Numerical Analysis Calculator

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Intro

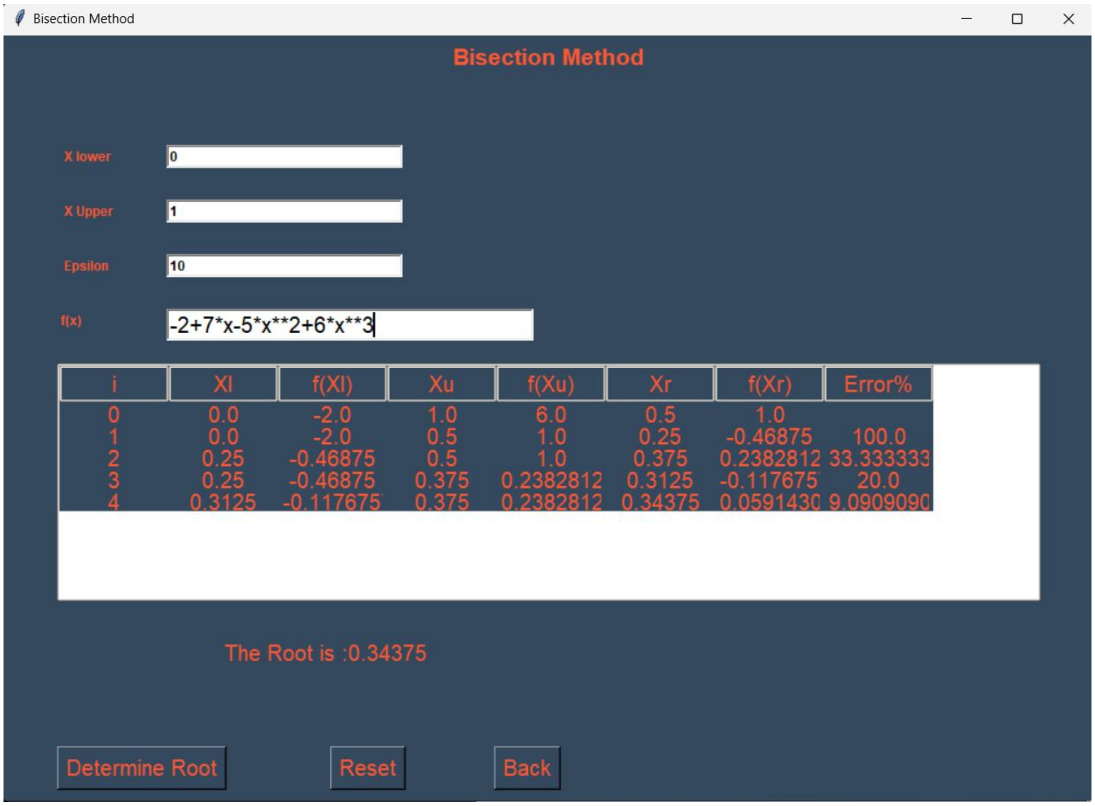
Numerical Analysis Calculator Developed in **Python** and powered by the libraries **Tkinter**, **Sympy**, and **Numpy**, this comprehensive tool is designed to assist in tackling a wide range of numerical problems encountered in various fields of mathematics, engineering, physics, and more. Whether you're a seasoned professional or a student diving into the realm of numerical analysis, this calculator is here to simplify complex computations and provide reliable solutions.

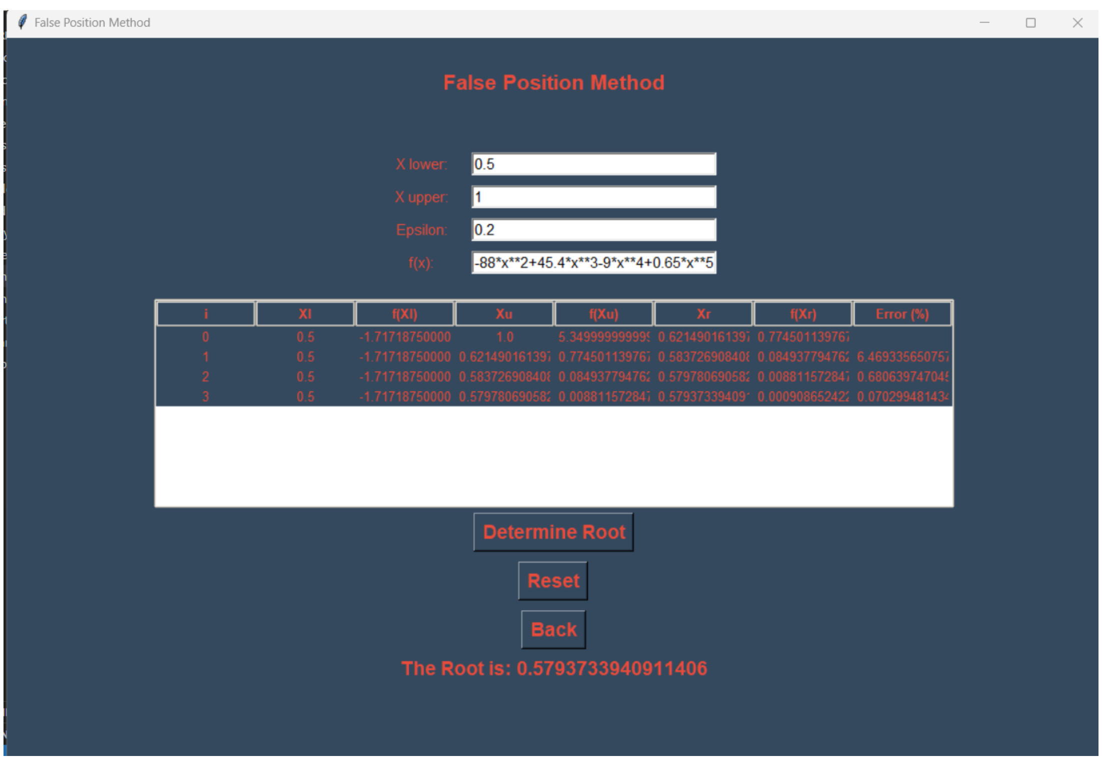
Brief Overview of Libraries:

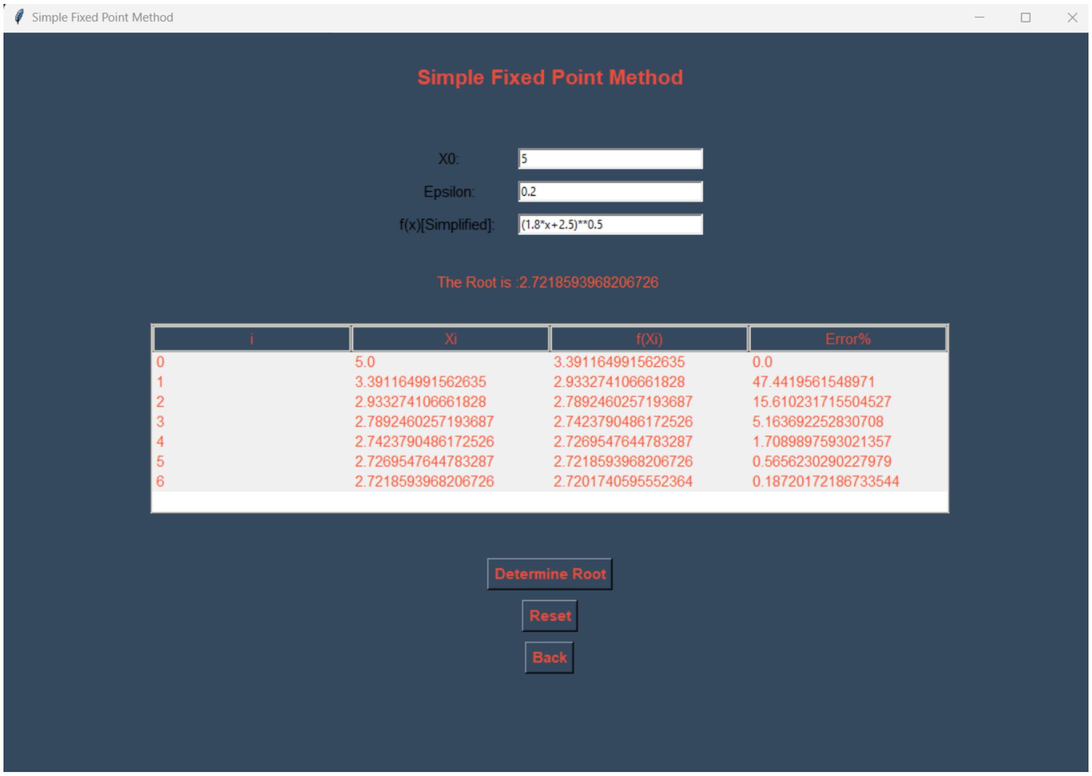
- Tkinter: Tkinter is a standard Python library for creating graphical user interfaces (GUIs). It provides a set of tools and widgets that allow developers to build interactive applications with ease.

- Sympy: Sympy is a Python library for symbolic mathematics. It enables users to perform symbolic computation, including algebraic manipulations, calculus operations, equation solving, and more.

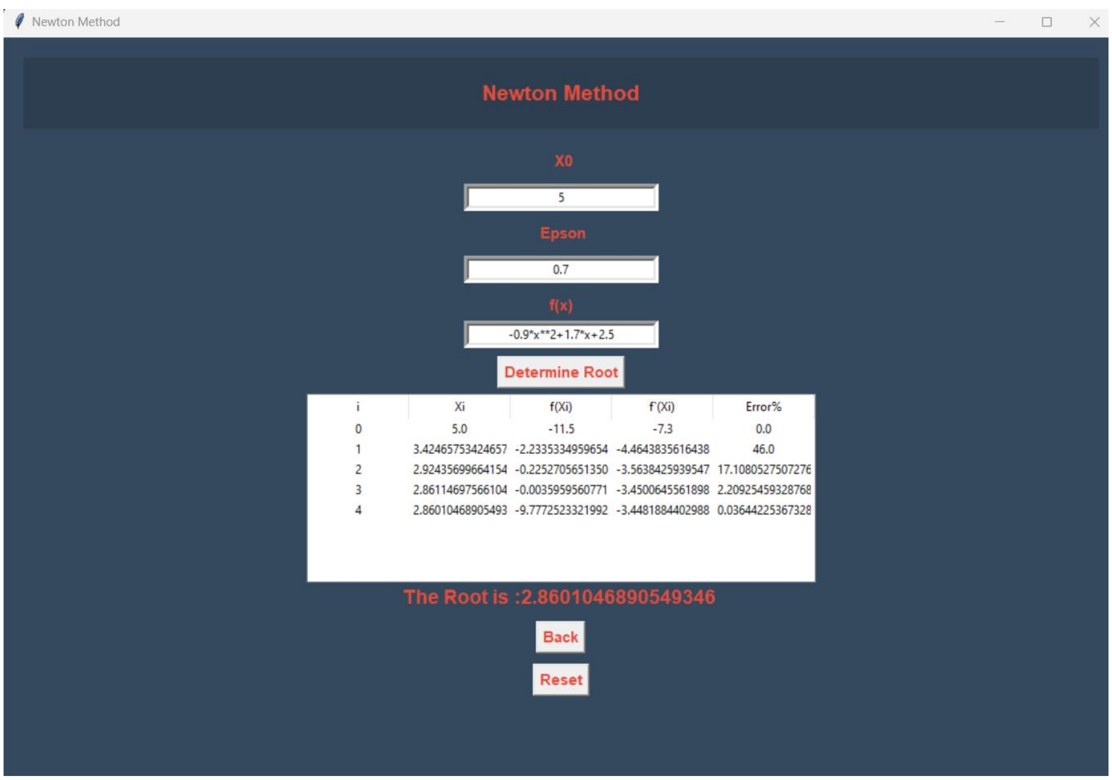
- Numpy: Numpy is a fundamental Python library for numerical computing. It provides support for multidimensional arrays, along with a collection of mathematical functions to operate on these arrays efficiently.


Bisection Method
Bisection Method
X lower 0
X Upper 1
Epsilon 10
f(x) -2+7*x-5*x**2+6*x**3
i | Xl | f(Xl) | Xu | f(Xu) | Xr | f(Xr) | Error%
0 | 0.0 | -2.0 | 1.0 | 6.0 | 0.5 | 1.0 |
1 | 0.0 | -2.0 | 0.5 | 1.0 | 0.25 | -0.46875 | 100.0
2 | 0.25 | -0.46875 | 0.5 | 1.0 | 0.375 | 0.2382812 | 33.333333
3 | 0.25 | -0.46875 | 0.375 | 0.2382812 | 0.3125 | -0.117675 | 20.0
4 | 0.3125 | -0.117675 | 0.375 | 0.2382812 | 0.34375 | 0.0591430 | 9.0909090
The Root is :0.34375
Determine Root
Reset
Back


False Position Method
False Position Method
X lower: 0.5
X upper: 1
Epsilon: 0.2
f(x): -88*x**2+45.4*x**3-9*x**4+0.65*x**5
i | Xl | f(Xl) | Xu | f(Xu) | Xr | f(Xr) | Error (%)
0 | 0.5 | -1.71718750000 | 1.0 | 5.349999999999 | 0.621490161397 | 0.774501139767 |
1 | 0.5 | -1.71718750000 | 0.621490161397 | 0.774501139767 | 0.583726908408 | 0.084937794762 | 6.469335650757
2 | 0.5 | -1.71718750000 | 0.583726908408 | 0.084937794762 | 0.579780690582 | 0.008811572847 | 0.680639747045
3 | 0.5 | -1.71718750000 | 0.579780690582 | 0.008811572847 | 0.579373394091 | 0.000908652422 | 0.070299481434
Determine Root
Reset
Back
The Root is: 0.5793733940911406

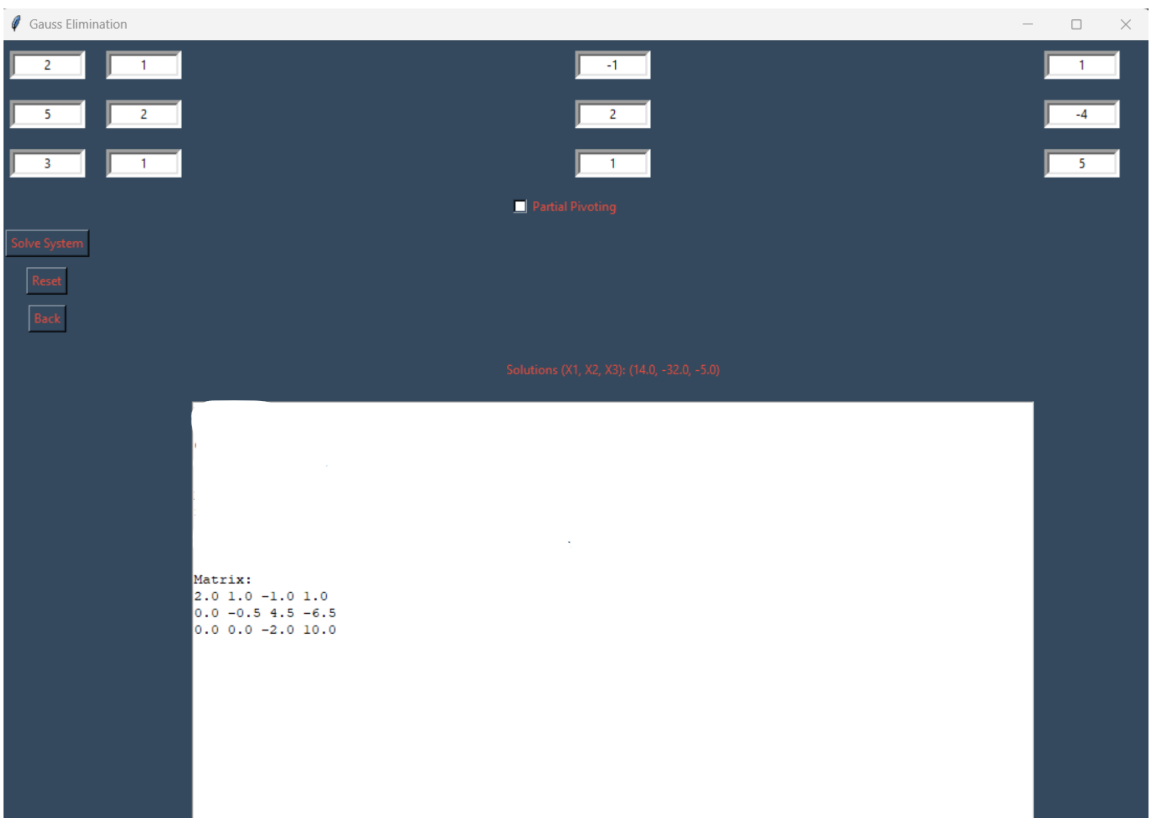


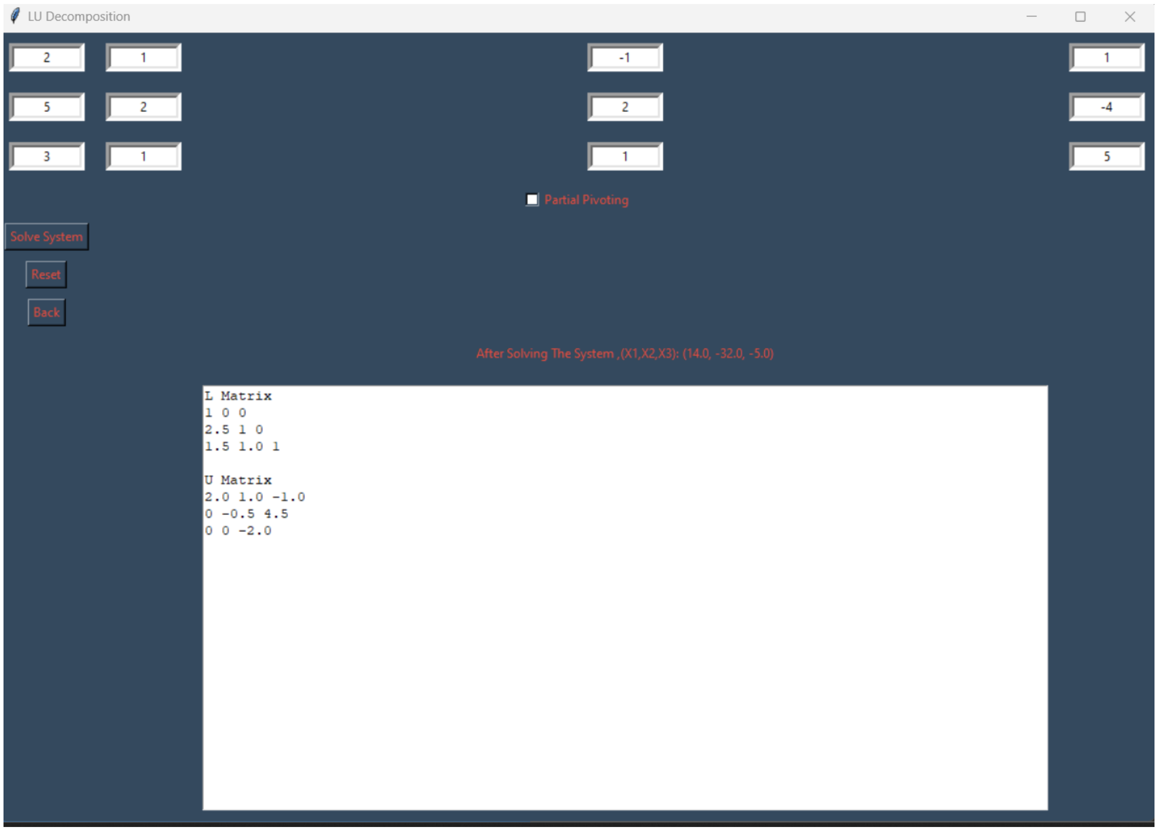
i	Xi	f(Xi)	Error%
0	5.0	3.391164991562635	0.0
1	3.391164991562635	2.933274106661828	47.4419561548971
2	2.933274106661828	2.7892460257193687	15.610231715504527
3	2.7892460257193687	2.7423790486172526	5.163692252830708
4	2.7423790486172526	2.7269547644783287	1.7089897593021357
5	2.7269547644783287	2.7218593968206726	0.5656230290227979
6	2.7218593968206726	2.7201740595552364	0.18720172186733544

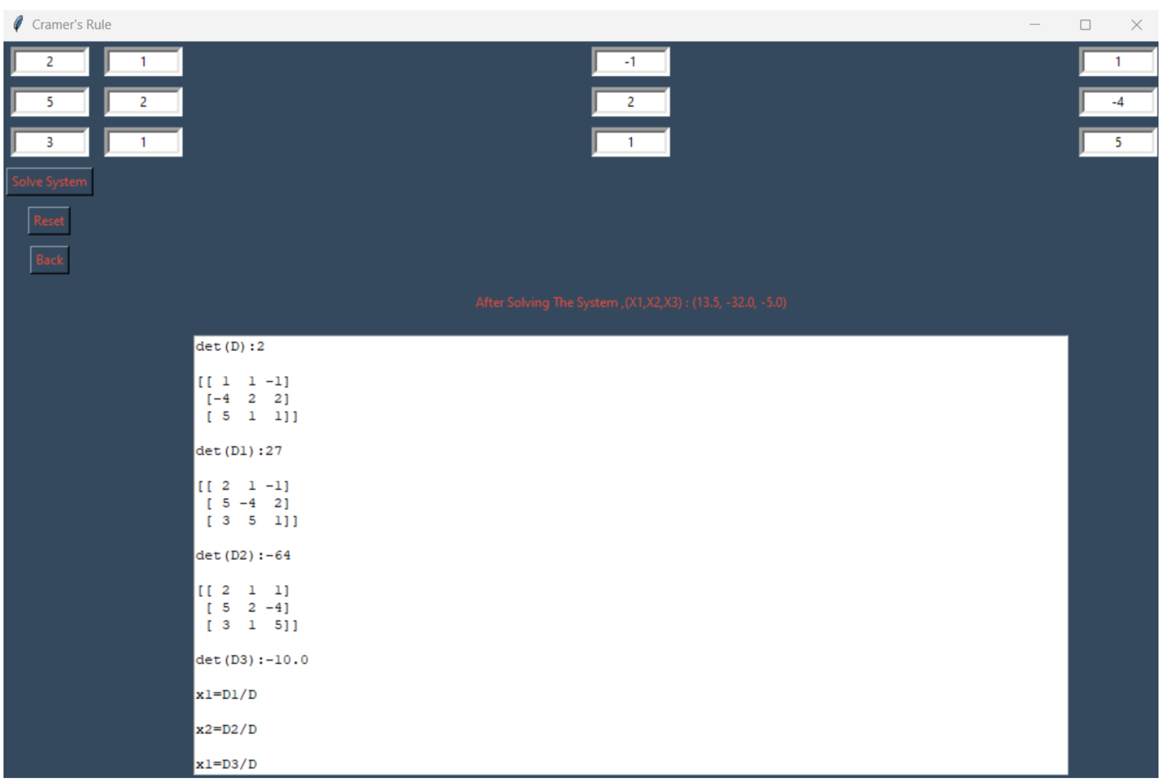


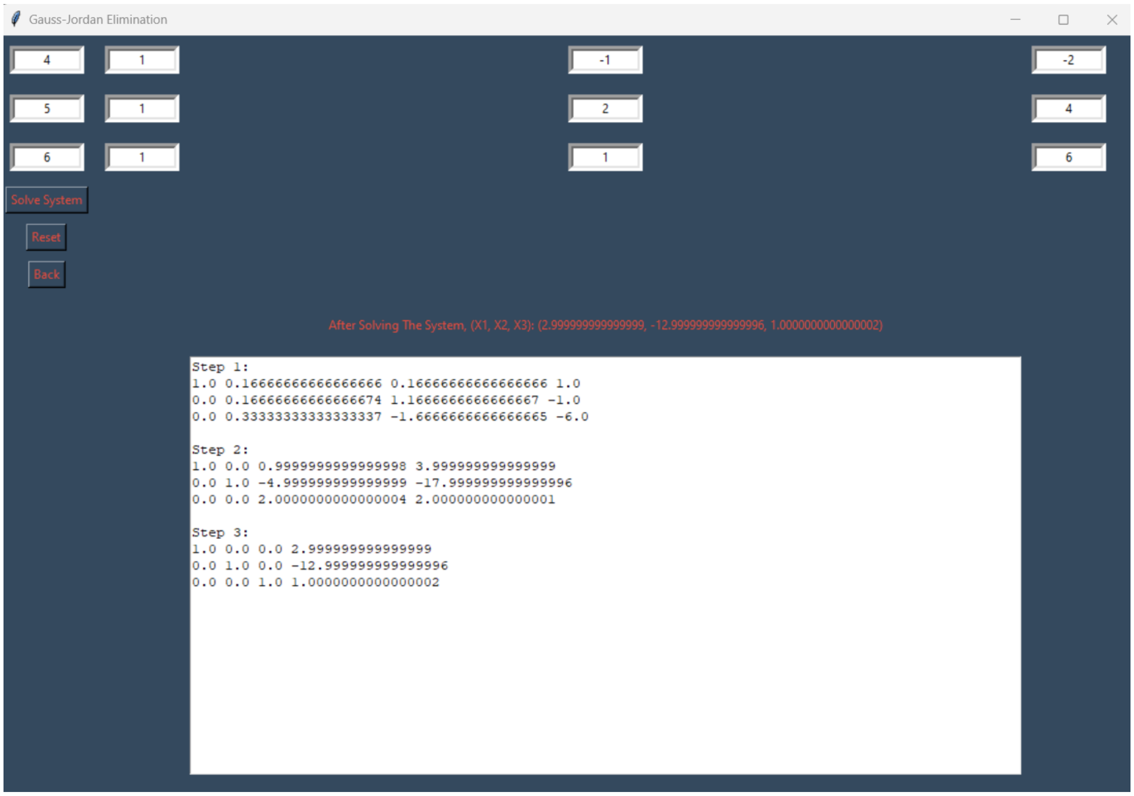
i	Xi	f(Xi)	f`(Xi)	Error%
0	5.0	-11.5	-7.3	0.0
1	3.42465753424657	-2.2335334959654	-4.4643835616438	46.0
2	2.92435699664154	-0.2252705651350	-3.5638425939547	17.1080527507276
3	2.86114697566104	-0.0035959560771	-3.4500645561898	2.20925459328768
4	2.86010468905493	-9.7772523321992	-3.4481884402988	0.03644225367328

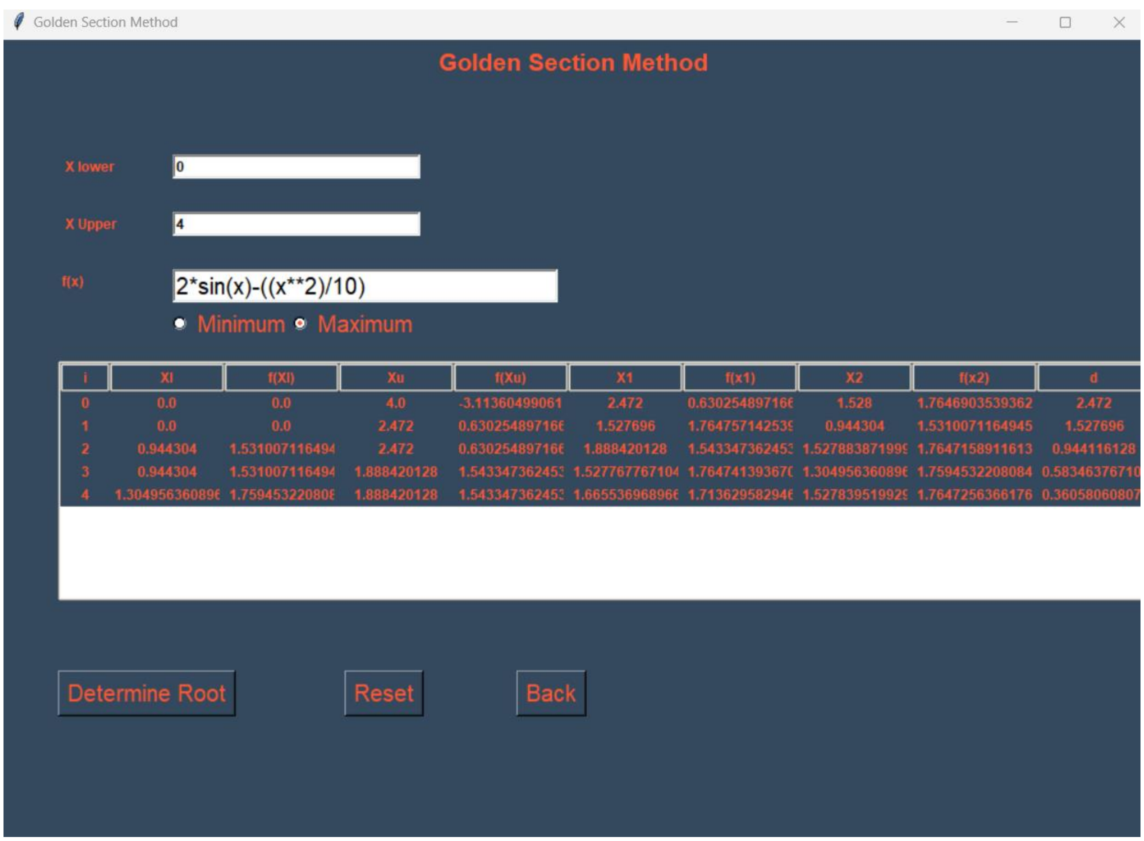
i	Xi-1	f(Xi-1)	Xi	f(Xi)	Error
0	2.5	-0.78125	3.5	0.60624999999998	0.0
1	3.5	0.60624999999998	3.06306306306306	-0.6667003014702	14.2647058823527
2	3.06306306306306	-0.6667003014702	3.29190623725681	-0.1648738547348	6.95169174637369
3	3.29190623725681	-0.1648738547348	3.36709210381394	0.07625562702461	2.23296138742288
4	3.36709210381394	0.07625562702461	3.34331506354550	-0.0044031454381	0.71118156131014
5	3.34331506354550	-0.0044031454381	3.34461304717697	-0.0001065638931	0.03880818537646

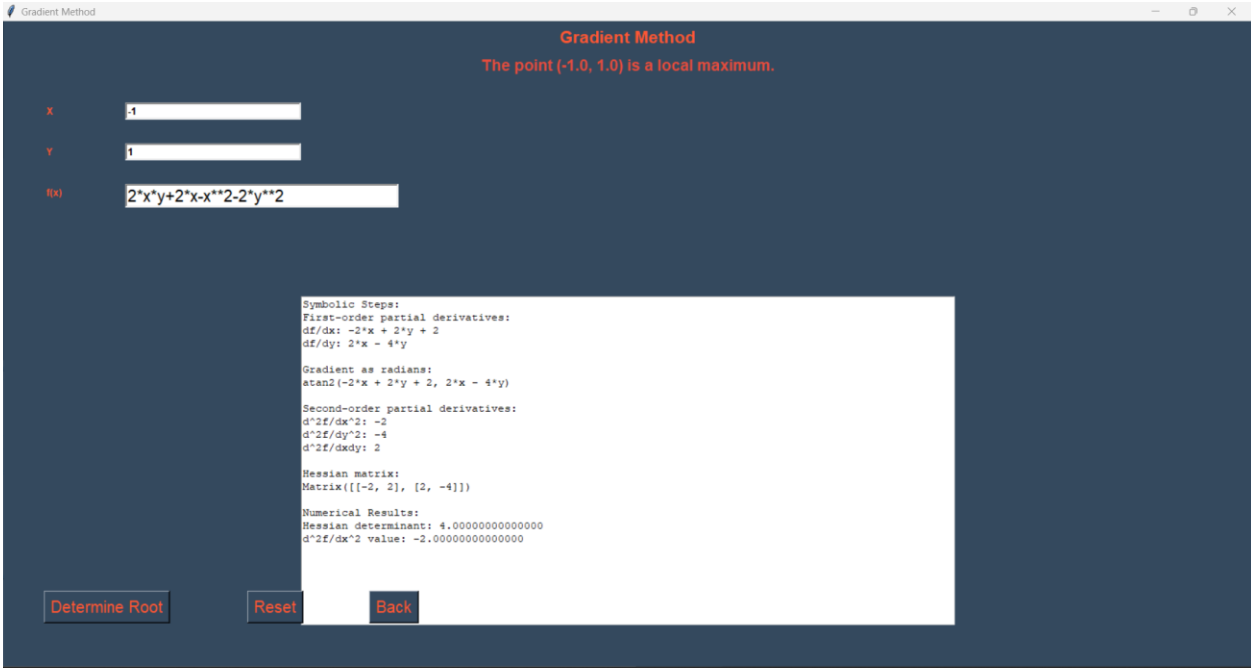



LU Decomposition
2
1
-1
1
5
2
2
-4
3
1
1
5
Partial Pivoting
Solve System
Reset
Back
After Solving The System ,(X1,X2,X3): (14.0, -32.0, -5.0)
L Matrix
1 0 0
2.5 1 0
1.5 1.0 1
U Matrix
2.0 1.0 -1.0
0 -0.5 4.5
0 0 -2.0


Cramer's Rule
2
1
-1
1
5
2
2
-4
3
1
1
5
Solve System
Reset
Back
After Solving The System ,(X1,X2,X3) : (13.5, -32.0, -5.0)
det(D):2
[[1 1 -1]
 [-4 2 2]
 [5 1 1]]
det(D1):27
[[2 1 -1]
 [5 -4 2]
 [3 5 1]]
det(D2):-64
[[2 1 1]
 [5 2 -4]
 [3 1 5]]
det(D3):-10.0
x1=D1/D
x2=D2/D
x1=D3/D


Gauss-Jordan Elimination
4
1
-1
-2
5
1
2
4
6
1
1
6
Solve System
Reset
Back
After Solving The System, (X1, X2, X3): (2.999999999999999, -12.999999999999996, 1.0000000000000002)
Step 1:
1.0 0.1666666666666666 0.1666666666666666 1.0
0.0 0.1666666666666674 1.166666666666667 -1.0
0.0 0.3333333333333337 -1.6666666666666665 -6.0
Step 2:
1.0 0.0 0.9999999999999998 3.999999999999999
0.0 1.0 -4.999999999999999 -17.999999999999996
0.0 0.0 2.0000000000000004 2.000000000000001
Step 3:
1.0 0.0 0.0 2.999999999999999
0.0 1.0 0.0 -12.999999999999996
0.0 0.0 1.0 1.0000000000000002


Golden Section Method
Golden Section Method
X lower
0
X Upper
4
f(x)
2*sin(x)-((x**2)/10)
Minimum
Maximum
i Xl f(Xl) Xu f(Xu) X1 f(x1) X2 f(x2) d
0 0.0 0.0 4.0 -3.11360499061 2.472 0.63025489716 1.528 1.7646903539362 2.472
1 0.0 0.0 2.472 0.63025489716 1.527696 1.76475714253 0.944304 1.5310071164945 1.527696
2 0.944304 1.53100711649 2.472 0.63025489716 1.888420128 1.54334736245 1.52788387199 1.7647158911613 0.944116128
3 0.944304 1.53100711649 1.888420128 1.54334736245 1.52776776710 1.76474139367 1.30495636089 1.7594532208084 0.58346376710
4 1.30495636089 1.75945322080 1.888420128 1.54334736245 1.66553696896 1.71362958294 1.52783951992 1.7647256366176 0.36058060807
Determine Root
Reset
Back



Gradient Method
Gradient Method
The point (-1.0, 1.0) is a local maximum.
X
-1
Y
1
f(x)
2*x*y+2*x-x**2-2*y**2
Symbolic Steps:
First-order partial derivatives:
df/dx: -2*x + 2*y + 2
df/dy: 2*x - 4*y
Gradient as radians:
atan2(-2*x + 2*y + 2, 2*x - 4*y)
Second-order partial derivatives:
d^2f/dx^2: -2
d^2f/dy^2: -4
d^2f/dxdy: 2
Hessian matrix:
Matrix([[-2, 2], [2, -4]])
Numerical Results:
Hessian determinant: 4.00000000000000
d^2f/dx^2 value: -2.00000000000000
Determine Root
Reset
Back