Design Document

Assignment 2: A Small Numerical Library

Purpose

This program will print out a small numerical library. The numerical library will contain approximations for $\sin^{-1}(x)$, $\cos^{-1}(x)$, $\tan^{-1}(x)$, and $\log(x)$. These approximations will be displayed alongside the values given by the functions from the standard library `<math.h>`. The user will use command-line options to specify which of the four functions to approximate.

Layout/Structure

`mathlib-test.c`

`main()`

Description/Explanation

For this assignment, the `main()` function will interpret the command-line options, and pass them to `printLib(opt)` accordingly.

Pseudocode

```
get the first 2 command-line options
if the first option is -1 …
    print error: no options
otherwise, if the second option is -1 …
    error: multiple options
otherwise, if the option is s, c, t, or l …
    call printLib(opt)
otherwise …
    error: invalid option
```

`printLib(opt)`

Description/Explanation

`printLib(opt)` will use the functions in `mathlib.c` to compute the approximation and print them as a table of values with rows and columns.

Pseudocode

```
print the table header (column titles)
for every x value …
    call function from mathlib.c to get approximation at x
    use <math.h> function to compute value at x
    compute the difference
    print row
```

mathlib.c

arcSin(x)

Description/Explanation
`arcSin(x)` will compute an approximation for $\sin^{-1}(x)$ at x using a Taylor series.

Pseudocode
plug x into formula

arcCos(x)

Description/Explanation
`arcCos(x)` will compute an approximation for $\cos^{-1}(x)$ at x using a Taylor series.

Pseudocode
plug x into formula

arcTan(x)

Description/Explanation
`arcTan(x)` will compute an approximation for $\tan^{-1}(x)$ at x using a Taylor series.

Pseudocode
plug x into formula

Log(x)

Description/Explanation
`Log(x)` will compute an approximation for $\log(x)$ at x using Newton's method

Pseudocode
use newton's method