CSCI OLA1 Report

The experiment that I ran was to determine the error bound of using the different numerical approximation formulas from the Taylor Series. Forward, Backward, and Center differences were calculated and then compared to each other. The function used was a simple sin(x) formula with an x-value of 2 and calculated through n=20. The results showed that the Center difference was the most accurate and took the least number of iterations to reach its minimum error value. Values generally peaked around the 12th iteration and began falling due to the floating point limitations of a double type variable.

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sc8m@ranger0: ~/mtsu_code/cs3180/current                                        —   □   ×
Enter the value for n: 20
Analytical solution: -0.416147
******FORWARDS******
i          h                value          error
1          0.25             -0.524897       0.10875
2          0.0625           -0.444282       0.0281354
3          0.015625            -0.423234           0.00708681
4          0.00390625          -0.417922           0.00177491
5          0.000976562         -0.416591           0.000443927
6          0.000244141         -0.416258           0.000110994
7          6.10352e-05         -0.416175           2.77493e-05
8          1.52588e-05         -0.416154           6.93737e-06
9          3.8147e-06          -0.416149           1.73434e-06
10         9.53674e-07         -0.416147           4.33576e-07
11         2.38419e-07         -0.416147           1.08661e-07
12         5.96046e-08         -0.416147           2.67048e-08
13         1.49012e-08         -0.416147           8.07833e-09
14         3.72529e-09         -0.416147           8.07833e-09
15         9.31323e-10         -0.416147           3.78807e-08
16         2.32831e-10         -0.416147           8.13286e-08
17         5.82077e-11         -0.416147           3.95509e-07
18         1.45519e-11         -0.416145           1.51184e-06
19         3.63798e-12         -0.416138           9.14123e-06
20         9.09495e-13         -0.416138           9.14123e-06
******BACKWARDS******
i          h                value          error
1          0.25             -0.298754       0.117393
2          0.0625           -0.38747        0.0286772
3          0.015625            -0.409026           0.00712067
4          0.00390625          -0.41437            0.00177703
5          0.000976562         -0.415703           0.000444059
6          0.000244141         -0.416036           0.000111002
7          6.10352e-05         -0.416119           2.77498e-05
8          1.52588e-05         -0.41614            6.93741e-06
9          3.8147e-06          -0.416145           1.73434e-06
10         9.53674e-07         -0.416146           4.33601e-07
11         2.38419e-07         -0.416147           1.08337e-07
12         5.96046e-08         -0.416147           2.73119e-08
13         1.49012e-08         -0.416147           6.82283e-09
14         3.72529e-09         -0.416147           8.07833e-09
15         9.31323e-10         -0.416147           3.78807e-08
16         2.32831e-10         -0.416147           8.13286e-08
17         5.82077e-11         -0.416147           3.95509e-07
18         1.45519e-11         -0.416145           1.51184e-06
19         3.63798e-12         -0.416138           9.14123e-06
20         9.09495e-13         -0.416138           9.14123e-06
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20          9.09495e-13           -0.416138              9.14123e-06
******BACKWARDS******
i           h                value           error
1           0.25             -0.298754              0.117393
2           0.0625           -0.38747               0.0286772
3           0.015625              -0.409026              0.00712067
4           0.00390625            -0.41437               0.00177703
5           0.000976562           -0.415703              0.000444059
6           0.000244141           -0.416036              0.000111002
7           6.10352e-05           -0.416119              2.77498e-05
8           1.52588e-05           -0.41614               6.93741e-06
9           3.8147e-06            -0.416145              1.73434e-06
10          9.53674e-07           -0.416146              4.33601e-07
11          2.38419e-07           -0.416147              1.08337e-07
12          5.96046e-08           -0.416147              2.73119e-08
13          1.49012e-08           -0.416147              6.82283e-09
14          3.72529e-09           -0.416147              8.07833e-09
15          9.31323e-10           -0.416147              3.78807e-08
16          2.32831e-10           -0.416147              8.13286e-08
17          5.82077e-11           -0.416147              3.95509e-07
18          1.45519e-11           -0.416145              1.51184e-06
19          3.63798e-12           -0.416138              9.14123e-06
20          9.09495e-13           -0.416138              9.14123e-06
******CENTERED******
i           h                value           error
1           0.25             -0.411825              0.00432134
2           0.0625           -0.415876              0.000270876
3           0.015625              -0.41613               1.69329e-05
4           0.00390625            -0.416146              1.05832e-06
5           0.000976562           -0.416147              6.61447e-08
6           0.000244141           -0.416147              4.13414e-09
7           6.10352e-05           -0.416147              2.59007e-10
8           1.52588e-05           -0.416147              1.61722e-11
9           3.8147e-06            -0.416147              2.01766e-12
10          9.53674e-07           -0.416147              1.25343e-11
11          2.38419e-07           -0.416147              1.62089e-10
12          5.96046e-08           -0.416147              3.03573e-10
13          1.49012e-08           -0.416147              6.2775e-10
14          3.72529e-09           -0.416147              8.07833e-09
15          9.31323e-10           -0.416147              3.78807e-08
16          2.32831e-10           -0.416147              8.13286e-08
17          5.82077e-11           -0.416147              3.95509e-07
18          1.45519e-11           -0.416145              1.51184e-06
19          3.63798e-12           -0.416138              9.14123e-06
20          9.09495e-13           -0.416138              9.14123e-06
sc8m@ranger0:~/mtsu_code/cs3180/current$
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Learned from this lab:

1) Make sure to put semicolons at the end of statements. Every error I had was because I forgot about the semicolon.

2) Cmath library has a lot of cool functions. It made everything a lot easier once I figured out I can just use it and have things work right.

3) Doubles can store a pretty long decimal value and going to the 20th degree of a polynomial will probably not happen a lot.

4) Improved how function flow worked, but could have made things better. "The best function is one that has no parameters and does not return anything" is my goal.