

## ▼ Лабораторная работа No 7-72 «LU разложение»

### Цель работы

Реализовать LU-разложение и проверить его перемножением L и U

```
import numpy as np

def fill_matrix(n, a, b):
    m = np.random.random((n, n)) * (b - a) + a
    return m

def decompose_lu(a):
    lu = np.matrix(np.zeros([a.shape[0], a.shape[1]]))

    for k in range(a.shape[0]):
        for j in range(k, a.shape[0]):
            lu[k, j] = a[k, j] - lu[k, :k] * lu[:k, j]
        for i in range(k + 1, a.shape[0]):
            lu[i, k] = (a[i, k] - lu[i, :k] * lu[:k, k]) / lu[k, k]

    l = lu.copy()
    for i in range(l.shape[0]):
        l[i, i] = 1
        l[i, i + 1:] = 0

    u = lu.copy()
    for i in range(1, u.shape[0]):
        u[i, :i] = 0

    return np.matrix(l), np.matrix(u)

if __name__ == '__main__':
    a = fill_matrix(5, 1, 10)
    print(f"MATRIX A: \n{a}\n")

    l, u = decompose_lu(a)

    print(f"LU MULT MATRIX:\n{np.matmul(l, u)}")
    print(f"\nWHERE\n")
    print(f"L:\n{l}\n")
    print(f"U:\n{u}\n")
```

```
➞ MATRIX A:
[[4.73614091  9.3194437  9.64133609  2.46659376  4.42774774]
 [3.97346147  4.56378451  9.11472086  1.77093647  5.27986814]
 [5.74326761  2.45265231  6.58930313  6.25927635  8.907672  ]
```

```
[9.70186844 2.09840515 9.42631896 1.71459824 2.4803872 ]  
[2.38763803 7.54829245 1.54425122 6.93105785 2.00294511]]
```

LU MULT MATRIX:

```
[[4.73614091 9.3194437 9.64133609 2.46659376 4.42774774]  
 [3.97346147 4.56378451 9.11472086 1.77093647 5.27986814]  
 [5.74326761 2.45265231 6.58930313 6.25927635 8.907672 ]  
 [9.70186844 2.09840515 9.42631896 1.71459824 2.4803872 ]  
 [2.38763803 7.54829245 1.54425122 6.93105785 2.00294511]]
```

WHERE

L:

```
[[ 1. 0. 0. 0. 0.]  
 [ 0.83896606 1. 0. 0. 0.]  
 [ 1.21264711 2.71851988 1. 0. 0.]  
 [ 2.04847546 5.22049268 1.98695796 1. 0.]  
 [ 0.50413154 -0.87562014 0.30639799 -0.42244771 1.]]
```

U:

```
[[ 4.73614091 9.3194437 9.64133609 2.46659376 4.42774774]  
 [ 0. -3.25491245 1.02596711 -0.29845198 1.56513807]  
 [ 0. 0. -7.89134725 4.07951618 -0.71648246]  
 [ 0. 0. 0. -9.88591934 -13.33691667]  
 [ 0. 0. 0. 0. -4.2733769 ]]
```

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