Sample Output

- $f(x) = \underline{x * x * x}$ on $[-2, 2]$ with 40 plot points and a graphWidth of 112 columns in Eclipse.
- $f(x) = \underline{1 - x * x}$ on $[-2, 2]$ with 40 plot points and a graphWidth of 100 columns in Eclipse.
- $f(x) = \underline{1 - x * x}$ on $[-1, 1]$ with 40 plot points and a graphWidth of 100 columns in Eclipse.
- $f(x) = \underline{x * x * x}$ on $[-2, 2]$ with 40 plot points and a graphWidth of 64 columns in DOS.