Second 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 Variables

Matrix A =
[4.0 , - 1.0 , 0.0 , 3.0]
[1.0 , 15.5 , 3.0 , 8.0]
[0.0 , - 1.3 , -4.0 , 1.1]
[14.0 , 5.0 , -2.0 , 30.0]

Vector B = [1, 1, 1, 1]

X0 = [0, 0, 0, 0]

Tol = 1e-7

Nmax = 100

Table =
[X, -1, 0, 3, 4]
[Y, 15.5, 3, 8, 1]

2 Methods test

- Simple Factoring LU

```
step  3
[4.0, -1.0, 0.0, 3.0]
[0.0, 15.75, 3.0, 7.25]
[0.0, 0.0, -3.7523809523809524, 1.6984126984126986]
[0.0, 0.0, 0.0, 13.949238578680202]
L step 3
[1, 0, 0, 0]
[0.25, 1, 0, 0]
[0.0, -0.08253968253968254, 1, 0]
[3.5, 0.5396825396825397, 0.9644670050761421, 1]
u step 3
[4.0, -1.0, 0.0, 3.0]
[0.0, 15.75, 3.0, 7.25]
[0.0, 0.0, -3.7523809523809524, 1.6984126984126986]
[0, 0, 0, 0]
u step 3
[4.0, -1.0, 0.0, 3.0]
[0.0, 15.75, 3.0, 7.25]
[0.0, 0.0, -3.7523809523809524, 1.6984126984126986]
[0.0, 0.0, 0.0, 13.949238578680202]
u [[4.0, -1.0, 0.0, 3.0], [0.0, 15.75, 3.0, 7.25], [0.0, 0.0, -3.7523809523809524, 1.6984126984126986], [0.0, 0.0, 0.0, 13.949238578680202]]
z  [1.0, 0.75, 1.061904761904762, -3.9289340101522843]
x  [0.5251091703056769, 0.2554585152838428, -0.41048034934497823, -0.28165938864628826]
```

- Partial Factoring LU

```
[1, 0, 0, 0]
step  3
[14.0, 5.0, -2.0, 30.0]
[0.0, 15.142857142857142, 3.142857142857143, 5.857142857142858]
[0.0, 0.0, -3.730188679245283, 1.6028301886792455]
[0.0, 0.0, 0.0, -4.169954476479514]
L step 3
[1, 0, 0, 0]
[0.07142857142857142, 1, 0, 0]
[0.0, -0.0858490566037736, 1, 0]
[0.2857142857142857, -0.16037735849056603, -0.28831562974203334, 1]
u step 3
[14.0, 5.0, -2.0, 30.0]
[0.0, 15.142857142857142, 3.142857142857143, 5.857142857142858]
[0.0, 0.0, -3.730188679245283, 1.6028301886792455]
[0.0, 0.0, 0.0, -4.169954476479514]
P step 3
[0, 0, 0, 1]
[0, 1, 0, 0]
[0, 0, 1, 0]
[1, 0, 0, 0]
z [1.0, 0.9285714285714286, 1.0797169811320755, 1.1745068285280729]
x [0.5251091703056769, 0.25545851528384284, -0.41048034934497823, -0.28165938864628826]
```

- Crout

```
U:
[[ 1.          -0.25        0.          0.75      ]
 [ 0.          1.          0.19047619  0.46031746]
 [ 0.          0.          1.         -0.45262267]
 [ 0.          0.          0.          1.        ]]
L:
[[ 4.          0.          0.          0.        ]
 [ 1.          15.75       0.          0.        ]
 [ 0.          -1.3        -3.75238095  0.        ]
 [14.          8.5        -3.61904762 13.94923858]]
x1 =  0.5251091703056769
x2 =  0.2554585152838428
x3 =  -0.4104803493449782
x4 =  -0.28165938864628826
```

- Doolittle
```

```
Matriz L:
[[ 1.           0.           0.           0.         ]
 [ 0.25         1.           0.           0.         ]
 [ 0.          -0.08253968  1.           0.         ]
 [ 3.5          0.53968254   0.96446701   1.        ]]
Matriz U:
[[ 4.          -1.           0.           3.         ]
 [ 0.          15.75         3.           7.25       ]
 [ 0.           0.          -3.75238095   1.6984127  ]
 [ 0.           0.           0.          13.94923858]]
x1: 0.5251091703056769
x2: 0.2554585152838428
x3: -0.41048034934497823
x4: -0.28165938864628826
```

- Cholesky

Matrix A =
[4 , 12 , -16]
[12 , 37 , -43]
[-16 , -43 , 98]

Vector B = [1, 1, 1]

```
Matriz L
[[ 2.  0.  0.]
 [ 6.  1.  0.]
 [-8.  5.  3.]]
Matriz U
[[ 2.  6. -8.]
 [ 0.  1.  5.]
 [ 0.  0.  3.]]
[ 37.91666667 -10.33333333   1.66666667]
```

- Jacobbi

```
error abs = 2.102987737450171e-07
x1: 0.5251
x2: 0.2555
x3: -0.4105
x4: -0.2817
itereración: #50
error abs = 1.58463531730239e-07
x1: 0.5251
x2: 0.2555
x3: -0.4105
x4: -0.2817
itereración: #51
error abs = 1.1940504535335952e-07
x1: 0.5251
x2: 0.2555
x3: -0.4105
x4: -0.2817
itereración: #52
error abs = 8.997367394699865e-08
x1: 0.5251
x2: 0.2555
x3: -0.4105
x4: -0.2817

T:
[[ 0.          0.25        0.         -0.75       ]
 [-0.06451613  0.         -0.19354839 -0.51612903]
 [-0.         -0.325       0.          0.275      ]
 [-0.46666667 -0.16666667  0.06666667  0.         ]]
C:
[ 0.25        0.06451613 -0.25        0.03333333]

Spectral radius:
0.75
PS C:\Users\Usuario\Desktop\Metodos entrega>
```

- Gauss-Seidel

```
iter:  30
x 1 :  0.5251090632546336
x 2 :  0.25545845077650514
x 3 :  -0.4104802989917548
x 4 :  -0.28165932458103016
E =  9.967983269187507e-08

T:
[[ 0.           0.25         0.          -0.75       ]
 [ 0.          -0.01612903 -0.19354839 -0.46774194]
 [ 0.           0.00524194  0.06290323  0.42701613]
 [ 0.          -0.11362903  0.03645161  0.45642473]]
C:
[ 0.25         0.0483871  -0.26572581 -0.1091129 ]

Spectral Radius:  0.5994876461601171
```

- SOR

```
17   2.155237e-04   [0.5251530968559291, 0.2553887920967195, -0.41...
18   1.666535e-04   [0.5250830323307982, 0.2554967023591342, -0.41...
19   1.138496e-04   [0.5251215061126127, 0.255442774363417, -0.410...
20   6.816800e-05   [0.5251055413197577, 0.25546126317745305, -0.4...
21   3.592628e-05   [0.5251083944326809, 0.2554616537970371, -0.41...
22   1.771948e-05   [0.525111497554948, 0.25545383964621243, -0.41...
23   1.064441e-05   [0.5251068247105375, 0.2554625956174943, -0.41...
24   8.426540e-06   [0.525110917873488, 0.25545572572131375, -0.41...
25   6.571071e-06   [0.5251081124078638, 0.25546007052908376, -0.4...
26   4.537825e-06   [0.5251096803308466, 0.2554578533523812, -0.41...
27   2.747051e-06   [0.525109010211074, 0.2554586503876049, -0.410...
28   1.462035e-06   [0.5251091496357326, 0.25545862495354826, -0.4...
29   7.201971e-07   [0.5251092576613404, 0.2554583364051015, -0.41...
30   4.207385e-07   [0.5251090789357744, 0.25545867555715984, -0.4...
31   3.293455e-07   [0.5251092396862909, 0.25545840380154267, -0.4...
32   2.588758e-07   [0.5251091275979577, 0.25545857854496995, -0.4...
33   1.807148e-07   [0.525109191360249, 0.2554584875672993, -0.410...
34   1.105975e-07   [0.5251091633139184, 0.2554585216829697, -0.41...
35   5.945865e-08   [0.5251091698894261, 0.2554585190301648, -0.41...
Spectral Radious   0.6312081938144991
X [ 0.52510917  0.25545852 -0.41048033 -0.28165939]
T [[-5.00000000e-01  3.75000000e-01  2.41217055e-17 -1.12500000e+00]
 [ 4.83870968e-02 -5.36290323e-01 -2.90322581e-01 -6.65322581e-01]
 [-2.35887097e-02  2.61441532e-01 -3.58467742e-01  7.36844758e-01]
 [ 3.35544355e-01 -1.02283266e-01  3.67338710e-02  5.27515121e-01]]
C [ 0.375       0.06048387 -0.40448589 -0.26806956]
```

1.

- Vandermonde

1. $x : [-1, 0, 3, 4]$

2. $y : [15.5, 3, 8, 1]$

```
A:
[-1, 1, -1, 1]
[0, 0, 0, 1]
[27, 9, 3, 1]
[64, 16, 4, 1]
step 0
```

- Divided Differences

```
Matrix D:
[[ 15.5          0.           0.           0.         ]
 [  3.         -12.5          0.           0.         ]
 [  8.           1.66666667   3.54166667   0.         ]
 [  1.          -7.          -2.16666667  -1.14166667]]
Coef:  [ 15.5         -12.5          3.54166667  -1.14166667]
Newton Polinom :   +15.5-12.5(x+1)+3.5416666666666665(x+1)(x)-1.1416666666666666(x+1)(x)(x-3)
```

- Lagrange

1. $x : [-1, 0, 3, 4]$

2. $y : [15.5, 3, 8, 1]$

```
-0.775(x - 0) (x - 3) (x - 4)  + 0.25(x + 1) (x - 3) (x - 4)  -0.6666666666666666(x + 1) (x - 0) (x - 4)  + 0.05(x + 1) (x - 0) (x - 3)
```

- Spline 1

```
x  [-12.5, 3.0, 1.6666666666666667, 3.0, -7.0, 29.0]

 Traces:

-12.5x+3.0
+1.6666666666666667x+3.0
-7.0x+29.0
```

- spline 2

```
x  [0.0, -12.500000000000007, 2.999999999999994, 4.722222222222225, -12.5000000000000
000000006]

 Traces:

+0.0x**2-12.500000000000007x+2.999999999999994
+4.722222222222225x**2-12.500000000000007x+2.999999999999994
-22.833333333334x**2+152.83333333337x-245.00000000000006
```

- spline 3

```
x  [2.5333333333333328, 7.599999999999999, -7.433333333333333, 3.0, -1.52222222222222
88.56666666666665, -92.99999999999]

 Traces:

+2.5333333333333328x**3+7.599999999999999x**2-7.43333333333333x+3.0
-1.52222222222222222x**3+7.6x**2-7.433333333333333x+3.0
+2.033333333333323x**3-24.39999999999999x**2+88.56666666666665x-92.99999999999999
```

3   Signatures

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