HW2 Data Report for Math/CS 471

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Abstract

This is the HW2 report. This report is made all through LaTeX.

1 Question 1

We run the script and see the output. The iteration is ten times.

2 Question 2

Please see the newtonS.f90.Template file. The do-while loop is used for approximating the absolute error.

3 Question 3

In newtonS.f90.Template file, I add linear and quadratic convergence right after the x output. So for every iteration there should be a total of 6 outputs.

4 Question 4

4.1 Convergence

The first number is linear convergence and the second is quadratic convergence. Rate of convergence for 'x' is 0.5000000000000000E+00 and 0.5000000000000000E+00. Rate of convergence for 'x*x' is 0.5000000000000000E+00 and 0.140737488355328OE+15.

Rate of convergence for 'sin(x)+cos(x*x)' is 0.1633240749027686E-04 and 0.7677507053309917E+00. The results are read from the file when the iteration reaches maximum.

4.2 Convergence discussion

$f'(x)$ is ('1.d0', '2.d0*x', 'cos(x)-2.d0*x*sin(x*x)'). For the first one, when x comes closer to its root, there should not be very big change happening since $f'(x)$ is already a constant. However, when it comes to the second one, it is difficult to determine convergence since x still exists in the equation. The third is better since they are cos() and sin(), which is more possible to give a final rate of convergence I think when it comes to quadratic convergence. The data also proves this quadratic convergence when it reaches fifth and sixth iteration in case three.

4.3 Modified Newton's method discussion

I think I will implement Modified Newton's method on case two since the multiplicity m of the root is known in advance (I know what $f'(x)$ is as soon as I have a x). $-m \times$ (f'(x)/f(x)) $= x_{n+1} - x_n$. So I will just modify newtonS.f90.Template file.

5 Question 5

>> is actally more useful.

6 Question 6

One good method writing double slashes at the end of each output data row has not come up though.

7 Tabulated Data

Explanation: the first character is the case ('x', 'x*x' , 'sin(x)+cos(x*x)'). The second number is the iteration number. The third one is x value, the

forth one is dx, the fifth one is linear convergence and the sixth one is quadratic convergence.

7.1 Convergence Results Table

x	01	0.0000000000000000E+00	0.5000000000000000E+00	0.1000000000000000E+01	0.1000000000000000E+01
x	02	0.0000000000000000E+00	-0.0000000000000000E+00	0.5000000000000000E+00	0.5000000000000000E+00
x*x	01	-0.2500000000000000E+00	0.2500000000000000E+00	0.1000000000000000E+01	0.1000000000000000E+01
x*x	02	-0.1250000000000000E+00	0.1250000000000000E+00	0.2500000000000000E+00	0.2500000000000000E+00
x*x	03	-0.6250000000000000E-01	0.6250000000000000E-01	0.5000000000000000E+00	0.2000000000000000E+01
x*x	04	-0.3125000000000000E-01	0.3125000000000000E-01	0.5000000000000000E+00	0.4000000000000000E+01
x*x	05	-0.1562500000000000E-01	0.1562500000000000E-01	0.5000000000000000E+00	0.8000000000000000E+01
x*x	06	-0.7812500000000000E-02	0.7812500000000000E-02	0.5000000000000000E+00	0.1600000000000000E+02
x*x	07	-0.3906250000000000E-02	0.3906250000000000E-02	0.5000000000000000E+00	0.3200000000000000E+02
x*x	08	-0.1953125000000000E-02	0.1953125000000000E-02	0.5000000000000000E+00	0.6400000000000000E+02
x*x	09	-0.9765625000000000E-03	0.9765625000000000E-03	0.5000000000000000E+00	0.1280000000000000E+03
x*x	10	-0.4882812500000000E-03	0.4882812500000000E-03	0.5000000000000000E+00	0.2560000000000000E+03
x*x	11	-0.2441406250000000E-03	0.2441406250000000E-03	0.5000000000000000E+00	0.5120000000000000E+03
x*x	12	-0.1220703125000000E-03	0.1220703125000000E-03	0.5000000000000000E+00	0.1024000000000000E+04
x*x	13	-0.6103515625000000E-04	0.6103515625000000E-04	0.5000000000000000E+00	0.2048000000000000E+04
x*x	14	-0.3051757812500000E-04	0.3051757812500000E-04	0.5000000000000000E+00	0.4096000000000000E+04
x*x	15	-0.1525878906250000E-04	0.1525878906250000E-04		

0.5000000000000000E+00 0.8192000000000000E+04
x*x 16 -0.7629394531250000E-05 0.7629394531250000E-05
0.5000000000000000E+00 0.1638400000000000E+05
x*x 17 -0.3814697265625000E-05 0.3814697265625000E-05
0.5000000000000000E+00 0.3276800000000000E+05
x*x 18 -0.1907348632812500E-05 0.1907348632812500E-05
0.5000000000000000E+00 0.6553600000000000E+05
x*x 19 -0.9536743164062500E-06 0.9536743164062500E-06
0.5000000000000000E+00 0.1310720000000000E+06
x*x 20 -0.4768371582031250E-06 0.4768371582031250E-06
0.5000000000000000E+00 0.2621440000000000E+06
x*x 21 -0.2384185791015625E-06 0.2384185791015625E-06
0.5000000000000000E+00 0.5242880000000000E+06
x*x 22 -0.1192092895507812E-06 0.1192092895507812E-06
0.5000000000000000E+00 0.1048576000000000E+07
x*x 23 -0.5960464477539062E-07 0.5960464477539062E-07
0.5000000000000000E+00 0.2097152000000000E+07
x*x 24 -0.2980232238769531E-07 0.2980232238769531E-07
0.5000000000000000E+00 0.4194304000000000E+07
x*x 25 -0.1490116119384766E-07 0.1490116119384766E-07
0.5000000000000000E+00 0.8388608000000000E+07
x*x 26 -0.7450580596923828E-08 0.7450580596923828E-08
0.5000000000000000E+00 0.1677721600000000E+08
x*x 27 -0.3725290298461914E-08 0.3725290298461914E-08
0.5000000000000000E+00 0.3355443200000000E+08
x*x 28 -0.1862645149230957E-08 0.1862645149230957E-08
0.5000000000000000E+00 0.6710886400000000E+08
x*x 29 -0.9313225746154785E-09 0.9313225746154785E-09
0.5000000000000000E+00 0.1342177280000000E+09
x*x 30 -0.4656612873077393E-09 0.4656612873077393E-09
0.5000000000000000E+00 0.2684354560000000E+09
x*x 31 -0.2328306436538696E-09 0.2328306436538696E-09
0.5000000000000000E+00 0.5368709120000000E+09
x*x 32 -0.1164153218269348E-09 0.1164153218269348E-09
0.5000000000000000E+00 0.1073741824000000E+10
x*x 33 -0.5820766091346741E-10 0.5820766091346741E-10
0.5000000000000000E+00 0.2147483648000000E+10
x*x 34 -0.2910383045673370E-10 0.2910383045673370E-10

0.5000000000000000E+00 0.4294967296000000E+10
x*x 35 -0.1455191522836685E-10 0.1455191522836685E-10
0.5000000000000000E+00 0.8589934592000000E+10
x*x 36 -0.7275957614183426E-11 0.7275957614183426E-11
0.5000000000000000E+00 0.1717986918400000E+11
x*x 37 -0.3637978807091713E-11 0.3637978807091713E-11
0.5000000000000000E+00 0.3435973836800000E+11
x*x 38 -0.1818989403545856E-11 0.1818989403545856E-11
0.5000000000000000E+00 0.6871947673600000E+11
x*x 39 -0.9094947017729282E-12 0.9094947017729282E-12
0.5000000000000000E+00 0.1374389534720000E+12
x*x 40 -0.4547473508864641E-12 0.4547473508864641E-12
0.5000000000000000E+00 0.2748779069440000E+12
x*x 41 -0.2273736754432321E-12 0.2273736754432321E-12
0.5000000000000000E+00 0.5497558138880000E+12
x*x 42 -0.1136868377216160E-12 0.1136868377216160E-12
0.5000000000000000E+00 0.1099511627776000E+13
x*x 43 -0.5684341886080801E-13 0.5684341886080801E-13
0.5000000000000000E+00 0.2199023255552000E+13
x*x 44 -0.2842170943040401E-13 0.2842170943040401E-13
0.5000000000000000E+00 0.4398046511104000E+13
x*x 45 -0.1421085471520200E-13 0.1421085471520200E-13
0.5000000000000000E+00 0.8796093022208000E+13
x*x 46 -0.7105427357601002E-14 0.7105427357601002E-14
0.5000000000000000E+00 0.1759218604441600E+14
x*x 47 -0.3552713678800501E-14 0.3552713678800501E-14
0.5000000000000000E+00 0.3518437208883200E+14
x*x 48 -0.1776356839400250E-14 0.1776356839400250E-14
0.5000000000000000E+00 0.7036874417766400E+14
x*x 49 -0.8881784197001252E-15 0.8881784197001252E-15
0.5000000000000000E+00 0.1407374883553280E+15
sin(x)+cos(x*x) 01 -0.9351046647281536E+00 -0.4351046647281536E+00
0.1000000000000000E+01 0.1000000000000000E+01
sin(x)+cos(x*x) 02 -0.8546415960180649E+00 0.8046306871008869E-01
0.4351046647281536E+00 0.4351046647281536E+00
sin(x)+cos(x*x) 03 -0.8493901358009870E+00 0.5251460217077924E-02
0.1849280764672121E+00 0.4250197514723320E+00
sin(x)+cos(x*x) 04 -0.8493688627401134E+00 0.2127306087358230E-04

		0.6526547273506428E-01	0.8111233362254442E+00	
sin(x)+cos(x*x)	05	-0.8493688623926731E+00	0.3474402480610000E-09	
		0.4050884895680481E-02	0.7713825732711236E+00	
sin(x)+cos(x*x)	06	-0.8493688623926731E+00	-0.0000000000000000E+00	
		0.1633240749027686E-04	0.7677507053309917E+00	