

Computing the Rank

In [16]:

```
#keep  
import numpy as np
```

In [17]:

```
#keep  
n = 5  
A = np.random.randn(n, n)
```

Now decrease the rank of A:

In [18]:

```
#keep  
A[4] = A[0] + 5 * A[2]  
A[1] = 3 * A[0] - 2 * A[2]
```

What should the rank be now?

Let's run Gaussian Elimination:

In [19]:

```
#keep
np.set_printoptions(precision=4)

for i in range(n):
    # find biggest entry
    j = max(
        (j for j in range(i, n)),
        key=lambda j: abs(A[j, i]))

    # swap rows i and piv_row
    row_i = A[i].copy()
    row_j = A[j]
    A[i] = row_j
    A[j] = row_i

    # eliminate down
    for j in range(i+1, n):
        A[j] -= A[i] * A[j,i]/A[i,i]

print(A)
print()
```

```

[[ 6.2344e+00 -5.5712e+00 -2.7390e-01 -1.1447e+00 -4.1407e+00]
 [ 0.0000e+00 4.5908e+00 -3.3457e+00 2.1521e+00 5.3686e-01]
 [-2.2204e-16 -2.7005e-01 1.9681e-01 -1.2660e-01 -3.1580e-02]
 [ 0.0000e+00 -1.5893e+00 -1.1484e+00 9.0711e-01 -1.9974e+00]
 [ 0.0000e+00 1.3502e+00 -9.8403e-01 6.3298e-01 1.5790e-01]]

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 [ 0.0000e+00 4.5908e+00 -3.3457e+00 2.1521e+00 5.3686e-01]
 [-2.2204e-16 0.0000e+00 -2.7756e-17 -2.7756e-17 1.0408e-16]
 [ 0.0000e+00 0.0000e+00 -2.3067e+00 1.6522e+00 -1.8116e+00]
 [ 0.0000e+00 0.0000e+00 2.2204e-16 0.0000e+00 5.5511e-17]]

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 [ 0.0000e+00 4.5908e+00 -3.3457e+00 2.1521e+00 5.3686e-01]
 [ 0.0000e+00 0.0000e+00 -2.3067e+00 1.6522e+00 -1.8116e+00]
 [-2.2204e-16 0.0000e+00 0.0000e+00 -4.7635e-17 1.2588e-16]
 [ 0.0000e+00 0.0000e+00 0.0000e+00 1.5904e-16 -1.1887e-16]]

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 [-2.2204e-16 0.0000e+00 0.0000e+00 6.1630e-33 9.0277e-17]]

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 [-2.2204e-16 0.0000e+00 0.0000e+00 6.1630e-33 9.0277e-17]]

```

Now what is the rank of that matrix?