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CSE13S Assignment 2 - A Small Numerical Library

Programming Analysis:

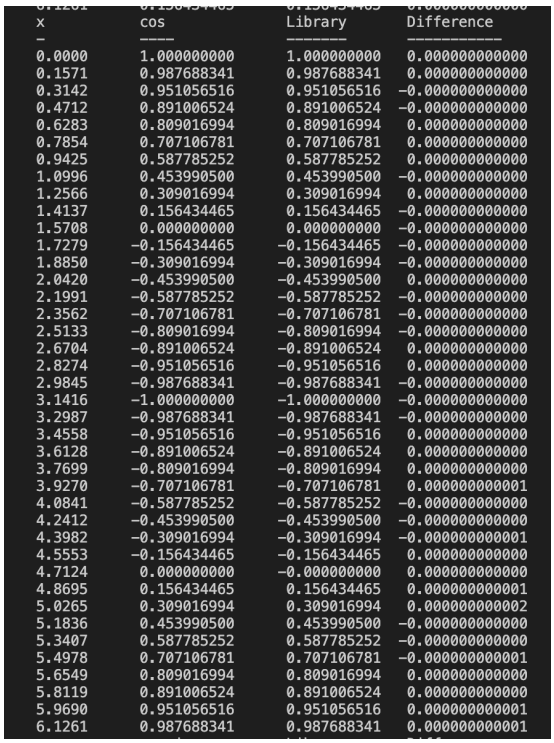
This program implements functions, created in mathlib.c which is small numerical library and has a corresponding test harness. The functions in mathlib.c, sin, cos, sin−1 (arcsin), cos−1 (arccos), tan−1 (arctan) of the taylor series expansion near some point f(a). The program takes certain command line arguments like -a, -s, and etc;

Sin(x)

x	sin	Library	Difference
0.0000	0.000000000	0.000000000	0.000000000000
0.1571	0.156434465	0.156434465	0.000000000000
0.3142	0.309016994	0.309016994	0.000000000000
0.4712	0.453990500	0.453990500	-0.000000000000
0.6283	0.587785252	0.587785252	0.000000000000
0.7854	0.707106781	0.707106781	0.000000000000
0.9425	0.809016994	0.809016994	0.000000000000
1.0996	0.891006524	0.891006524	-0.000000000000
1.2566	0.951056516	0.951056516	-0.000000000000
1.4137	0.987688341	0.987688341	0.000000000000
1.5708	1.000000000	1.000000000	0.000000000000
1.7279	0.987688341	0.987688341	0.000000000000
1.8850	0.951056516	0.951056516	-0.000000000000
2.0420	0.891006524	0.891006524	-0.000000000000
2.1991	0.809016994	0.809016994	-0.000000000000
2.3562	0.707106781	0.707106781	-0.000000000001
2.5133	0.587785252	0.587785252	0.000000000000
2.6704	0.453990500	0.453990500	0.000000000000
2.8274	0.309016994	0.309016994	0.000000000001
2.9845	0.156434465	0.156434465	-0.000000000000
3.1416	-0.000000000	0.000000000	-0.000000000000
3.2987	-0.156434465	-0.156434465	-0.000000000001
3.4558	-0.309016994	-0.309016994	-0.000000000002
3.6128	-0.453990500	-0.453990500	0.000000000000
3.7699	-0.587785252	-0.587785252	0.000000000000
3.9270	-0.707106781	-0.707106781	0.000000000001
4.0841	-0.809016994	-0.809016994	-0.000000000000
4.2412	-0.891006524	-0.891006524	-0.000000000000
4.3982	-0.951056516	-0.951056516	-0.000000000001
4.5553	-0.987688341	-0.987688341	-0.000000000001
4.7124	-1.000000000	-1.000000000	0.000000000000
4.8695	-0.987688341	-0.987688341	0.000000000000
5.0265	-0.951056516	-0.951056516	0.000000000001
5.1836	-0.891006524	-0.891006524	0.000000000002
5.3407	-0.809016994	-0.809016994	-0.000000000000
5.4978	-0.707106781	-0.707106781	-0.000000000000
5.6549	-0.587785252	-0.587785252	-0.000000000001
5.8119	-0.453990500	-0.453990500	-0.000000000002
5.9690	-0.309016994	-0.309016994	0.000000000000
6.1261	-0.156434465	-0.156434465	0.000000000000

my_sin(x) I created has a similar output to the library sin(x) with an acceptable difference. I created my_sin(x) using the puesdocode I had mentioned in my Design Document.

Cos(x)



x	cos	Library	Difference
0.0000	1.000000000	1.000000000	0.000000000000
0.1571	0.987688341	0.987688341	0.000000000000
0.3142	0.951056516	0.951056516	-0.000000000000
0.4712	0.891006524	0.891006524	-0.000000000000
0.6283	0.809016994	0.809016994	0.000000000000
0.7854	0.707106781	0.707106781	0.000000000000
0.9425	0.587785252	0.587785252	0.000000000000
1.0996	0.453990500	0.453990500	-0.000000000000
1.2566	0.309016994	0.309016994	0.000000000000
1.4137	0.156434465	0.156434465	-0.000000000000
1.5708	0.000000000	0.000000000	-0.000000000000
1.7279	-0.156434465	-0.156434465	-0.000000000000
1.8850	-0.309016994	-0.309016994	-0.000000000000
2.0420	-0.453990500	-0.453990500	0.000000000000
2.1991	-0.587785252	-0.587785252	-0.000000000000
2.3562	-0.707106781	-0.707106781	-0.000000000000
2.5133	-0.809016994	-0.809016994	-0.000000000000
2.6704	-0.891006524	-0.891006524	0.000000000000
2.8274	-0.951056516	-0.951056516	0.000000000000
2.9845	-0.987688341	-0.987688341	-0.000000000000
3.1416	-1.000000000	-1.000000000	-0.000000000000
3.2987	-0.987688341	-0.987688341	-0.000000000000
3.4558	-0.951056516	-0.951056516	0.000000000000
3.6128	-0.891006524	-0.891006524	0.000000000000
3.7699	-0.809016994	-0.809016994	0.000000000000
3.9270	-0.707106781	-0.707106781	0.000000000001
4.0841	-0.587785252	-0.587785252	-0.000000000000
4.2412	-0.453990500	-0.453990500	-0.000000000000
4.3982	-0.309016994	-0.309016994	-0.000000000001
4.5553	-0.156434465	-0.156434465	0.000000000000
4.7124	0.000000000	-0.000000000	0.000000000000
4.8695	0.156434465	0.156434465	0.000000000001
5.0265	0.309016994	0.309016994	0.000000000002
5.1836	0.453990500	0.453990500	-0.000000000000
5.3407	0.587785252	0.587785252	-0.000000000000
5.4978	0.707106781	0.707106781	-0.000000000001
5.6549	0.809016994	0.809016994	0.000000000000
5.8119	0.891006524	0.891006524	0.000000000000
5.9690	0.951056516	0.951056516	0.000000000001
6.1261	0.987688341	0.987688341	0.000000000001

my_cos(x) I created has a similar output to the library cos(x) with an acceptable difference. I created my_cos(x) using the puesdocode I had mentioned in my Design Document.

Arcsin(x)

x	arccos	Library	Difference
-1.0000	3.141592358	3.141592654	-0.000000295286
-0.9500	2.824032224	2.824032224	0.000000000000
-0.9000	2.690565842	2.690565842	0.000000000000
-0.8500	2.586781621	2.586781621	0.000000000000
-0.8000	2.498091545	2.498091545	-0.000000000000
-0.7500	2.418858406	2.418858406	-0.000000000000
-0.7000	2.346193823	2.346193823	-0.000000000000
-0.6500	2.278380764	2.278380764	-0.000000000000
-0.6000	2.214297436	2.214297436	-0.000000000000
-0.5500	2.153160565	2.153160565	0.000000000000
-0.5000	2.094395102	2.094395102	0.000000000000
-0.4500	2.037561666	2.037561666	0.000000000000
-0.4000	1.982313173	1.982313173	0.000000000000
-0.3500	1.928367430	1.928367430	0.000000000000
-0.3000	1.875488981	1.875488981	-0.000000000000
-0.2500	1.823476582	1.823476582	-0.000000000000
-0.2000	1.772154248	1.772154248	-0.000000000000
-0.1500	1.721364600	1.721364600	0.000000000000
-0.1000	1.670963748	1.670963748	0.000000000000
-0.0500	1.620817184	1.620817184	-0.000000000000
0.0000	1.570796327	1.570796327	0.000000000000
0.0500	1.520775470	1.520775470	0.000000000000
0.1000	1.470628906	1.470628906	-0.000000000000
0.1500	1.420228054	1.420228054	0.000000000000
0.2000	1.369438406	1.369438406	0.000000000000
0.2500	1.318116072	1.318116072	0.000000000000
0.3000	1.266103673	1.266103673	0.000000000000
0.3500	1.213225223	1.213225223	-0.000000000000
0.4000	1.159279481	1.159279481	-0.000000000000
0.4500	1.104030988	1.104030988	-0.000000000000
0.5000	1.047197551	1.047197551	-0.000000000000
0.5500	0.988432089	0.988432089	-0.000000000000
0.6000	0.927295218	0.927295218	0.000000000000
0.6500	0.863211890	0.863211890	0.000000000000
0.7000	0.795398830	0.795398830	0.000000000000
0.7500	0.722734248	0.722734248	0.000000000000
0.8000	0.643501109	0.643501109	0.000000000000
0.8500	0.554811033	0.554811033	-0.000000000000
0.9000	0.451026812	0.451026812	-0.000000000000
0.9500	0.317560429	0.317560429	-0.000000000000

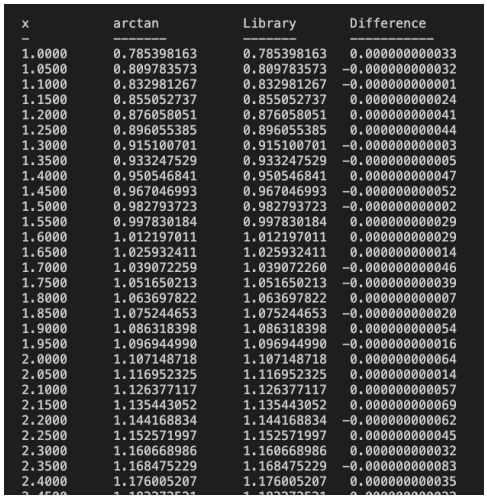
my_cos(x) I created has a similar output to the library cos(x) with an acceptable difference. I created my_cos(x) using the puesdocode I had mentioned in my Design Document.

Arccos(x)

x	arccos	Library	Difference
-1.0000	3.141592358	3.141592654	-0.000000295286
-0.9500	2.824032224	2.824032224	0.000000000000
-0.9000	2.690565842	2.690565842	0.000000000000
-0.8500	2.586781621	2.586781621	0.000000000000
-0.8000	2.498091545	2.498091545	-0.000000000000
-0.7500	2.418858406	2.418858406	-0.000000000000
-0.7000	2.346193823	2.346193823	-0.000000000000
-0.6500	2.278380764	2.278380764	-0.000000000000
-0.6000	2.214297436	2.214297436	-0.000000000000
-0.5500	2.153160565	2.153160565	0.000000000000
-0.5000	2.094395102	2.094395102	0.000000000000
-0.4500	2.037561666	2.037561666	0.000000000000
-0.4000	1.982313173	1.982313173	0.000000000000
-0.3500	1.928367430	1.928367430	0.000000000000
-0.3000	1.875488981	1.875488981	-0.000000000000
-0.2500	1.823476582	1.823476582	-0.000000000000
-0.2000	1.772154248	1.772154248	-0.000000000000
-0.1500	1.721364600	1.721364600	0.000000000000
-0.1000	1.670963748	1.670963748	0.000000000000
-0.0500	1.620817184	1.620817184	-0.000000000000
0.0000	1.570796327	1.570796327	0.000000000000
0.0500	1.520775470	1.520775470	0.000000000000
0.1000	1.470628906	1.470628906	-0.000000000000
0.1500	1.420228054	1.420228054	0.000000000000
0.2000	1.369438406	1.369438406	0.000000000000
0.2500	1.318116072	1.318116072	0.000000000000
0.3000	1.266103673	1.266103673	0.000000000000
0.3500	1.213225223	1.213225223	-0.000000000000
0.4000	1.159279481	1.159279481	-0.000000000000
0.4500	1.104030988	1.104030988	-0.000000000000
0.5000	1.047197551	1.047197551	-0.000000000000
0.5500	0.988432089	0.988432089	-0.000000000000
0.6000	0.927295218	0.927295218	0.000000000000
0.6500	0.863211890	0.863211890	0.000000000000
0.7000	0.795398830	0.795398830	0.000000000000
0.7500	0.722734248	0.722734248	0.000000000000
0.8000	0.643501109	0.643501109	0.000000000000
0.8500	0.554811033	0.554811033	-0.000000000000
0.9000	0.451026812	0.451026812	-0.000000000000
0.9500	0.317560429	0.317560429	-0.000000000000

my_arccos(x) I created has a similar output to the library acos(x) with an acceptable difference. I created my_arccos(x) using the puesdocode I had mentioned in my Design Document.

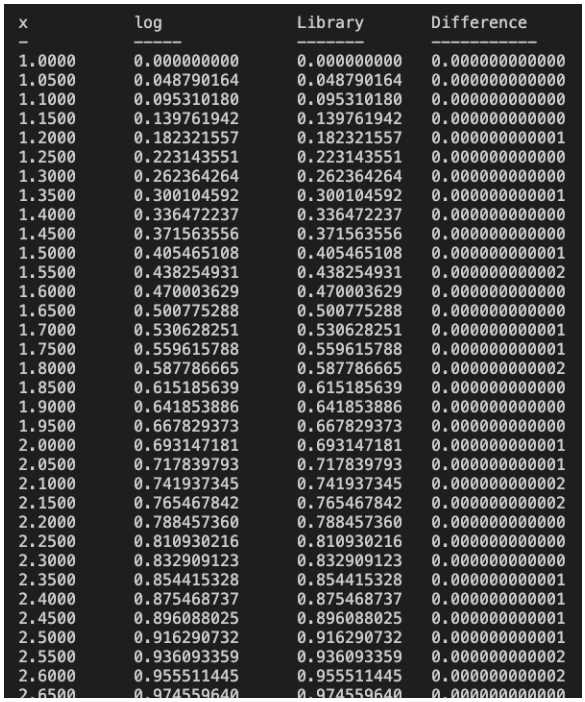
Arctan(x)



x	arctan	Library	Difference
1.0000	0.785398163	0.785398163	0.000000000033
1.0500	0.809783573	0.809783573	-0.000000000032
1.1000	0.832981267	0.832981267	-0.000000000001
1.1500	0.855052737	0.855052737	0.000000000024
1.2000	0.876058051	0.876058051	0.000000000041
1.2500	0.896055385	0.896055385	0.000000000044
1.3000	0.915100701	0.915100701	-0.000000000003
1.3500	0.933247529	0.933247529	-0.000000000005
1.4000	0.950546841	0.950546841	0.000000000047
1.4500	0.967046993	0.967046993	-0.000000000052
1.5000	0.982793723	0.982793723	-0.000000000002
1.5500	0.997830184	0.997830184	0.000000000029
1.6000	1.012197011	1.012197011	0.000000000029
1.6500	1.025932411	1.025932411	0.000000000014
1.7000	1.039072259	1.039072260	-0.000000000046
1.7500	1.051650213	1.051650213	-0.000000000039
1.8000	1.063697822	1.063697822	0.000000000007
1.8500	1.075244653	1.075244653	-0.000000000020
1.9000	1.086318398	1.086318398	0.000000000054
1.9500	1.096944990	1.096944990	-0.000000000016
2.0000	1.107148718	1.107148718	0.000000000064
2.0500	1.116952325	1.116952325	0.000000000014
2.1000	1.126377117	1.126377117	0.000000000057
2.1500	1.135443052	1.135443052	0.000000000069
2.2000	1.144168834	1.144168834	-0.000000000062
2.2500	1.152571997	1.152571997	0.000000000045
2.3000	1.160668986	1.160668986	0.000000000032
2.3500	1.168475229	1.168475229	-0.000000000083
2.4000	1.176005207	1.176005207	0.000000000035

my_arctan(x) I created has a similar output to the library atan(x) with an acceptable difference. I created my_arctan(x) using the puesdocode I had mentioned in my Design Document.

Log(x)



x	log	Library	Difference
1.0000	0.000000000	0.000000000	0.000000000000
1.0500	0.048790164	0.048790164	0.000000000000
1.1000	0.095310180	0.095310180	0.000000000000
1.1500	0.139761942	0.139761942	0.000000000000
1.2000	0.182321557	0.182321557	0.000000000001
1.2500	0.223143551	0.223143551	0.000000000000
1.3000	0.262364264	0.262364264	0.000000000000
1.3500	0.300104592	0.300104592	0.000000000001
1.4000	0.336472237	0.336472237	0.000000000000
1.4500	0.371563556	0.371563556	0.000000000000
1.5000	0.405465108	0.405465108	0.000000000001
1.5500	0.438254931	0.438254931	0.000000000002
1.6000	0.470003629	0.470003629	0.000000000000
1.6500	0.500775288	0.500775288	0.000000000000
1.7000	0.530628251	0.530628251	0.000000000001
1.7500	0.559615788	0.559615788	0.000000000001
1.8000	0.587786665	0.587786665	0.000000000002
1.8500	0.615185639	0.615185639	0.000000000000
1.9000	0.641853886	0.641853886	0.000000000000
1.9500	0.667829373	0.667829373	0.000000000000
2.0000	0.693147181	0.693147181	0.000000000001
2.0500	0.717839793	0.717839793	0.000000000001
2.1000	0.741937345	0.741937345	0.000000000002
2.1500	0.765467842	0.765467842	0.000000000002
2.2000	0.788457360	0.788457360	0.000000000000
2.2500	0.810930216	0.810930216	0.000000000000
2.3000	0.832909123	0.832909123	0.000000000000
2.3500	0.854415328	0.854415328	0.000000000001
2.4000	0.875468737	0.875468737	0.000000000001
2.4500	0.896088025	0.896088025	0.000000000001
2.5000	0.916290732	0.916290732	0.000000000001
2.5500	0.936093359	0.936093359	0.000000000002
2.6000	0.955511445	0.955511445	0.000000000002
2.6500	0.974559640	0.974559640	0.000000000000

my_log(x) I created has a similar output to the library log(x) with an acceptable difference. I created my_log(x) using the puesdocode I had mentioned in my Design Document.