In [ ]:
```
%load_ext autoreload
```

```
The autoreload extension is already loaded. To reload it, use:
  %reload_ext autoreload
```

Examen

Determinante

Property: Determinants of Triangular Matrices

The determinant of a triangular matrix is the product of the entries on the main diagonal:

$$\begin{vmatrix} a & b & c \\ 0 & d & e \\ 0 & 0 & f \end{vmatrix} = adf, \quad \begin{vmatrix} u & 0 & 0 \\ v & w & 0 \\ x & y & z \end{vmatrix} = uwz.$$

In [ ]:
```
A = [
    [-4, 2, -4, -4, 1, 2, 5, 3, 5, 1],
    [1, 0, 4, 3, 0, -2, 3, 0, 1, 5],
    [5, 5, -4, 5, -4, 2, 2, 2, 4, 4],
    [-1, 3, 4, -1, -4, 0, 5, 0, 0, 5],
    [4, 1, 4, 2, 0, 0, 3, -1, 0, 2],
    [2, -2, 1, -1, -2, -3, 2, -2, 4, -1],
    [3, -2, -3, -2, -1, -3, 5, -1, 5, 0],
    [3, 4, -3, 3, -2, 2, -4, -4, 1, 5],
    [-4, 0, 3, 3, -3, -2, -2, 0, 5, -4],
    [-2, 4, 4, -2, -1, 1, 5, -1, 3, -3],
]
```

Indicaciones

Su trabajo es ajustar el código de los métodos de resolución de sistemas de ecuaciones lineales para encontrar el valor del determinante. Tenga en cuenta las siguientes consideraciones:

- Usar algún método de resolución de sistemas de ecuaciones lineales para calcular el determinante.
- Usar la función creada para calcular el determinante de la matriz de ejemplo A.
- Listar los cambios realizados.
- Modificar y utilizar SOLO el código provisto. No se aceptarán la utilización de otras librerías o funciones.

In [ ]:
```
%autoreload 2
import numpy as np

from src import (
    eliminacion_gaussiana,
    descomposicion_LU,
    resolver_LU,
    matriz_aumentada,
    separar_m_aumentada,
)


# ########################################################################
def calc_determinante(A: list[list[float]]) -> float:
    """Función que calcula el determinante usando el método
    [Descomposición LU, eliminación gaussiana, Gauss-Jordan, Gauss-Jacobi o Gauss-Seidel]

    ## Parameters
    ``A``: Matriz cuadrada de tamaño n x n

    ## Return
    ``detA``: Determinante de la matriz A
    La matriz A se convierte a un array de numpy con tipo de datos float para asegurar cálculos numéricos preci
La matriz A se descompone en una matriz triangular inferior L y una matriz triangular superior U utilizando la
Se inicializa la variable detA con 1.0 para calcular el producto de los elementos diagonales de U.
Se recorre la diagonal de la matriz U y se multiplican sus elementos. El producto de los elementos diagonales d
```

```
    """
    A = np.array(A, dtype=float)
    L, U = descomposicion_LU(A)
    detA = np.prod(np.diag(U))
    return detA
```

In [ ]:
```
A = [
    [-4, 2, -4, -4, 1, 2, 5, 3, 5, 1],
    [1, 0, 4, 3, 0, -2, 3, 0, 1, 5],
    [5, 5, -4, 5, -4, 2, 2, 2, 4, 4],
    [-1, 3, 4, -1, -4, 0, 5, 0, 0, 5],
    [4, 1, 4, 2, 0, 0, 3, -1, 0, 2],
    [2, -2, 1, -1, -2, -3, 2, -2, 4, -1],
    [3, -2, -3, -2, -1, -3, 5, -1, 5, 0],
    [3, 4, -3, 3, -2, 2, -4, -4, 1, 5],
    [-4, 0, 3, 3, -3, -2, -2, 0, 5, -4],
    [-2, 4, 4, -2, -1, 1, 5, -1, 3, -3],
]


determinante = calc_determinante(A)
print(f"El determinante de la matriz A es: {determinante}")
```

```
[07-19 22:45:53][INFO]
[[-4.    2.   -4.   -4.    1.    2.    5.    3.    5.    1.  ]
 [ 0.    0.5   3.    2.    0.25 -1.5   4.25  0.75  2.25  5.25]
 [ 0.    7.5  -9.    0.   -2.75  4.5   8.25  5.75 10.25  5.25]
 [ 0.    2.5   5.    0.   -4.25 -0.5   3.75 -0.75 -1.25  4.75]
 [ 0.    3.    0.   -2.    1.    2.    8.    2.    5.    3.  ]
 [ 0.   -1.   -1.   -3.   -1.5  -2.    4.5  -0.5   6.5  -0.5 ]
 [ 0.   -0.5  -6.   -5.   -0.25 -1.5   8.75  1.25  8.75  0.75]
 [ 0.    5.5  -6.    0.   -1.25  3.5  -0.25 -1.75  4.75  5.75]
 [ 0.   -2.    7.    7.   -4.   -4.   -7.   -3.    0.   -5.  ]
 [ 0.    3.    6.    0.   -1.5   0.    2.5  -2.5   0.5  -3.5 ]]
[07-19 22:45:53][INFO]
[[ -4.     2.    -4.    -4.     1.     2.     5.     3.     5.     1.  ]
 [  0.     0.5    3.     2.     0.25  -1.5    4.25   0.75   2.25   5.25]
 [  0.     0.   -54.   -30.    -6.5   27.   -55.5   -5.5  -23.5  -73.5 ]
 [  0.     0.   -10.   -10.    -5.5    7.   -17.5   -4.5  -12.5  -21.5 ]
 [  0.     0.   -18.   -14.    -0.5   11.   -17.5   -2.5   -8.5  -28.5 ]
 [  0.     0.     5.     1.    -1.    -5.    13.     1.    11.    10.  ]
 [  0.     0.    -3.    -3.     0.    -3.    13.     2.    11.     6.  ]
 [  0.     0.   -39.   -22.    -4.    20.   -47.   -10.   -20.   -52.  ]
 [  0.     0.    19.    15.    -3.   -10.    10.     0.     9.    16.  ]
 [  0.     0.   -12.   -12.    -3.     9.   -23.    -7.   -13.   -35.  ]]
[07-19 22:45:53][INFO]
[[ -4.           2.          -4.          -4.           1.
    2.           5.           3.           5.           1.        ]
 [  0.           0.5          3.           2.           0.25
   -1.5          4.25         0.75         2.25         5.25      ]
 [  0.           0.         -54.         -30.          -6.5
   27.         -55.5         -5.5        -23.5        -73.5       ]
 [  0.           0.           0.          -4.44444444  -4.2962963
    2.          -7.22222222  -3.48148148  -8.14814815  -7.88888889]
 [  0.           0.           0.          -4.           1.66666667
    2.           1.          -0.66666667  -0.66666667  -4.        ]
 [  0.           0.           0.          -1.77777778  -1.60185185
   -2.5          7.86111111   0.49074074   8.82407407   3.19444444]
 [  0.           0.           0.          -1.33333333   0.36111111
   -4.5         16.08333333   2.30555556  12.30555556  10.08333333]
 [  0.           0.           0.          -0.33333333   0.69444444
    0.5         -6.91666667  -6.02777778  -3.02777778   1.08333333]
 [  0.           0.           0.           4.44444444  -5.28703704
   -0.5         -9.52777778  -1.93518519   0.73148148  -9.86111111]
 [  0.           0.           0.          -5.33333333  -1.55555556
    3.         -10.66666667  -5.77777778  -7.77777778 -18.66666667]]
[07-19 22:45:53][INFO]
[[ -4.           2.          -4.          -4.           1.
    2.           5.           3.           5.           1.        ]
 [  0.           0.5          3.           2.           0.25
   -1.5          4.25         0.75         2.25         5.25      ]
 [  0.           0.         -54.         -30.          -6.5
   27.         -55.5         -5.5        -23.5        -73.5       ]
 [  0.           0.           0.          -4.44444444  -4.2962963
    2.          -7.22222222  -3.48148148  -8.14814815  -7.88888889]
 [  0.           0.           0.           0.           5.53333333
    0.2          7.5          2.46666667   6.66666667   3.1       ]
 [  0.           0.           0.           0.           0.11666667
   -3.3         10.75         1.88333333  12.08333333   6.35      ]
 [  0.           0.           0.           0.           1.65
   -5.1         18.25         3.35        14.75        12.45      ]
```

```
 [  0.           0.           0.           0.           1.01666667
    0.35        -6.375       -5.76666667  -2.41666667   1.675     ]
 [  0.           0.           0.           0.          -9.58333333
    1.5        -16.75        -5.41666667  -7.41666667 -17.75      ]
 [  0.           0.           0.           0.           3.6
    0.6         -2.          -1.6          2.          -9.2       ]]
[07-19 22:45:53][INFO]
[[ -4.     2.    -4.    -4.     1.     2.     5.     3.     5.     1.  ]
 [  0.     0.5    3.     2.     0.25  -1.5    4.25   0.75   2.25   5.25]
 [  0.     0.   -54.   -30.    -6.5   27.   -55.5   -5.5  -23.5  -73.5 ]
 [  0.     0.   -10.   -10.    -5.5    7.   -17.5   -4.5  -12.5  -21.5 ]
 [  0.     0.   -18.   -14.    -0.5   11.   -17.5   -2.5   -8.5  -28.5 ]
 [  0.     0.     5.     1.    -1.    -5.    13.     1.    11.    10.  ]
 [  0.     0.    -3.    -3.     0.    -3.    13.     2.    11.     6.  ]
 [  0.     0.   -39.   -22.    -4.    20.   -47.   -10.   -20.   -52.  ]
 [  0.     0.    19.    15.    -3.   -10.    10.     0.     9.    16.  ]
 [  0.     0.   -12.   -12.    -3.     9.   -23.    -7.   -13.   -35.  ]]
[07-19 22:45:53][INFO]
[[ -4.           2.          -4.          -4.           1.
    2.           5.           3.           5.           1.        ]
 [  0.           0.5          3.           2.           0.25
   -1.5          4.25         0.75         2.25         5.25      ]
 [  0.           0.         -54.         -30.          -6.5
   27.         -55.5         -5.5        -23.5        -73.5       ]
 [  0.           0.           0.          -4.44444444  -4.2962963
    2.          -7.22222222  -3.48148148  -8.14814815  -7.88888889]
 [  0.           0.           0.          -4.           1.66666667
    2.           1.          -0.66666667  -0.66666667  -4.        ]
 [  0.           0.           0.          -1.77777778  -1.60185185
   -2.5          7.86111111   0.49074074   8.82407407   3.19444444]
 [  0.           0.           0.          -1.33333333   0.36111111
   -4.5         16.08333333   2.30555556  12.30555556  10.08333333]
 [  0.           0.           0.          -0.33333333   0.69444444
    0.5         -6.91666667  -6.02777778  -3.02777778   1.08333333]
 [  0.           0.           0.           4.44444444  -5.28703704
   -0.5         -9.52777778  -1.93518519   0.73148148  -9.86111111]
 [  0.           0.           0.          -5.33333333  -1.55555556
    3.         -10.66666667  -5.77777778  -7.77777778 -18.66666667]]
[07-19 22:45:53][INFO]
[[ -4.           2.          -4.          -4.           1.
    2.           5.           3.           5.           1.        ]
 [  0.           0.5          3.           2.           0.25
   -1.5          4.25         0.75         2.25         5.25      ]
 [  0.           0.         -54.         -30.          -6.5
   27.         -55.5         -5.5        -23.5        -73.5       ]
 [  0.           0.           0.          -4.44444444  -4.2962963
    2.          -7.22222222  -3.48148148  -8.14814815  -7.88888889]
 [  0.           0.           0.           0.           5.53333333
    0.2          7.5          2.46666667   6.66666667   3.1       ]
 [  0.           0.           0.           0.           0.11666667
   -3.3         10.75         1.88333333  12.08333333   6.35      ]
 [  0.           0.           0.           0.           1.65
   -5.1         18.25         3.35        14.75        12.45      ]
 [  0.           0.           0.           0.           1.01666667
    0.35        -6.375       -5.76666667  -2.41666667   1.675     ]
 [  0.           0.           0.           0.          -9.58333333
    1.5        -16.75        -5.41666667  -7.41666667 -17.75      ]
 [  0.           0.           0.           0.           3.6
    0.6         -2.          -1.6          2.          -9.2       ]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16 -5.15963855e+00  1.60135542e+01  2.61445783e+00
   1.27620482e+01  1.15256024e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  3.13253012e-01 -7.75301205e+00 -6.21987952e+00
```

```
  -3.64156627e+00  1.10542169e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  1.84638554e+00 -3.76054217e+00 -1.14457831e+00
   4.12951807e+00 -1.23810241e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  4.69879518e-01 -6.87951807e+00 -3.20481928e+00
  -2.33734940e+00 -1.12168675e+01]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16  0.00000000e+00 -5.25979945e-01 -2.45214221e-01
  -5.88696445e+00  1.71194166e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00 -6.74886053e+00 -6.04626253e+00
  -2.50934366e+00  1.70123063e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  2.15815861e+00 -1.21239745e-01
   1.08030994e+01 -8.86918870e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00 -5.37329079e+00 -2.94439380e+00
  -6.39015497e-01 -1.03231541e+01]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16  0.00000000e+00 -5.25979945e-01 -2.45214221e-01
  -5.88696445e+00  1.71194166e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -2.89991334e+00
   7.30264298e+01 -2.02647314e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -1.12738302e+00
  -1.33518198e+01 -1.84488735e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.39341421e-01
   5.95008666e+01 -2.78119584e+01]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
```

```
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16  0.00000000e+00 -5.25979945e-01 -2.45214221e-01
  -5.88696445e+00  1.71194166e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -2.89991334e+00
   7.30264298e+01 -2.02647314e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -4.17418945e+01  6.03331839e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   4.84372479e+01 -2.47418198e+01]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16  0.00000000e+00 -5.25979945e-01 -2.45214221e-01
  -5.88696445e+00  1.71194166e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -2.89991334e+00
   7.30264298e+01 -2.02647314e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -4.17418945e+01  6.03331839e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -1.77407639e+01]]
[07-19 22:45:53][INFO]
[[-4.00000000e+00  2.00000000e+00 -4.00000000e+00 -4.00000000e+00
   1.00000000e+00  2.00000000e+00  5.00000000e+00  3.00000000e+00
   5.00000000e+00  1.00000000e+00]
 [ 0.00000000e+00  5.00000000e-01  3.00000000e+00  2.00000000e+00
   2.50000000e-01 -1.50000000e+00  4.25000000e+00  7.50000000e-01
   2.25000000e+00  5.25000000e+00]
 [ 0.00000000e+00  0.00000000e+00 -5.40000000e+01 -3.00000000e+01
  -6.50000000e+00  2.70000000e+01 -5.55000000e+01 -5.50000000e+00
  -2.35000000e+01 -7.35000000e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00 -4.44444444e+00
  -4.29629630e+00  2.00000000e+00 -7.22222222e+00 -3.48148148e+00
  -8.14814815e+00 -7.88888889e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   5.53333333e+00  2.00000000e-01  7.50000000e+00  2.46666667e+00
   6.66666667e+00  3.10000000e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -3.30421687e+00  1.05918675e+01  1.83132530e+00
   1.19427711e+01  6.28463855e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -2.22044605e-16  0.00000000e+00 -5.25979945e-01 -2.45214221e-01
  -5.88696445e+00  1.71194166e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00 -2.89991334e+00
   7.30264298e+01 -2.02647314e+01]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
  -4.17418945e+01  6.03331839e+00]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00  0.00000000e+00  0.00000000e+00  0.00000000e+00
   0.00000000e+00 -1.77407639e+01]]
El determinante de la matriz A es: 9912776.000000015
```

In [ ]:
```python
def calc_determinante_2(A: list[list[float]]) -> float:
    """Función que calcula el determinante usando el método
```

```
    [Descomposición LU, eliminación gaussiana, Gauss-Jordan, Gauss-Jacobi o Gauss-Seidel]

    ## Parameters
    ``A``: Matriz cuadrada de tamaño n x n

    ## Return
    ``detA``: Determinante de la matriz A

    """
    A = np.array(A, dtype=float)
    U = eliminacion_gaussiana(A)
    detA = np.prod(np.diag(U))
    return detA
```

In [ ]:

```
A = [
    [2, 2, 4, 5, -2, -3, 2, -2],
    [-1, -1, 3, 2, 1, 1, -4, 4],
    [2, 5, -3, -3, -2, 2, 5, 3],
    [-2, -4, 0, 1, -1, 5, -4, -1],
    [1, -2, -1, 5, 5, 2, 1, -2],
    [5, 4, 0, 3, 4, -1, -3, -2],
    [4, -4, 1, 2, 3, 3, -1, 3],
    [-2, 1, -3, 0, 5, 4, 4, -4],
]

determinante = calc_determinante(A)
print(f"El determinante de la matriz A es: {determinante}")
```

```
[07-19 22:45:53][INFO]
[[  2.    2.    4.    5.   -2.   -3.    2.   -2. ]
 [  0.    0.    5.    4.5   0.   -0.5  -3.    3. ]
 [  0.    3.   -7.   -8.    0.    5.    3.    5. ]
 [  0.   -2.    4.    6.   -3.    2.   -2.   -3. ]
 [  0.   -3.   -3.    2.5   6.    3.5   0.   -1. ]
 [  0.   -1.  -10.   -9.5   9.    6.5  -8.    3. ]
 [  0.   -8.   -7.   -8.    7.    9.   -5.    7. ]
 [  0.    3.    1.    5.    3.    1.    6.   -6. ]]
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[68], line 12
      1 A = [
      2     [2, 2, 4, 5, -2, -3, 2, -2],
      3     [-1, -1, 3, 2, 1, 1, -4, 4],
   (...)
      9     [-2, 1, -3, 0, 5, 4, 4, -4],
     10 ]
---> 12 determinante = calc_determinante(A)
     13 print(f"El determinante de la matriz A es: {determinante}")

Cell In[65], line 26, in calc_determinante(A)
     15 """Función que calcula el determinante usando el método
     16 [Descomposición LU, eliminación gaussiana, Gauss-Jordan, Gauss-Jacobi o Gauss-Seidel]
     17
   (...)
     23
     24 """
     25 A = np.array(A, dtype=float)
---> 26 L, U = descomposicion_LU(A)
     27 detA = np.prod(np.diag(U))
     28 return detA

File c:\Users\Pandi\Downloads\MN-prueba02-main\src\linear_syst_methods.py:127, in descomposicion_LU(A)
    123 for i in range(0, n):  # loop por columna
    124
    125     # --- deterimnar pivote
    126     if A[i, i] == 0:
--> 127         raise ValueError("No existe solución única.")
    129     # --- Eliminación: loop por fila
    130     L[i, i] = 1

ValueError: No existe solución única.
```