Tarea N°3

Presentar las capturas de pantalla en archivo PDF.

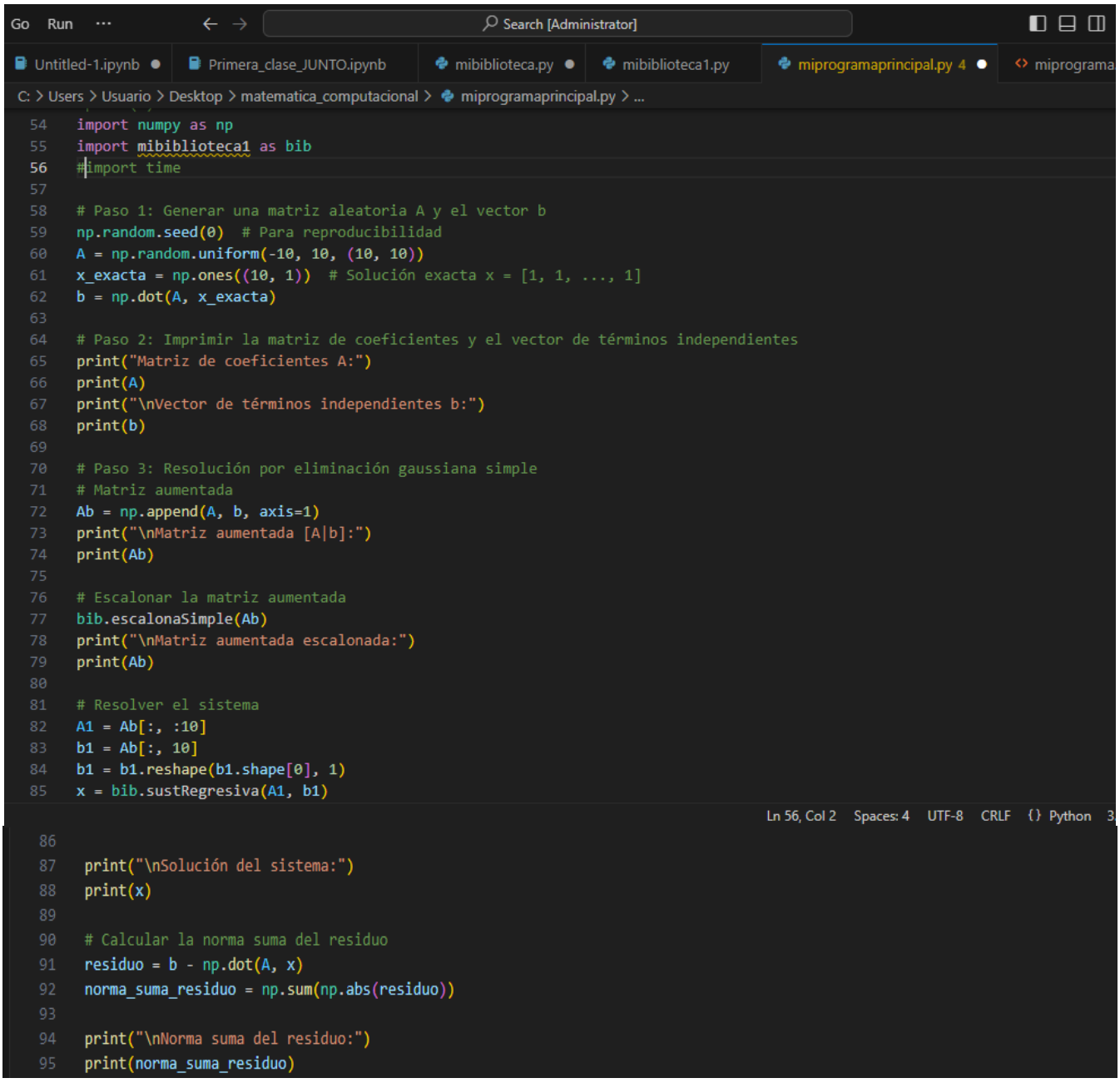
1. Generar aleatoriamente un sistema lineal de 10 x 10, con entradas reales en el intervalo [-10,10] y con solución exacta x= [1,1,...,1].

2. Imprimir la matriz de coeficientes y el vector de términos independientes del sistema.

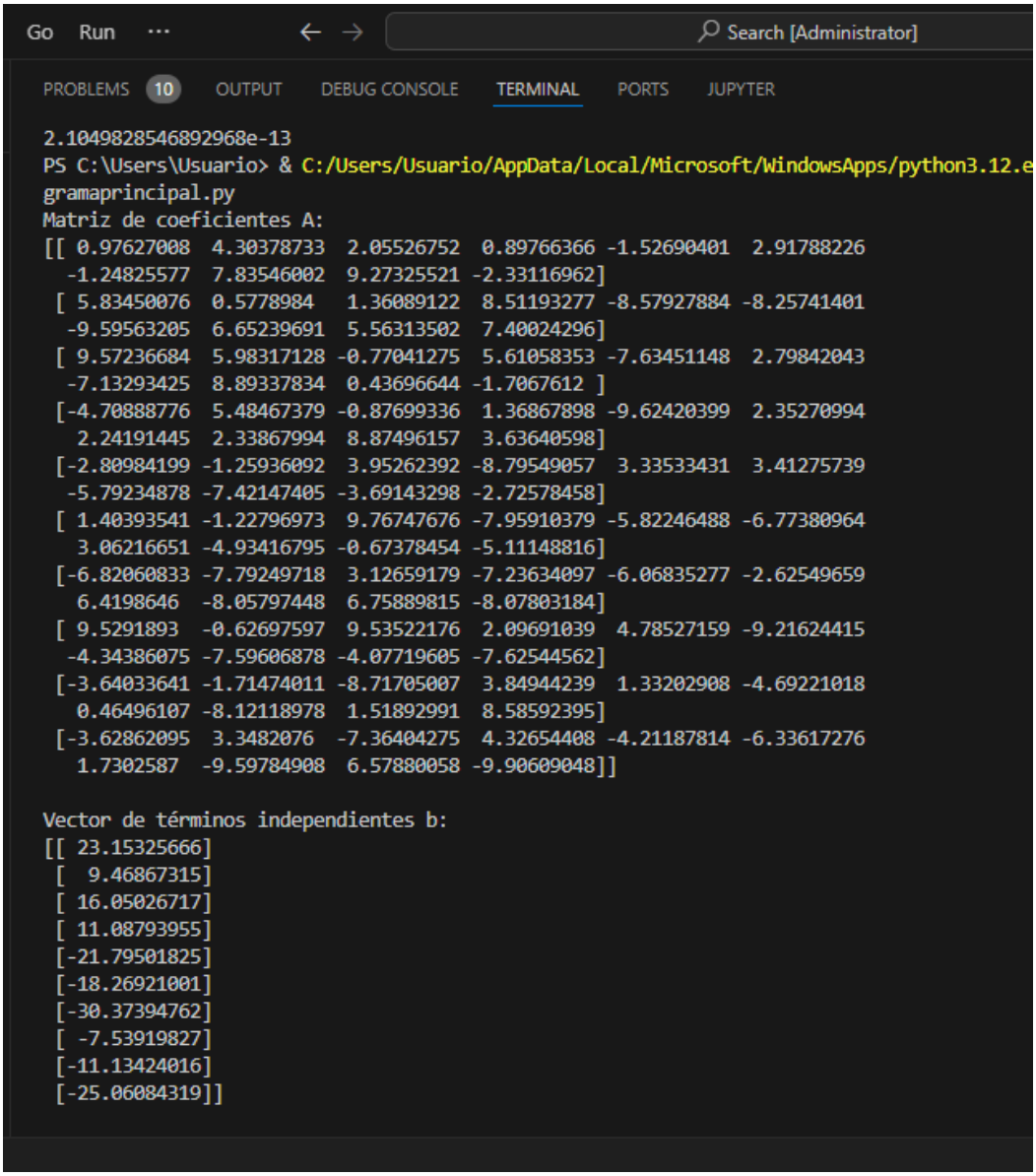
3. Resolver por eliminación gaussiana simple, imprimiendo en pantalla lo siguiente: matriz aumentada, matriz aumentada escalonada, solución del sistema y la norma suma del residuo.

Con np.random.seed(0), A y b tendremos los mismos valores en cada ejecución del script.

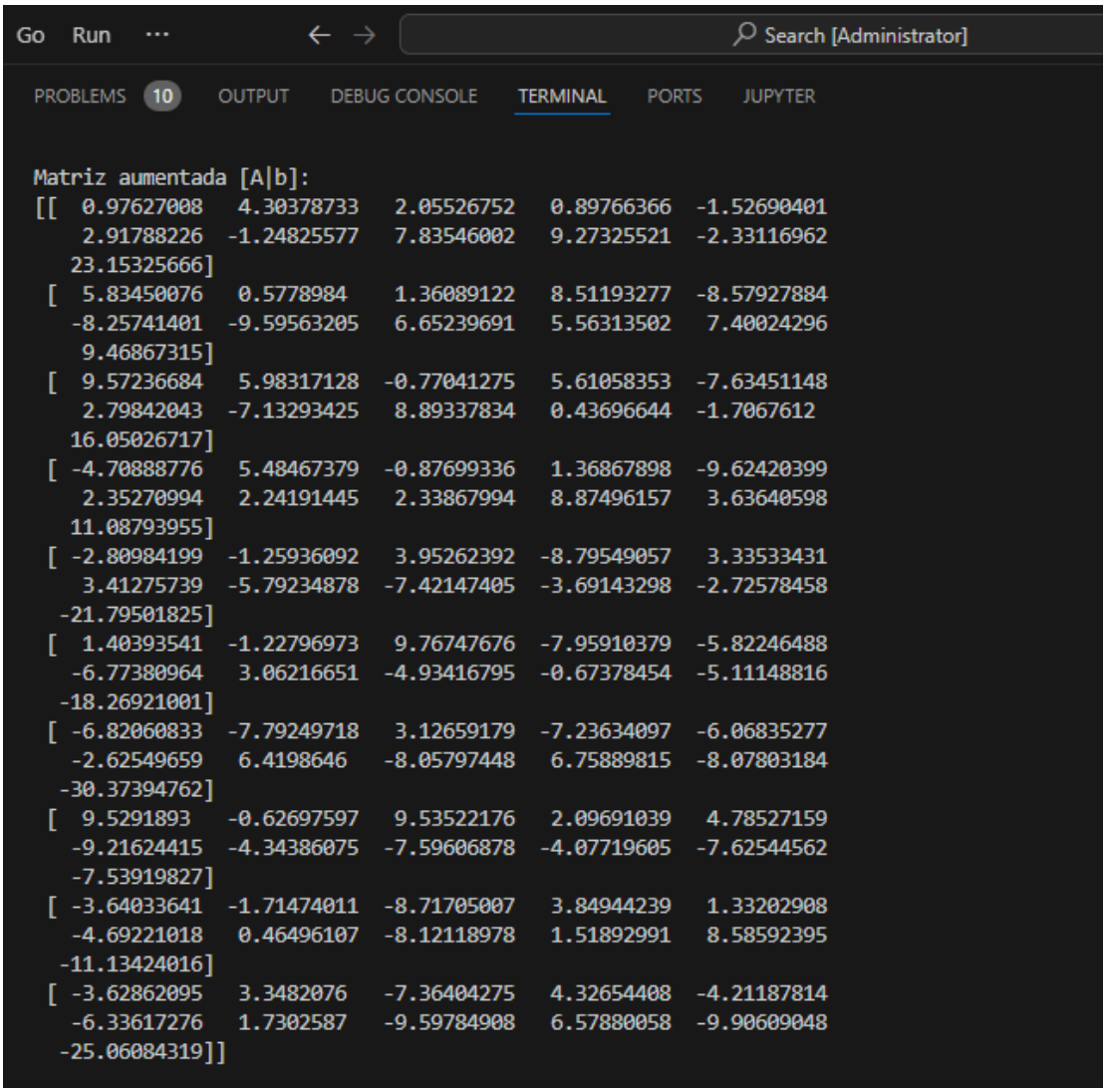
Como se observa en el siguiente programa trabajado en clase miblioteca1.py y miprogramaprincipal.py



Tarea N°3


Go Run ···
Search [Administrator]
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL PORTS JUPYTER
2.1049828546892968e-13
PS C:\Users\Usuario> & C:/Users/Usuario/AppData/Local/Microsoft/WindowsApps/python3.12.e
gramaprincipal.py
Matriz de coeficientes A:
[[0.97627008 4.30378733 2.05526752 0.89766366 -1.52690401 2.91788226
-1.24825577 7.83546002 9.27325521 -2.33116962]
[5.83450076 0.5778984 1.36089122 8.51193277 -8.57927884 -8.25741401
-9.59563205 6.65239691 5.56313502 7.40024296]
[9.57236684 5.98317128 -0.77041275 5.61058353 -7.63451148 2.79842043
-7.13293425 8.89337834 0.43696644 -1.7067612]
[-4.70888776 5.48467379 -0.87699336 1.36867898 -9.62420399 2.35270994
2.24191445 2.33867994 8.87496157 3.63640598]
[-2.80984199 -1.25936092 3.95262392 -8.79549057 3.33533431 3.41275739
-5.79234878 -7.42147405 -3.69143298 -2.72578458]
[1.40393541 -1.22796973 9.76747676 -7.95910379 -5.82246488 -6.77380964
3.06216651 -4.93416795 -0.67378454 -5.11148816]
[-6.82060833 -7.79249718 3.12659179 -7.23634097 -6.06835277 -2.62549659
6.4198646 -8.05797448 6.75889815 -8.07803184]
[9.5291893 -0.62697597 9.53522176 2.09691039 4.78527159 -9.21624415
-4.34386075 -7.59606878 -4.07719605 -7.62544562]
[-3.64033641 -1.71474011 -8.71705007 3.84944239 1.33202908 -4.69221018
0.46496107 -8.12118978 1.51892991 8.58592395]
[-3.62862095 3.3482076 -7.36404275 4.32654408 -4.21187814 -6.33617276
1.7302587 -9.59784908 6.57880058 -9.90609048]]
Vector de términos independientes b:
[[23.15325666]
[9.46867315]
[16.05026717]
[11.08793955]
[-21.79501825]
[-18.26921001]
[-30.37394762]
[-7.53919827]
[-11.13424016]
[-25.06084319]]

Tarea N°3


Go Run ···
Search [Administrator]
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL PORTS JUPYTER
Matriz aumentada [A|b]:
[[0.97627008 4.30378733 2.05526752 0.89766366 -1.52690401
2.91788226 -1.24825577 7.83546002 9.27325521 -2.33116962
23.15325666]
[5.83450076 0.5778984 1.36089122 8.51193277 -8.57927884
-8.25741401 -9.59563205 6.65239691 5.56313502 7.40024296
9.46867315]
[9.57236684 5.98317128 -0.77041275 5.61058353 -7.63451148
2.79842043 -7.13293425 8.89337834 0.43696644 -1.7067612
16.05026717]
[-4.70888776 5.48467379 -0.87699336 1.36867898 -9.62420399
2.35270994 2.24191445 2.33867994 8.87496157 3.63640598
11.08793955]
[-2.80984199 -1.25936092 3.95262392 -8.79549057 3.33533431
3.41275739 -5.79234878 -7.42147405 -3.69143298 -2.72578458
-21.79501825]
[1.40393541 -1.22796973 9.76747676 -7.95910379 -5.82246488
-6.77380964 3.06216651 -4.93416795 -0.67378454 -5.11148816
-18.26921001]
[-6.82060833 -7.79249718 3.12659179 -7.23634097 -6.06835277
-2.62549659 6.4198646 -8.05797448 6.75889815 -8.07803184
-30.37394762]
[9.5291893 -0.62697597 9.53522176 2.09691039 4.78527159
-9.21624415 -4.34386075 -7.59606878 -4.07719605 -7.62544562
-7.53919827]
[-3.64033641 -1.71474011 -8.71705007 3.84944239 1.33202908
-4.69221018 0.46496107 -8.12118978 1.51892991 8.58592395
-11.13424016]
[-3.62862095 3.3482076 -7.36404275 4.32654408 -4.21187814
-6.33617276 1.7302587 -9.59784908 6.57880058 -9.90609048
-25.06084319]]

Tarea N°3

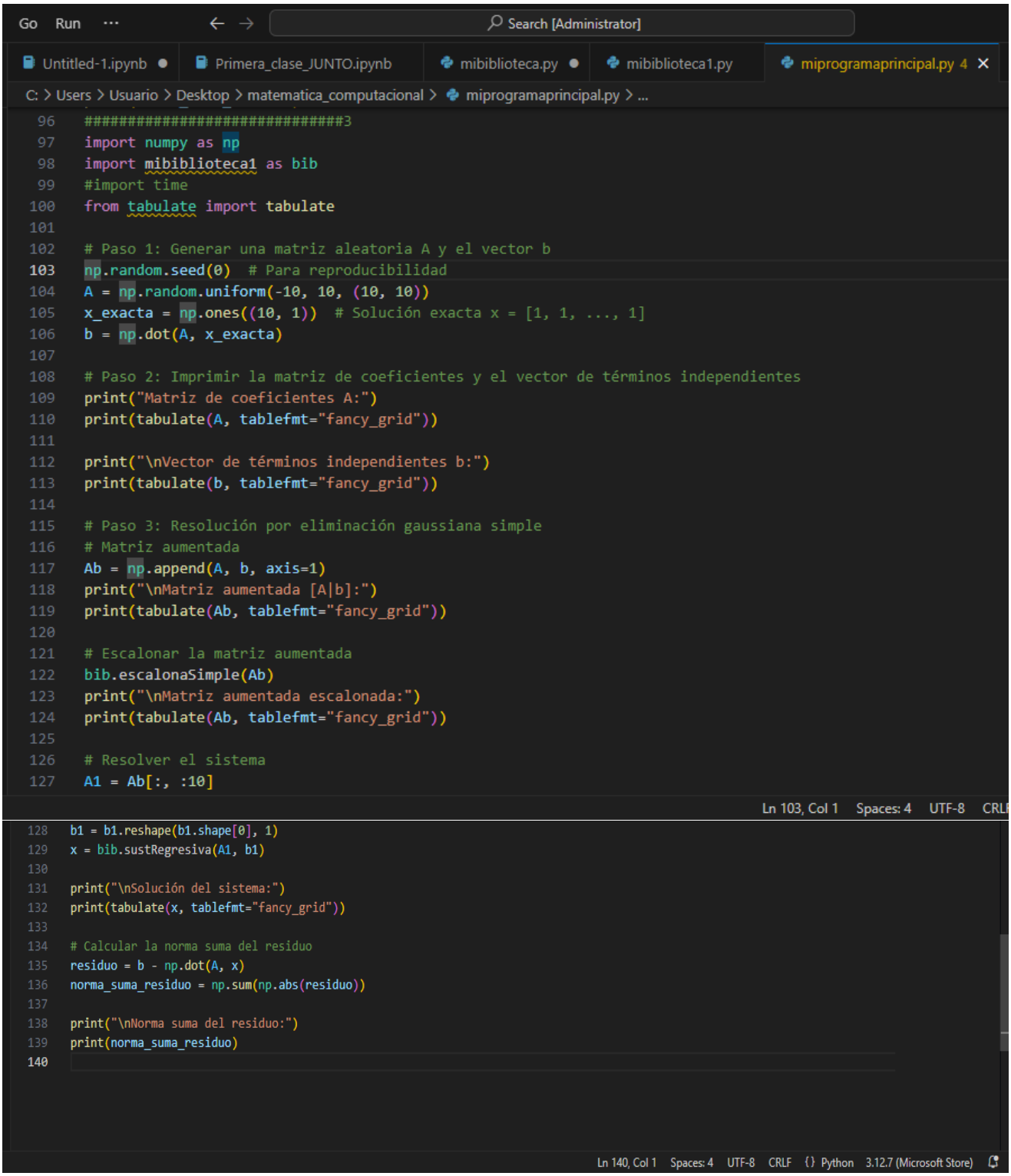
```
Matriz aumentada escalonada:
[[ 9.76270079e-01  4.30378733e+00  2.05526752e+00  8.97663660e-01
  -1.52690401e+00  2.91788226e+00 -1.24825577e+00  7.83546002e+00
   9.27325521e+00 -2.33116962e+00  2.31532567e+01]
 [ 0.00000000e+00 -2.51429047e+01 -1.09220417e+01  3.14720898e+00
   5.45985600e-01 -2.56956072e+01 -2.13565819e+00 -4.01748064e+01
  -4.98567900e+01  2.13320547e+01 -1.28902559e+02]
 [ 0.00000000e+00  0.00000000e+00 -5.19037278e+00 -7.72425834e+00
   6.55040974e+00  1.12002115e+01  8.18244771e+00 -1.00661555e+01
  -1.86743563e+01 -9.57606763e+00 -2.52981416e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  1.25011427e+01
  -1.94022854e+01 -1.54943384e+01 -9.73442098e+00  2.78299812e+00
   1.00688641e+01  1.90191761e+01 -2.58863761e-01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -1.35713081e+01 -3.95662073e+00 -1.19802024e+01 -9.67277123e+00
  -7.26373379e+00  9.44749940e+00 -3.69971368e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -4.08622288e+00  2.83209013e+01  3.23161391e+00
   9.31750513e-01 -9.31289295e+00  1.90851499e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  6.11466556e+01  1.82702541e+01
   2.01013805e+01 -3.36807688e+01  6.58375215e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00 -1.77635684e-15 -1.88279571e+01
  -1.09468932e+01 -4.45483594e+00 -3.42296862e+01]
 [ 0.00000000e+00 -1.77635684e-15  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00 -6.12040388e-16  0.00000000e+00
   1.99631398e+01 -1.05726222e+01  9.39051762e+00]
 [ 0.00000000e+00  2.41794748e-15  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  3.47124519e-16  0.00000000e+00
   3.55271368e-15 -1.94633229e+01 -1.94633229e+01]]
```

```
Solución del sistema:
[[1.]
 [1.]
 [1.]
 [1.]
 [1.]
 [1.]
 [1.]
 [1.]
 [1.]
 [1.]]

Norma suma del residuo:
1.971756091734278e-13
```

Tarea N°3

Para visualizar mejor importamos labulate



Tarea N°3

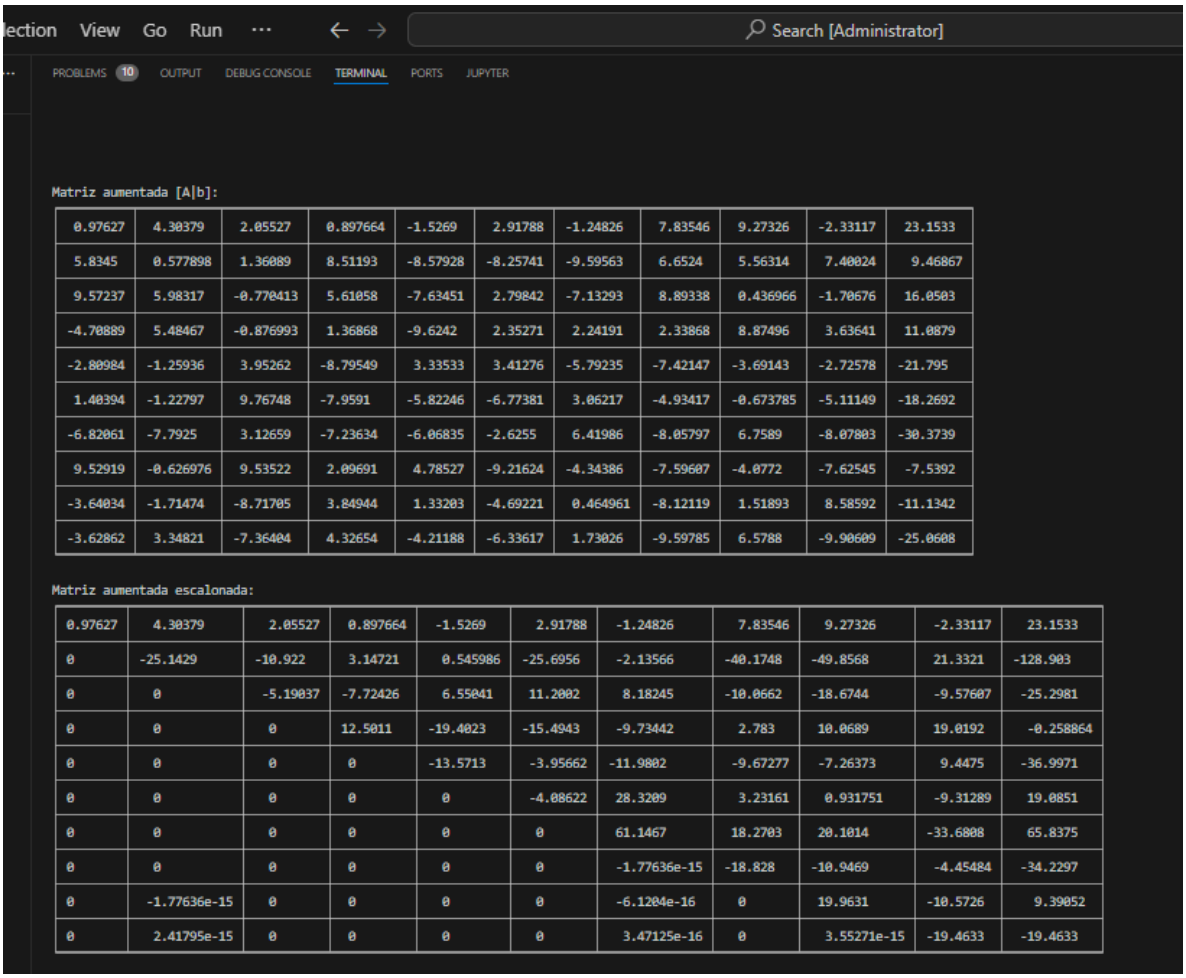
Matriz de coeficientes A:

0.97627	4.30379	2.05527	0.897664	-1.5269	2.91788	-1.24826	7.83546	9.27326	-2.33117
5.8345	0.577898	1.36089	8.51193	-8.57928	-8.25741	-9.59563	6.6524	5.56314	7.40024
9.57237	5.98317	-0.770413	5.61058	-7.63451	2.79842	-7.13293	8.89338	0.436966	-1.70676
-4.70889	5.48467	-0.876993	1.36868	-9.6242	2.35271	2.24191	2.33868	8.87496	3.63641
-2.80984	-1.25936	3.95262	-8.79549	3.33533	3.41276	-5.79235	-7.42147	-3.69143	-2.72578
1.40394	-1.22797	9.76748	-7.9591	-5.82246	-6.77381	3.06217	-4.93417	-0.673785	-5.11149
-6.82061	-7.7925	3.12659	-7.23634	-6.06835	-2.6255	6.41986	-8.05797	6.7589	-8.07803
9.52919	-0.626976	9.53522	2.09691	4.78527	-9.21624	-4.34386	-7.59607	-4.0772	-7.62545
-3.64034	-1.71474	-8.71705	3.84944	1.33203	-4.69221	0.464961	-8.12119	1.51893	8.58592
-3.62862	3.34821	-7.36404	4.32654	-4.21188	-6.33617	1.73026	-9.59785	6.5788	-9.90609

Vector de términos independientes b:

23.1533
9.46867
16.0503
11.0879
-21.795
-18.2692
-30.3739
-7.5392
-11.1342
-25.0608

Tarea N°3


lection View Go Run ···
Search [Administrator]
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL PORTS JUPYTER
Matriz aumentada [A|b]:
0.97627 4.30379 2.05527 0.897664 -1.5269 2.91788 -1.24826 7.83546 9.27326 -2.33117 23.1533
5.8345 0.577898 1.36089 8.51193 -8.57928 -8.25741 -9.59563 6.6524 5.56314 7.40024 9.46867
9.57237 5.98317 -0.770413 5.61858 -7.63451 2.79842 -7.13293 8.89338 0.436966 -1.70676 16.0503
-4.70889 5.48467 -0.876993 1.36868 -9.6242 2.35271 2.24191 2.33868 8.87496 3.63641 11.0879
-2.80984 -1.25936 3.95262 -8.79549 3.33533 3.41276 -5.79235 -7.42147 -3.69143 -2.72578 -21.795
1.40394 -1.22797 9.76748 -7.9591 -5.82246 -6.77381 3.06217 -4.93417 -0.673785 -5.11149 -18.2692
-6.82061 -7.7925 3.12659 -7.23634 -6.06835 -2.6255 6.41986 -8.05797 6.7589 -8.07803 -30.3739
9.52919 -0.626976 9.53522 2.09691 4.78527 -9.21624 -4.34386 -7.59607 -4.0772 -7.62545 -7.5392
-3.64034 -1.71474 -8.71705 3.84944 1.33203 -4.69221 0.464961 -8.12119 1.51893 8.58592 -11.1342
-3.62862 3.34821 -7.36404 4.32654 -4.21188 -6.33617 1.73026 -9.59785 6.5788 -9.90609 -25.0608
Matriz aumentada escalonada:
0.97627 4.30379 2.05527 0.897664 -1.5269 2.91788 -1.24826 7.83546 9.27326 -2.33117 23.1533
0 -25.1429 -10.922 3.14721 0.545986 -25.6956 -2.13566 -40.1748 -49.8568 21.3321 -128.903
0 0 -5.19037 -7.72426 6.55041 11.2002 8.18245 -10.0662 -18.6744 -9.57607 -25.2981
0 0 0 12.5011 -19.4023 -15.4943 -9.73442 2.783 10.0689 19.0192 -0.258864
0 0 0 0 -13.5713 -3.95662 -11.9802 -9.67277 -7.26373 9.4475 -36.9971
0 0 0 0 0 -4.08622 28.3209 3.23161 0.931751 -9.31289 19.0851
0 0 0 0 0 0 61.1467 18.2703 20.1014 -33.6808 65.8375
0 0 0 0 0 0 -1.77636e-15 -18.828 -10.9469 -4.45484 -34.2297
0 -1.77636e-15 0 0 0 0 -6.1204e-16 0 19.9631 -10.5726 9.39052
0 2.41795e-15 0 0 0 0 3.47125e-16 0 3.55271e-15 -19.4633 -19.4633

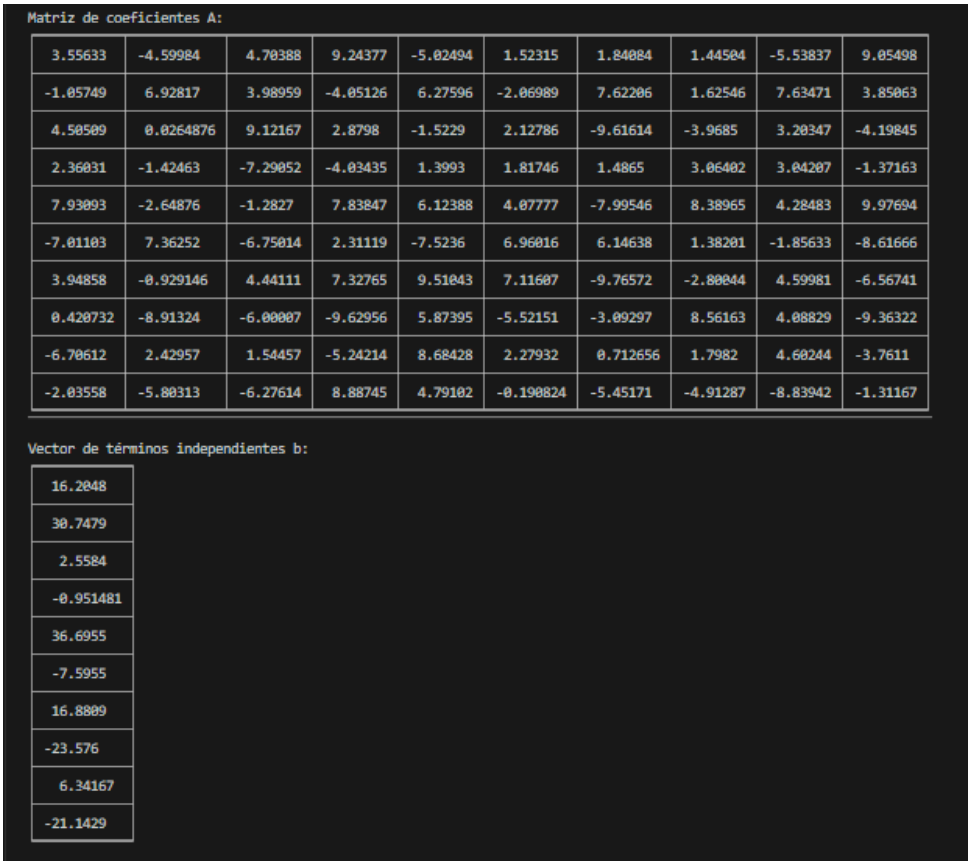

Solución del sistema:
1
1
1
1
1
1
1
1
1
1
Norma suma del residuo:
1.971756091734278e-13
PS C:\Users\Usuario>

Comentario

Si no ponemos np.random.seed(0), cada vez que ejecutemos nuestro script, la matriz A generada y el vector b serán diferentes debido a la naturaleza aleatoria del generador de números. Esto significa que no obtendremos resultados reproducibles.

Caso contrario podemos omitir y generara matrices diferentes en cada iteración que hagamos correr.

Por ejemplo aquí:



Matriz de coeficientes A:

3.55633	-4.59984	4.70388	9.24377	-5.02494	1.52315	1.84084	1.44504	-5.53837	9.05498
-1.05749	6.92817	3.98959	-4.05126	6.27596	-2.06989	7.62206	1.62546	7.63471	3.85063
4.50509	0.0264876	9.12167	2.8798	-1.5229	2.12786	-9.61614	-3.9685	3.20347	-4.19845
2.36031	-1.42463	-7.29052	-4.03435	1.3993	1.81746	1.4865	3.06402	3.04207	-1.37163
7.93093	-2.64876	-1.2827	7.83847	6.12388	4.07777	-7.99546	8.38965	4.28483	9.97694
-7.01103	7.36252	-6.75014	2.31119	-7.5236	6.96016	6.14638	1.38201	-1.85633	-8.61666
3.94858	-0.929146	4.44111	7.32765	9.51043	7.11607	-9.76572	-2.80044	4.59981	-6.56741
0.420732	-8.91324	-6.00007	-9.62956	5.87395	-5.52151	-3.09297	8.56163	4.08829	-9.36322
-6.70612	2.42957	1.54457	-5.24214	8.68428	2.27932	0.712656	1.7982	4.60244	-3.7611
-2.03558	-5.80313	-6.27614	8.88745	4.79102	-0.190824	-5.45171	-4.91287	-8.83942	-1.31167

Vector de términos independientes b:

16.2048
30.7479
2.5584
-0.951481
36.6955
-7.5955
16.8809
-23.576
6.34167
-21.1429

Tarea N°3

Matriz aumentada [A|b]:

3.55633	-4.59984	4.70388	9.24377	-5.02494	1.52315	1.84084	1.44504	-5.53837	9.05498	16.2048
-1.05749	6.92817	3.98959	-4.05126	6.27596	-2.06989	7.62206	1.62546	7.63471	3.85063	30.7479
4.50509	0.0264876	9.12167	2.8798	-1.5229	2.12786	-9.61614	-3.9685	3.20347	-4.19845	2.5584
2.36031	-1.42463	-7.29052	-4.03435	1.3993	1.81746	1.4865	3.06402	3.04207	-1.37163	-0.951481
7.93093	-2.64876	-1.2827	7.83847	6.12388	4.07777	-7.99546	8.38965	4.28483	9.97694	36.6955
-7.01103	7.36252	-6.75014	2.31119	-7.5236	6.96016	6.14638	1.38201	-1.85633	-8.61666	-7.5955
3.94858	-0.929146	4.44111	7.32765	9.51043	7.11607	-9.76572	-2.80044	4.59981	-6.56741	16.8809
0.420732	-8.91324	-6.00007	-9.62956	5.87395	-5.52151	-3.09297	8.56163	4.08829	-9.36322	-23.576
-6.70612	2.42957	1.54457	-5.24214	8.68428	2.27932	0.712656	1.7982	4.60244	-3.7611	6.34167
-2.03558	-5.80313	-6.27614	8.88745	4.79102	-0.190824	-5.45171	-4.91287	-8.83942	-1.31167	-21.1429

Matriz aumentada escalonada:

3.55633	-4.59984	4.70388	9.24377	-5.02494	1.52315	1.84084	1.44504	-5.53837	9.05498	16.2048
0	5.56039	5.38831	-1.30258	4.78177	-1.61697	8.16945	2.05515	5.98785	6.54317	35.5665
0	0	-2.50942	-7.45877	-0.191221	1.90057	-20.5481	-7.96252	3.9159	-22.5572	-55.4108
0	0	1.77636e-15	25.8509	4.24774	-7.8011	96.0537	39.549	-13.7462	98.4833	242.637
-8.88178e-16	0	-3.15514e-15	0	4.70039	2.2489	-37.1103	-7.13869	2.97963	-21.9871	-56.3072
-3.31625e-15	0	-1.23112e-14	0	0	23.357	-189.169	-46.8581	10.8103	-137.811	-339.671
1.69989e-15	0	6.81005e-15	0	-1.77636e-15	0	69.4904	9.38777	-1.85924	32.539	109.558
-4.25614e-16	0	-8.64472e-16	0	7.10547e-16	0	0	13.9936	6.60877	-3.11871	17.4757
-8.84651e-17	0	6.00853e-16	0	1.66904e-15	0	0	0	-3.93198	20.5633	16.6313
3.73534e-16	0	2.41466e-15	0	2.66446e-15	0	0	0	0	10.1297	10.1297

Solución del sistema:

1
1
1
1
1
1
1
1
1
1

Norma suma del residuo:
2.1049828546892968e-13
PS C:\Users\Usuario>