EAFIT UNIVERSITY
DEPARTMENT OF INFORMATICS AND SYSTEMS
PROJECT CHOICE

Second Report

April 5, 2022

Course

Numerical analysis

Teacher

Edwar Samir Posada Murillo

Semester

2022-1

Project's name

Numerical Algorithms

Repository

This project has a GitHub repository where the evidence related with it will be. https://github.com/DanielHernandezO/NumericalMethodsProject

Members

1. Jose Miguel Blanco Velez
2. Neller Pellegrino Baquero
3. Samuel David Villegas Bedoya
4. Daniel Andres Hernandez Oyola

Project's description

Webpage used to calculate data using different types of numerical methods with the option of visualising them in a 2d graph.

Added values

1. The project will be done in english
2. The project will have its documentation in latex
3. The numerical algorithms can be found in multiple programming languages
4. The project will have extra numerical methods

1 Incremental Search - JavaScript

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

x0 = -3
delta = 0.5
iterations = 100

There is at least one root between -2.5 and -2

(index)	0	1	2	3	4	5
0	'iteration'	'x0'	'x1'	'fx0'	'fx1'	'fx0*fx1'
1	1	-3	-2.5	-0.4802808500361744	-0.19386259916617415	0.09310849391775228
2	2	-2.5	-2	-0.19386259916617415	0.10257774140337728	-0.019885987565054396
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0

2 Incremental Search - Matlab

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

x0 = -3
delta = 0.5
iterations = 100

```
answer =

    "There is at least one root between -2.5 and -2"


matrix =

  3×6 string array

    "iteration"    "x0"      "x1"      "fx0"         "fx1"         "fx0*fx1"
    "1"            "-3"      "-2.5"    "-0.48028"    "-0.19386"    "0.093108"
    "2"            "-2.5"    "-2"      "-0.19386"    "0.10258"     "-0.019886"
```

3 Bisection - JavaScript

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

a = 0
b=1
Tolerance = 1e-7
iterations = 100

0.9364045262336731 is an approximation with tolerance 1e-7

Result table:

(index)	0	1	2	3	4	5
0	'iteration'	'left'	'right'	'mid'	'f(mid)'	'error'
1	1	0	1	0.5	-0.2931087267313766	'1e-71'
2	2	0.5	1	0.75	-0.11839639385347844	0.25
3	3	0.75	1	0.875	-0.036817690757380395	0.125
4	4	0.875	1	0.9375	0.0006339161592386899	0.0625
5	5	0.875	0.9375	0.90625	-0.017772289226861138	0.03125
6	6	0.90625	0.9375	0.921875	-0.008486582211768012	0.015625
7	7	0.921875	0.9375	0.9296875	-0.0039053586270640928	0.0078125
8	8	0.9296875	0.9375	0.93359375	-0.0016304381170096915	0.00390625
9	9	0.93359375	0.9375	0.935546875	-0.0004969353153195244	0.001953125
10	10	0.935546875	0.9375	0.9365234375	0.00006882244496264622	0.0009765625
11	11	0.935546875	0.9365234375	0.93603515625	-0.00021397350516394464	0.00048828125
12	12	0.93603515625	0.9365234375	0.936279296875	-0.00007255478812051575	0.000244140625
13	13	0.936279296875	0.9365234375	0.9364013671875	-0.0000018609849000705836	0.0001220703125
14	14	0.9364013671875	0.9365234375	0.93646240234375	0.00003348202684883006	0.00006103515625
15	15	0.9364013671875	0.93646240234375	0.936431884765625	0.000015810845160335596	0.000030517578125
16	16	0.9364013671875	0.936431884765625	0.9364166259765625	0.000006975011174192858	0.0000152587890625
17	17	0.9364013671875	0.9364166259765625	0.9364089965820312	0.000002557033397687647	0.00000762939453125
18	18	0.9364013671875	0.9364089965820312	0.9364051818847656	3.4802931392352576e-7	0.000003814697265625
19	19	0.9364013671875	0.9364051818847656	0.9364032745361328	-7.56476526753147e-7	0.0000019073486328125
20	20	0.9364032745361328	0.9364051818847656	0.9364042282104492	-2.0422328983471516e-7	9.5367431640625e-7
21	21	0.9364042282104492	0.9364051818847656	0.9364047050476074	7.190309125881811e-8	4.76837158203125e-7
22	22	0.9364042282104492	0.9364047050476074	0.9364044666290283	-6.616007947046754e-8	2.384185791015625e-7
23	23	0.9364044666290283	0.9364047050476074	0.9364045858383179	2.8715108069121698e-9	1.1920928955078125e-7
24	24	0.9364044666290283	0.9364045858383179	0.9364045262336731	-3.164428308277678e-8	5.960464477539063e-8
25	0	0	0	0	0	0

4 Bisection - Matlab

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

a = 0
b=1
Tolerance = 1e-7
iterations = 100

```
    "0.9364 is an approximation with tolerance 1e-07"


matrix =

  25×6 string array

    "counter"    "left"       "right"      "xmid"       "fXmid"          "error"
    "1"          "0"          "1"          "0.5"        "-0.29311"       "1"
    "2"          "0.5"        "1"          "0.75"       "-0.1184"        "0.25"
    "3"          "0.75"       "1"          "0.875"      "-0.036818"      "0.125"
    "4"          "0.875"      "1"          "0.9375"     "0.00063392"     "0.0625"
    "5"          "0.875"      "0.9375"     "0.90625"    "-0.017772"      "0.03125"
    "6"          "0.90625"    "0.9375"     "0.92188"    "-0.0084866"     "0.015625"
    "7"          "0.92188"    "0.9375"     "0.92969"    "-0.0039054"     "0.0078125"
    "8"          "0.92969"    "0.9375"     "0.93359"    "-0.0016304"     "0.0039062"
    "9"          "0.93359"    "0.9375"     "0.93555"    "-0.00049694"    "0.0019531"
    "10"         "0.93555"    "0.9375"     "0.93652"    "6.8822e-05"     "0.00097656"
    "11"         "0.935547"   "0.936523"   "0.936035"   "-0.000213974"   "0.000488281"
    "12"         "0.936035"   "0.936523"   "0.936279"   "-7.25548e-05"   "0.000244141"
    "13"         "0.936279"   "0.936523"   "0.936401"   "-1.86098e-06"   "0.00012207"
    "14"         "0.936401"   "0.936523"   "0.936462"   "3.3482e-05"     "6.10352e-05"
    "15"         "0.936401"   "0.936462"   "0.936432"   "1.58108e-05"    "3.05176e-05"
    "16"         "0.936401"   "0.936432"   "0.936417"   "6.97501e-06"    "1.52588e-05"
    "17"         "0.936401"   "0.936417"   "0.936409"   "2.55703e-06"    "7.62939e-06"
    "18"         "0.936401"   "0.936409"   "0.936405"   "3.48029e-07"    "3.8147e-06"
    "19"         "0.936401"   "0.936405"   "0.936403"   "-7.56477e-07"   "1.90735e-06"
    "20"         "0.936403"   "0.936405"   "0.936404"   "-2.04223e-07"   "9.53674e-07"
    "21"         "0.936404"   "0.936405"   "0.936405"   "7.19031e-08"    "4.76837e-07"
    "22"         "0.936404"   "0.936405"   "0.936404"   "-6.61601e-08"   "2.38419e-07"
    "23"         "0.936404"   "0.936405"   "0.936405"   "2.87151e-09"    "1.19209e-07"
    "24"         "0.936404"   "0.936405"   "0.936405"   "-3.16443e-08"   "5.96046e-08"
```

5 Newton - JavaScript

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

$$f'(x) = 2(sin(x)^2 + 1)^{-1} sin(x) * cos(x)$$

x0=0.5
Tolerance = 1e-7
iterations = 100

```
0.9364045808795621 is a root approximation with tolerance 1e-7

Result table:
```

(index)	0	1	2	3	4
0	'iteration'	'xn'	'f(xn)'	"f'(n)"	'error'
1	1	0.5	-0.2931087267313766	0.6842068330717285	1.0000001
2	2	0.9283919899125719	-0.004662157097372055	0.5846147284064961	0.4283919899125719
3	3	0.9363667412673313	-0.000021912619882713535	0.5791052537949999	0.007974751354759446
4	4	0.9364045800189902	-4.98339092214195e-10	0.5790789133390186	0.000037838751658853
5	5	0.9364045808795621	-1.1102230246251565e-16	0.5790789127399327	8.605719470367035e-10
6	0	0	0	0	0

6 Newton - Matlab

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

$$f'(x) = 2(sin(x)^2 + 1)^{-1} sin(x) * cos(x)$$

x0=0.5

Tolerance = 1e-7
iterations = 100

```
answer =

    "0.9364 is a root approximation with tolerance 1e-07"


matrix =

  6×5 string array

    "iteration"    "xn"         "f(xn)"          "f'(xn)"     "erro"
    "1"            "0.5"        "-0.29311"       "0.68421"    "1"
    "2"            "0.92839"    "-0.0046622"     "0.58461"    "0.42839"
    "3"            "0.93637"    "-2.1913e-05"    "0.57911"    "0.0079748"
    "4"            "0.9364"     "-4.9834e-10"    "0.57908"    "3.7839e-05"
    "5"            "0.9364"     "-1.1102e-16"    "0.57908"    "8.6057e-10"
```

7 Trisection - JavaScript

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

a = 0
b=1
Tolerance = 1e-7
iterations = 100

```
0.9364046334679011 is an approximation with tolerance 1e-7

Result table:
```

(index)	0	1	2	3	4	5	6	7	8
0	'iteration'	'left'	'right'	'xmid1'	'xmid2'	'f(xmid1)'	'f(xmid2)'	'error1'	'error2'
1	1	0	1	0.3333333333333333	0.6666666666666667	-0.3982954265116443	-0.1761924709056893	'1e-71'	'1e-71'
2	2	0.6666666666666667	1	0.7777777777777778	0.888888888888889	-0.09962789967372415	-0.02827699960529806	0.4444444444444445	0.2222222222222222
3	3	0.888888888888889	1	0.9259259259259259	0.962962962962963	-0.006105935760274961	0.01512991161806953	0.1481481481481481	0.07407407407407407
4	4	0.9259259259259259	0.962962962962963	0.9382716049382717	0.9506172839506173	0.0010799395431232428	0.008159349987386988	0.012345679012345734	0.012345679012345734
5	5	0.9259259259259259	0.9382716049382717	0.9300411522633745	0.9341563786008231	-0.0036989657992226865	-0.0013036433734338049	0.008230452674897193	0.016460905349794164
6	6	0.9341563786008231	0.9382716049382717	0.9355281207133059	0.9368998628257889	-0.0005078068385195866	0.00028672192051582	0.005486968449931462	0.002743484224965731
7	7	0.9355281207133059	0.9368998628257889	0.9359853680841336	0.9364426154549612	-0.00024281844414431042	0.00002202451702237873	0.00045724737082764033	0.00045724737082764033
8	8	0.9359853680841336	0.9364426154549612	0.9361377838744095	0.9362901996646853	-0.00015452129169313267	-0.00006624030310087292	0.00015241579027591712	0.00015241579027591712
9	9	0.9362901996646853	0.9364426154549612	0.9363410049281106	0.936391810191536	-0.00003681689966916757	-0.000007395292904388562	0.0002032210537010748	0.00010161052685064842
10	10	0.936391810191536	0.9364426154549612	0.9364087452793444	0.9364256803671528	0.0000024115100616395324	0.000012218113372708395	0.00006774035123380262	0.0000338701756168458
11	11	0.936391810191536	0.9364087452793444	0.9363974552208054	0.9364031002500749	-0.0000041263363988464086	-8.574020767260215e-7	0.0000112900585389486	0.00000225801170778972
12	12	0.9364031002500749	0.9364087452793444	0.936404981926498	0.9364068636029212	2.3223776757230752e-7	0.0000013218751471200108	0.000007526705692595392	0.0000037633528463532073
13	13	0.9364031002500749	0.936404981926498	0.9364037274755492	0.9364043547010237	-4.94188521660277e-7	-1.3097524004246353e-7	0.0000012544509487844024	0.000002508901897568805
14	14	0.9364043547010237	0.936404981926498	0.9364045637761818	0.9364047728513399	-9.904207065591919e-9	1.1116679554667996e-7	8.36300632522935e-7	4.181503162614675e-7
15	15	0.9364045637761818	0.9364047728513399	0.9364046334679011	0.9364047031596205	3.045279706181958e-8	7.080979791407316e-8	6.969171939541496e-8	6.969171939541496e-8

8 Trisection - Matlab

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

a = 0
b=1
Tolerance = 1e-7
iterations = 100

```
answer =

    "0.9364 is an approximation with tolerance 1e-07"


matrix =

  16×9 string array

    "iteration"    "left"        "right"       "xmid1"       "xmid2"       "f(xmid1)"       "f(xmid2)"       "error1"        "error2"
    "1"            "0"           "1"           "0.33333"     "0.66667"     "-0.3983"        "-0.17619"       "1"             "1"
    "2"            "0.66667"     "1"           "0.77778"     "0.88889"     "-0.099628"      "-0.028277"      "0.44444"       "0.22222"
    "3"            "0.88889"     "1"           "0.92593"     "0.96296"     "-0.0061059"     "0.01513"        "0.14815"       "0.074074"
    "4"            "0.92593"     "0.96296"     "0.93827"     "0.95062"     "0.0010799"      "0.0081593"      "0.012346"      "0.012346"
    "5"            "0.92593"     "0.93827"     "0.93004"     "0.93416"     "-0.003699"      "-0.0013036"     "0.0082305"     "0.016461"
    "6"            "0.93416"     "0.93827"     "0.93553"     "0.9369"      "-0.00050781"    "0.00028672"     "0.005487"      "0.0027435"
    "7"            "0.93553"     "0.9369"      "0.93599"     "0.93644"     "-0.00024282"    "2.2025e-05"     "0.00045725"    "0.00045725"
    "8"            "0.93599"     "0.93644"     "0.93614"     "0.93629"     "-0.00015452"    "-6.624e-05"     "0.00015242"    "0.00015242"
    "9"            "0.93629"     "0.93644"     "0.93634"     "0.93639"     "-3.6817e-05"    "-7.3953e-06"    "0.00020322"    "0.00010161"
    "10"           "0.93639"     "0.93644"     "0.93641"     "0.93643"     "2.4115e-06"     "1.2218e-05"     "6.774e-05"     "3.387e-05"
    "11"           "0.936392"    "0.936409"    "0.936397"    "0.936403"    "-4.12634e-06"   "-8.57402e-07"   "1.12901e-05"   "2.25801e-05"
    "12"           "0.936403"    "0.936409"    "0.936405"    "0.936407"    "2.32238e-07"    "1.32188e-06"    "7.52671e-06"   "3.76335e-06"
    "13"           "0.936403"    "0.936405"    "0.936404"    "0.936404"    "-4.94189e-07"   "-1.30975e-07"   "1.25445e-06"   "2.5089e-06"
    "14"           "0.936404"    "0.936405"    "0.936405"    "0.936405"    "-9.90421e-09"   "1.11167e-07"    "8.36301e-07"   "4.1815e-07"
    "15"           "0.936405"    "0.936405"    "0.936405"    "0.936405"    "3.04528e-08"    "7.08098e-08"    "6.96917e-08"   "6.96917e-08"
```

9 Fixed Point - Javascript

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

(index)	x1	fx1	error
0	-0.2931087267313766	-0.12671281687488078	0.2068912732686234
1	-0.41982154360625734	0.07351702442859231	0.12671281687488073
2	-0.3463045191776651	-0.0446539373646444	0.07351702442859226
3	-0.3909584565423095	0.026553421648170206	0.0446539373646444
4	-0.3644050348941392	-0.016021268273817058	0.02655342164817026
5	-0.3804263031679563	0.009589507887747373	0.016021268273817058
6	-0.37083679528020885	-0.005768850083372357	0.009589507887747428
7	-0.3766056453635812	0.003460227756392209	0.005768850083372357
8	-0.373145417607189	-0.002079223579867173	0.003460227756392209
9	-0.3752246411870562	0.0012480551387465955	0.002079223579867173
10	-0.37397658604830963	-0.0007496296601224861	0.00124805513874654
11	-0.3747262157084321	0.00045008239797827976	0.0007496296601224861
12	-0.3742761333104539	-0.0002702951476383775	0.00045008239797822425
13	-0.3745464284580923	0.00016230202324751808	0.0002702951476383775
14	-0.3743841264348447	-0.00009746439711039168	0.0001623020232475736
15	-0.3744815908319551	0.000058525648058083135	0.00009746439711039168
16	-0.37442306518389706	-0.00003514467880871841	0.000058525648058027624
17	-0.37445820986270584	0.00002110401325028377	0.00003514467880877392
18	-0.3744371058494556	-0.000012672877957364825	0.00002110401325022826
19	-0.37444977872741303	0.000007609964212673681	0.000012672877957420337
20	-0.37444216876320036	-0.0000045697420043566694	0.000007609964212673681
21	-0.3744467385052047	0.0000027440986793969557	0.0000045697420043566694
22	-0.37444399440652526	-0.000001647814738270359	0.000002744098679452467
23	-0.37444564222126353	9.895019896788426e-7	0.000001647814738270359
24	-0.37444465271927385	-5.941897863737111e-7	9.895019896788426e-7

-0.37444465271927385

10 Fixed Point - Matlab

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

```
x17 = -0.3744
x1 =

   -0.3745

x18 = -0.3745
x1 =

   -0.3744

x19 = -0.3744
x1 =

   -0.3744

x20 = -0.3744
x1 =

   -0.3744

x21 = -0.3744
x1 =

   -0.3744

x22 = -0.3744
x1 =

   -0.3744

x23 = -0.3744
x1 =

   -0.3744

x24 = -0.3744
x1 =

   -0.3744

x25 = -0.3744
```

11 gaussSimple - Javascript

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

(index)	0	1	2	3	4
0	2	-1	0	3	1
1	0	1	3	6.5	0.5
2	0	13	-2	11	1
3	0	12	-2	-18	-6

(index)	0	1	2	3	4
0	2	-1	0	3	1
1	0	1	3	6.5	0.5
2	0	0	-41	-73.5	-5.5
3	0	0	-38	-96	-12

(index)	0	1	2	3	4
0	2	-1	0	3	1
1	0	1	3	6.5	0.5
2	0	0	-41	-73.5	-5.5
3	0	0	0	-27.878048780487802	-6.902439024390244

```
x:

[
  0.038495188101487222,
  -0.18022747156605434,
  -0.30971128608923887,
  0.24759405074365706
]
```

12 gaussSimple - Matlab

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

```
Etapa 1
    2.0000   -1.0000         0    3.0000    1.0000
         0    1.0000    3.0000    6.5000    0.5000
         0   13.0000   -2.0000   11.0000    1.0000
         0   12.0000   -2.0000  -18.0000   -6.0000

Etapa 2
    2.0000   -1.0000         0    3.0000    1.0000
         0    1.0000    3.0000    6.5000    0.5000
         0         0  -41.0000  -73.5000   -5.5000
         0         0  -38.0000  -96.0000  -12.0000

Etapa 3
    2.0000   -1.0000         0    3.0000    1.0000
         0    1.0000    3.0000    6.5000    0.5000
         0         0  -41.0000  -73.5000   -5.5000
         0         0         0  -27.8780   -6.9024


ans =

    0.0385   -0.1802   -0.3097    0.2476
```

13 gaussPartialPivot - Javascript

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

(index)	0	1	2	3	4
0	14	5	-2	3	1
1	0	0.1428571428571429	3.142857142857143	7.785714285714286	0.9285714285714286
2	0	13	-2	11	1
3	0	-1.7142857142857142	0.2857142857142857	2.5714285714285716	0.8571428571428572

(index)	0	1	2	3	4
0	14	5	-2	3	1
1	0	13	-2	11	1
2	0	0	3.1648351648351647	7.664835164835164	0.9175824175824177
3	0	2.220446049250313e-16	0.021978021978021955	4.021978021978022	0.989010989010989

(index)	0	1	2	3	4
0	14	5	-2	3	1
1	0	13	-2	11	1
2	0	0	3.1648351648351647	7.664835164835164	0.9175824175824177
3	0	2.220446049250313e-16	0	3.96875	0.982638888888889

```
x:

[
  0.03849518810148731,
  -0.18022747156605426,
  -0.30971128608923887,
  0.24759405074365706
]
```

14 gaussPartialPivot - Matlab

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

```
Etapa 0
    2.0000   -1.0000         0    3.0000    1.0000
    1.0000    0.5000    3.0000    8.0000    1.0000
         0   13.0000   -2.0000   11.0000    1.0000
   14.0000    5.0000   -2.0000    3.0000    1.0000

Etapa 1
   14.0000    5.0000   -2.0000    3.0000    1.0000
         0    0.1429    3.1429    7.7857    0.9286
         0   13.0000   -2.0000   11.0000    1.0000
         0   -1.7143    0.2857    2.5714    0.8571

Etapa 2
   14.0000    5.0000   -2.0000    3.0000    1.0000
         0   13.0000   -2.0000   11.0000    1.0000
         0         0    3.1648    7.6648    0.9176
         0    0.0000    0.0220    4.0220    0.9890

Etapa 3
   14.0000    5.0000   -2.0000    3.0000    1.0000
         0   13.0000   -2.0000   11.0000    1.0000
         0         0    3.1648    7.6648    0.9176
         0    0.0000         0    3.9688    0.9826


ans =

    0.0385   -0.1802   -0.3097    0.2476
```

15 gaussTotalPivot - Javascript

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

(index)	0	1	2	3	4
0	14	5	-2	3	1
1	0	0.1428571428571429	3.142857142857143	7.785714285714286	0.9285714285714286
2	0	13	-2	11	1
3	0	-1.7142857142857142	0.2857142857142857	2.5714285714285716	0.8571428571428572

(index)	0	1	2	3	4
0	14	5	-2	3	1
1	0	13	-2	11	1
2	0	0	3.1648351648351647	7.664835164835164	0.9175824175824177
3	0	2.220446049250313e-16	0.021978021978021955	4.021978021978022	0.989010989010989

(index)	0	1	2	3	4
0	14	5	3	-2	1
1	0	13	11	-2	1
2	0	0	7.664835164835164	3.1648351648351647	0.9175824175824177
3	0	2.220446049250313e-16	0	-1.638709677419355	0.5075268817204301

```
x:

[
  0.03849518810148732,
  -0.18022747156605423,
  -0.3097112860892388,
  0.24759405074365703
]
```

16 gaussTotalPivot - Matlab

Input data

$$A = \begin{pmatrix} 2 & -1 & 0 & 3 \\ 1 & 0.5 & 3 & 8 \\ 0 & 13 & -2 & 11 \\ 14 & 5 & -2 & 3 \end{pmatrix}$$

$$b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

n = 4

```
Etapa 0
    2.0000   -1.0000         0    3.0000    1.0000
    1.0000    0.5000    3.0000    8.0000    1.0000
         0   13.0000   -2.0000   11.0000    1.0000
   14.0000    5.0000   -2.0000    3.0000    1.0000

Etapa 1
   14.0000    5.0000   -2.0000    3.0000    1.0000
         0    0.1429    3.1429    7.7857    0.9286
         0   13.0000   -2.0000   11.0000    1.0000
         0   -1.7143    0.2857    2.5714    0.8571

Etapa 2
   14.0000    5.0000   -2.0000    3.0000    1.0000
         0   13.0000   -2.0000   11.0000    1.0000
         0         0    3.1648    7.6648    0.9176
         0    0.0000    0.0220    4.0220    0.9890

Etapa 3
   14.0000    5.0000    3.0000   -2.0000    1.0000
         0   13.0000   11.0000   -2.0000    1.0000
         0         0    7.6648    3.1648    0.9176
         0    0.0000         0   -1.6387    0.5075


ans =

    0.0385   -0.1802   -0.3097    0.2476
```

17 multiple roots - Javascript

Input data

$$h(x) = e^x - x - 1$$

$$h'(x) = e^x - 1$$

$$h''(x) = e^x$$

x0 = 1
Tolerance = 10e-7
iterations = 100

(index)	counter	xi	fxi	f1xi	f2xi	error
0	0	1	0.7182818284590451	1.718281828459045	2.718281828459045	
1	1	-0.23421061355351425	0.025405775475345838	-0.20880483807816852	0.7911951619218315	1.2342106135535142
2	2	-0.00845827991076109	0.00003567060801401567	-0.008422609302746964	0.991577390697253	0.22575233364275316
3	3	-0.000011890183808588653	7.068789997788372e-11	-0.000011890113120638368	0.9999881098868794	0.008446389726952502
4	4	-4.218590698935789e-11	0	-4.218592142279931e-11	0.9999999999578141	0.000011890141622681664

x:

-4.218590698935789e-11

18 multiple roots - Matlab

Input data

$$h(x) = e^x - x - 1$$

$$h'(x) = e^x - 1$$

$$h''(x) = e^x$$

x0 = 1
Tolerance = 10e-7
iterations = 100

Counter	Xi	Fxi	Error
0	1.00000000000000	0.718281828459045	1.00000100000000
1.00000000000000	-0.234210613553514	0.025405775475346	1.234210613553514
2.00000000000000	-0.008458279910761	0.000035670608014	0.225752333642753
3.00000000000000	-0.000011890183809	0.000000000070688	0.008446389726953
4.00000000000000	-0.000000000042186	0	0.000011890141623

The root has been found and it is: -4.21859069894e-11

ans =

-4.218590698935789e-11

19 Aitken - Javascript

Input data

$$f_1(x) = log((sin(x)^2) + 1) - x - 1/2$$

$$g(x) = log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

iterations:

(index)	counter	x1	x2	x3	xi	fxi	error
0	0	-0.2931087267313766	-0.41982154360625734	-0.3463045191776651	-0.37329726334431834	-0.0018363690031583668	
1	1	-0.41982154360625734	-0.3463045191776651	-0.3909584565423095	-0.37408481777431474	-0.000576447277706782	0.0007875544299963955
2	2	-0.3463045191776651	-0.3909584565423095	-0.3644050348941392	-0.3743068794647071	-0.0002210905207283842	0.00022206169039235002
3	3	-0.3909584565423095	-0.3644050348941392	-0.3804263031679563	-0.37439734470526514	-0.00007630930758173449	0.00009046524055805749
4	4	-0.3644050348941392	-0.3804263031679563	-0.37083679528020885	-0.3744274190453401	-0.000028176431394189017	0.000030074340074959238
5	5	-0.3804263031679563	-0.37083679528020885	-0.3766056453635812	-0.37443877105664	-0.0000100077354043826	0.000011352011299869957
6	6	-0.37083679528020885	-0.3766056453635812	-0.373145417607189	-0.3744427494028446	-0.000003640433321405734	0.000003978346204636107
7	7	-0.3766056453635812	-0.373145417607189	-0.3752246411870562	-0.3744442081743537	-0.000001305680867647041	0.0000014587715090885744
8	8	-0.373145417607189	-0.3752246411870562	-0.37397658604830963	-0.37444472886443075	-4.7231996919139263e-7	5.206900770549083e-7

x:

-0.37444472886443075

20 Aitken - Matlab

Input data

$$f_1(x) = log((sin(x)^2) + 1) - x - 1/2$$

$$g(x) = log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

Counter	Xi	Fxi	Error
0	-0.373297263344318	-0.001836369003158	1.000001000000000
1.000000000000000	-0.374084817774315	-0.000576447277707	0.000787554429996
2.000000000000000	-0.374306879464707	-0.000221090520728	0.000222061690392
3.000000000000000	-0.374397344705265	-0.000076309307582	0.000090465240558
4.000000000000000	-0.374427419045340	-0.000028176431394	0.000030074340075
5.000000000000000	-0.374438771056640	-0.000010007735404	0.000011352011300
6.000000000000000	-0.374442749402845	-0.000003640433321	0.000003978346205
7.000000000000000	-0.374444208174354	-0.000001305680868	0.000001458771509
8.000000000000000	-0.374444728864431	-0.000000472319969	0.000000520690077

An approximation has been found and is: -0.374444728864

\\

21 steffensen - Javascript

Input data

$$f_1(x) = log((sin(x)^2) + 1) - x - 1/2$$

$$g(x) = log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

(index)	counter	x0	x1	x2	xi	fxi	error
0	0	-0.5	-0.2931087267313766	-0.41982154360625734	-0.3716922237485173	-0.004402295146406721	
1	1	-0.3716922237485173	-0.376094518894924	-0.37345324878080155	-0.3744437000022661	-0.000002119006566103643	0.00275147625374883
2	2	-0.3744437000022661	-0.3744458190088322	-0.374444546559343	-0.37444502397307805	-4.902744876744691e-13	0.0000013239708119283655
3	3	-0.37444502397307805	-0.3744450239735684	-0.37444502397327384	-0.37444502397338436	-1.1102230246251565e-16	3.063105324940807e-13

x:

-0.37444502397338436

22 steffensen - Matlab

Input data

$$f_1(x) = log((sin(x)^2) + 1) - x - 1/2$$

$$g(x) = log((sin(x)^2) + 1) - 1/2$$

x0 = -0.5
Tolerance = 10e-7
iterations = 100

Counter	Xi	Fxi	Error
0	-0.371692223748517	-0.004402295146407	1.000001000000000
1.000000000000000	-0.374443700002266	-0.000002119006566	0.002751476253749
2.000000000000000	-0.374445023973078	-0.000000000000490	0.000001323970812
3.000000000000000	-0.374445023973384	-0.000000000000000	0.000000000000306

An approximation has been found and is: -0.374445023973

23 muller - Javascript

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

x0 = 0.5
x1 = 1
Tolerance = 10e-7
iterations = 100

iterations:

(index)	counter	x0	x1	x2	xi	fxi	error
0	0	0	1	0.5	0.9430532420830671	0.0038346496004928454	
1	1	1	0.5	0.9430532420830671	0.9373838328240021	0.000566730167486762	0.005669409259065006
2	2	0.5	0.9430532420830671	0.9373838328240021	0.936398251869595	-0.000003665010153086623	0.0009855809544070393
3	3	0.9430532420830671	0.9373838328240021	0.936398251869595	0.9364045899381098	5.245613721172049e-9	0.000006338068514799566
4	4	0.9373838328240021	0.936398251869595	0.9364045899381098	0.936404580879631	3.9745984281580604e-14	9.058478855905605e-9

x:

0.936404580879631

24 muller - Matlab

Input data

$$f(x) = ln(sin(x)^2 + 1) - (1/2)$$

x0 = 0.5
x1 = 1
Tolerance = 10e-7
iterations = 100

Counter	Xi	Fxi	Error
0	0.94305324208367	0.00383464960493	1.00000100000000
1.00000000000000	0.93738383282400	0.00056673016748	0.00569409259065
2.00000000000000	0.93639825186959	-0.00000366501015	0.00098558095440
3.00000000000000	0.93640458993811	0.00000000524561	0.00000633806851
4.00000000000000	0.93640458087963	0.00000000000004	0.00000000905847

An approximation has been found and is: 0.9364045808

25 secant method - Mathlab

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

x0 = 0.5
x1 = 1
Tolerance = 10e-7
iterations = 100

```
SOLUCION:
0.936405 es una aproximacion a una raìz con una tolerancia 1e-07

TABLA

interaciones                  Xn                y1                Error relativo

                   0   1.000000000000000   0.035366079380240   1.000000100000000

   1.000000000000000   0.946166222306525   0.005619392737864   0.056896744382019
   2.000000000000000   0.935996580791173  -0.000236322174701   0.010865041308972
   3.000000000000000   0.936407002376704   0.000001402235891   0.000438294015839
   4.000000000000000   0.936404581473120   0.000000000343716   0.000002585317962
   5.000000000000000   0.936404580879561  -0.000000000000000   0.000000000633869
```

26 secant method - JavaScript

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

x0 = 0.5
x1 = 1
Tolerance = 10e-7
iterations = 100

(index)	counter	xi	fxi	error
0	0	0.5	-0.2931087267313766	1.000001
1	0	1	0.03536607938024017	1.000001
2	1	0.946166222306525	0.005619392737863826	0.05383377769347497
3	2	0.9359965807911726	-0.00023632217470059835	0.010169641515352379
4	3	0.9364070023767039	0.0000014022358910681376	0.00041042158553128427
5	4	0.9364045814731196	3.4371649970665885e-10	0.0000024209035843769655
6	5	0.9364045808795615	-4.996003610813204e-16	5.935580915661376e-10

```
Solution
0.9364045808795615 is an approximation to a root with a tolerance 0.000001
```

27 false position - Mathlab

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

a = 0
b = 1
Tolerance = 10e-7
iterations = 100

```
SOLUCION:
0.936405 es una aproximacion a una raìz con una tolerancia 1e-07

TABLA
```

Iteraciones	Xi	Xs	Xm	Ym	Error Absoluto
1.000000000000000	0	1.000000000000000	0.933940380718216	-0.001429076703686	1.000000100000000
2.000000000000000	0.933940380718216	1.000000000000000	0.936506051665625	0.000058756008358	0.002739620254291
3.000000000000000	0.933940380718216	0.936506051665625	0.936404730742641	0.000000086782541	0.000108202062268
4.000000000000000	0.933940380718216	0.936404730742641	0.936404581100869	0.000000000128154	0.000000159804614
5.000000000000000	0.933940380718216	0.936404581100869	0.936404580879889	0.000000000000189	0.000000000235987

28 false position - JavaScript

Input data

$$log((sin(x)^2) + 1) - x - 1/2$$

$$log((sin(x)^2) + 1) - 1/2$$

a = 0
b = 1
Tolerance = 10e-7
iterations = 100

(index)	counter	xi	fxi	error
0	0	0.5	-0.2931087267313766	1.000001
1	0	1	0.03536607938024017	1.000001
2	1	0.946166222306525	0.005619392737863826	0.05383377769347497
3	2	0.9359965807911726	-0.00023632217470059835	0.010169641515352379
4	3	0.9364070023767039	0.0000014022358910681376	0.00041042158553128427
5	4	0.9364045814731196	3.4371649970665885e-10	0.0000024209035843769655
6	5	0.9364045808795615	-4.996003610813204e-16	5.935580915661376e-10

```
Solution
0.9364045808795615 is an approximation to a root with a tolerance 0.000001
```

29 gaussian elimination for tridiagonal matrices - Mathlab

Input data

a = [0,3,2,1]
b = [1,4,3,3]
c = [4,1,4,0]
d = [1,1,1,1]

```
D:
  1.000000000000000
  0.250000000000000
  1.000000000000000
  1.000000000000000


D:
  1.000000000000000
  0.250000000000000
  0.153846153846154
  1.000000000000000


D:
  1.000000000000000
  0.250000000000000
  0.153846153846154
  0.478260869565217


X:
  0.217391304347826   0.195652173913043  -0.434782608695652   0.478260869565217


X:
  0.217391304347826   0.195652173913043  -0.434782608695652   0.478260869565217


X:
  0.217391304347826   0.195652173913043  -0.434782608695652   0.478260869565217
```

30 gaussian elimination for tridiagonal matrices-JavaScript

Input data
a = [0,3,2,1]
b = [1,4,3,3]
c = [4,1,4,0]
d = [1,1,1,1]

```
d: 1,0.25,1,1
d: 1,0.25,0.15384615384615385,1
d: 1,0.25,0.15384615384615385,0.4782608695652174
d: 1,0.25,-0.4347826086956522,0.4782608695652174
d: 1,0.19565217391304346,-0.4347826086956522,0.4782608695652174
d: 0.21739130434782616,0.19565217391304346,-0.4347826086956522,0.4782608695652174
[
  0.21739130434782616,
  0.19565217391304346,
  -0.4347826086956522,
  0.4782608695652174
]
```

Members signatures

Jose Miguel
Daniel Hernandez
Neller Pellegrino
Samuel Villegas