FIRST FOLLOWAGE

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Subject: Numerical Analysis
Professor in charge: Edwar Samir Posada Murillo
Semester: 6th
System name (project): Alpha Numeric
repository from where we will work:
https://github.com/herreraalex/AlphaNumeric

1 Methods test

- Incremental Search

1. $Function f : ln(sin(x)^2 + 1) - (1/2)$
2. $X_0 : -3$
3. $Delta : 0.5$
4. $Iterations : 100$

	xi	xs
1	-2.5	-2.0
4	-1.0	-0.5
7	0.5	1.0
10	2.0	2.5
14	4.0	4.5
16	5.0	5.5
20	7.0	7.5
22	8.0	8.5
26	10.0	10.5
29	11.5	12.0
33	13.5	14.0
35	14.5	15.0
39	16.5	17.0
41	17.5	18.0
45	19.5	20.0
48	21.0	21.5
51	22.5	23.0
54	24.0	24.5
58	26.0	26.5
60	27.0	27.5
64	29.0	29.5
66	30.0	30.5
70	32.0	32.5
73	33.5	34.0
76	35.0	35.5
79	36.5	37.0
83	38.5	39.0
85	39.5	40.0
89	41.5	42.0
92	43.0	43.5
95	44.5	45.0
98	46.0	46.5

- Bisection Method

1. $Function : ln((sin(x)^2) + 1) - (1/2)$
2. $a : 0$

3. $b : 1$

4. $Iterations : 100$

5. $Tolerance : 0.0000001$

	xi	xm	xs	Fxm	Error
1	0.000000	0.500000	1.000000	-2.931087e-01	1.000000e+00
2	0.500000	0.750000	1.000000	-1.183964e-01	2.500000e-01
3	0.750000	0.875000	1.000000	-3.681769e-02	1.250000e-01
4	0.875000	0.937500	1.000000	6.339162e-04	6.250000e-02
5	0.875000	0.906250	0.937500	-1.777229e-02	3.125000e-02
6	0.906250	0.921875	0.937500	-8.486582e-03	1.562500e-02
7	0.921875	0.929688	0.937500	-3.905359e-03	7.812500e-03
8	0.929688	0.933594	0.937500	-1.630438e-03	3.906250e-03
9	0.933594	0.935547	0.937500	-4.969353e-04	1.953125e-03
10	0.935547	0.936523	0.937500	6.882244e-05	9.765625e-04
11	0.935547	0.936035	0.936523	-2.139735e-04	4.882812e-04
12	0.936035	0.936279	0.936523	-7.255479e-05	2.441406e-04
13	0.936279	0.936401	0.936523	-1.860985e-06	1.220703e-04
14	0.936401	0.936462	0.936523	3.348203e-05	6.103516e-05
15	0.936401	0.936432	0.936462	1.581085e-05	3.051758e-05
16	0.936401	0.936417	0.936432	6.975011e-06	1.525879e-05
17	0.936401	0.936409	0.936417	2.557033e-06	7.629395e-06
18	0.936401	0.936405	0.936409	3.480293e-07	3.814697e-06
19	0.936401	0.936403	0.936405	-7.564765e-07	1.907349e-06
20	0.936403	0.936404	0.936405	-2.042233e-07	9.536743e-07
21	0.936404	0.936405	0.936405	7.190309e-08	4.768372e-07
22	0.936404	0.936404	0.936405	-6.616008e-08	2.384186e-07
23	0.936404	0.936405	0.936405	2.871511e-09	1.192093e-07
24	0.936404	0.936405	0.936405	-3.164428e-08	5.960464e-08

- False Rule

1. $Function : ln((sin(x)^2) + 1) - (1/2)$

2. $a : -1.2$

3. $b : -0.8$

4. *Iterations* : 100
5. *Tolerance* : 0.0000001

```
iter|    a    |   c   |   b   |   fc  |   error
(1, -1.2, -0.961547411939714, -0.8, 0.0143362678026548, 1)
(2, -0.961547411939714, -0.938197249675416, -0.8, 0.00103697685707604, 0.0233501622642975)
(3, -0.938197249675416, -0.936528668587369, -0.8, 7.18512149441297e-5, 0.00166858108804657)
(4, -0.936528668587369, -0.936413151891694, -0.8, 4.96326681576065e-6, 0.000115516695675777)
(5, -0.936413151891694, -0.936405172810937, -0.8, 3.42774855055517e-7, 7.97908075644838e-6)
(6, -0.936405172810937, -0.936404621759120, -0.8, 2.3672488969062 0e-8, 5.51051817732073e-7)
c is an approximation of the root c: -0.936404583702756 error: 3.80563633939346e-8 in the iteration 7
```

- Secant

1. *Function* : $ln((sin(x)^2) + 1) - (1/2)$
2. a : 0.5
3. b : 1.0
4. *Iterations* : 100
5. *Tolerance* : 0.0000001

```
         xi         F(xi)         Error
0  0.500000 -2.931087e-01  0.000000e+00
1  1.000000  3.536608e-02  0.000000e+00
2  0.946166  5.619393e-03  5.383378e-02
3  0.935997 -2.363222e-04  1.016964e-02
4  0.936407  1.402236e-06  4.104216e-04
5  0.936405  3.437165e-10  2.420904e-06
6  0.936405 -4.996004e-16  5.935581e-10
0.936404580879561 was found as an approximation with a tolerance of = 1e-07
```

- Fixed point

1. *Function* : $f(x) = x^3 + 4x^2 - 10$
2. *Function* : $g(x) = \sqrt{10/(x+4}$
3. *Iterations* : 10
4. *Tolerance* : 0.000000005
5. *Value* : $x = 1.5$

```
Xa:  1.3652300135614253  approximate root with tolerance:  5e-09
```

- Newton

1. $Function : f(x) = x^3 - cos(x)$
2. $Function : f'(x) = 3x^2 + sin(x)$
3. $Iterations : 10$
4. $Tolerance : 0.000000005$
5. $Value : x = 1$

```
X0:  0.8654740331016144  approximate root with tolerance:  5e-09
```

- Multiple Root Method
    1. $Function : e^x - x - 1$
    2. $d'(f) : e^x - 1$
    3. $d''(f) : e^x$
    4. $x_0 : 1$
    5. $Iterations : 100$
    6. $Tolerance : 0.0000001$

```
              xi          F(xi)     Error
0  1.000000e+00  7.182818e-01  0.000000
1 -2.342106e-01  2.540578e-02  1.234211
2 -8.458280e-03  3.567061e-05  0.225752
3 -1.189018e-05  7.068790e-11  0.008446
4 -4.221606e-11  0.000000e+00  0.000012
-4.22160616909289e-11 is a root
```

- Simple Gaussian Method

```
simple Gaussian Elimination
step  0
[[ 2.  -1.   0.   3.   1. ]
 [ 1.   0.5  3.   8.   1. ]
 [ 0.  13.  -2.  11.   1. ]
 [14.   5.  -2.   3.   1. ]]
step  1
[[  2.   -1.    0.    3.    1. ]
 [  0.    1.    3.    6.5   0.5]
 [  0.   13.   -2.   11.    1. ]
 [  0.   12.   -2.  -18.   -6. ]]
step  2
[[  2.   -1.    0.    3.    1. ]
 [  0.    1.    3.    6.5   0.5]
 [  0.    0.  -41.  -73.5  -5.5]
 [  0.    0.  -38.  -96.  -12. ]]
step  3
[[  2.         -1.          0.          3.          1.        ]
 [  0.          1.          3.          6.5         0.5       ]
 [  0.          0.        -41.        -73.5        -5.5       ]
 [  0.          0.          0.        -27.87804878  -6.90243902]]
x  [0.03849518810148722, -0.18022747156605434, -0.30971128608923887, 0.24759405074365706]
```

- Partial Gaussian Method

```
Partial Gaussian Elimination
step  0
[2, -1, 0, 3, 1]
[1, 0.5, 3, 8, 1]
[0, 13, -2, 11, 1]
[14, 5, -2, 3, 1]
step  1
[14, 5, -2, 3, 1]
[0.0, 0.1428571428571429, 3.142857142857143, 7.785714285714286, 0.9285714285714286]
[0.0, 13.0, -2.0, 11.0, 1.0]
[0.0, -1.7142857142857142, 0.2857142857142857, 2.5714285714285716, 0.8571428571428572]
step  2
[14, 5, -2, 3, 1]
[0.0, 13.0, -2.0, 11.0, 1.0]
[0.0, 0.0, 3.1648351648351647, 7.664835164835164, 0.9175824175824177]
[0.0, 2.220446049250313e-16, 0.021978021978021955, 4.021978021978022, 0.989010989010989]
step  3
[14, 5, -2, 3, 1]
[0.0, 13.0, -2.0, 11.0, 1.0]
[0.0, 0.0, 3.1648351648351647, 7.664835164835164, 0.9175824175824177]
[0.0, 2.220446049250313e-16, 0.0, 3.96875, 0.982638888888889]
X  [0.03849518810148731, -0.18022747156605426, -0.30971128608923887, 0.24759405074365706]
```

- Total Gaussian Method

```
Total Gaussian Elimination
step  0
[14, 5, -2, 3, 1, 1]
[0.0, 13.0, -2.0, 11.0, 1.0, 1]
[0.0, 0.0, 3.1648351648351647, 7.664835164835164, 0.9175824175824177, 1]
[0.0, 2.220446049250313e-16, 0.0, 3.96875, 0.982638888888889, 1]
step  1
[14, 5, -2, 3, 1, 1]
[0.0, 13.0, -2.0, 11.0, 1.0, 1]
[0.0, 0.0, 3.1648351648351647, 7.664835164835164, 0.9175824175824177, 1]
[0.0, 2.220446049250313e-16, 0.0, 3.96875, 0.982638888888889, 1]
step  2
[14, 5, -2, 3, 1, 1]
[0.0, 13.0, -2.0, 11.0, 1.0, 1]
[0.0, 0.0, 3.1648351648351647, 7.664835164835164, 0.9175824175824177, 1]
[0.0, 0.0, 3.416070845000482e-17, 3.96875, 0.982638888888889, 1]
step  3
[14, 5, 3, -2, 1, 1]
[0.0, 13.0, 11.0, -2.0, 1.0, 1]
[0.0, 0.0, 7.664835164835164, 3.1648351648351647, 0.9175824175824177, 1]
[0.0, 0.0, -4.440892098500626e-16, -1.638709677419355, 0.5075268817204301, 1]
x  [0.03849518810148732, -0.18022747156605423, -0.3097112860892388, 0.24759405074365703]
```

2 Signatures

- Jose Joab Romero
- Juan Camilo Guerrero
- Santiago Moreno
- Kevin Alexander Herrera