```
# divide A and a scalar, 0.5
A / 0.5
'Output':
array([[ 30.,  58.,  48.],
       [ 10.,  46.,  52.],
       [ 60.,  28.,  88.]])
```

Matrix Transposition

Transposition is a vital matrix operation that reverses the rows and columns of a matrix by flipping the row and column indices. The transpose of a matrix is denoted as A^T. Observe that the diagonal elements remain unchanged. See Figure 10-4.

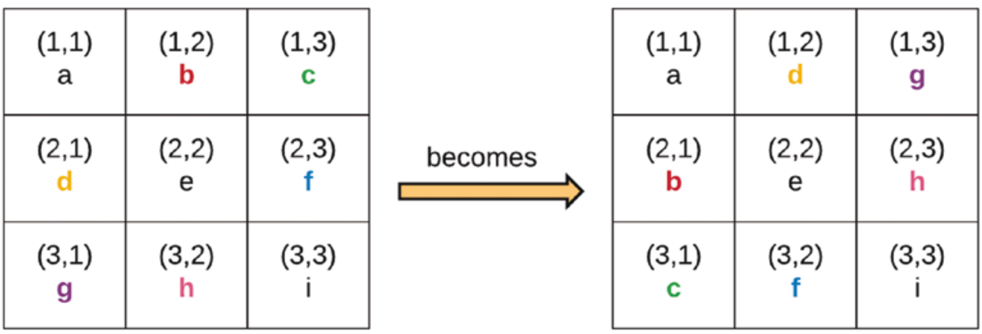

Figure 10-4. *Matrix transpose*

Let's see an example.

```
A = np.array([[15, 29, 24],
              [ 5, 23, 26],
              [30, 14, 44]])
# transpose A
A.T   # or A.transpose()
'Output':
array([[15,  5, 30],
       [29, 23, 14],
       [24, 26, 44]])
```

The Inverse of a Matrix

A $m \times m$ matrix A (also called a square matrix) has an inverse if A times another matrix B results in the identity matrix I also of shape $m \times m$. This matrix B is called the inverse of A and is denoted as A^{-1}. This relationship is formally written as

$$AA^{-1} = A^{-1}A = I$$

However, not all matrices have an inverse. A matrix with an inverse is called a *nonsingular* or *invertible* matrix, while those without an inverse are known as *singular* or *degenerate*.

Note A square matrix is a matrix that has the same number of rows and columns.

Let's use NumPy to get the inverse of a matrix. Some linear algebra modules are found in a sub-module of NumPy called **linalg**.

```
A = np.array([[15, 29, 24],
              [ 5, 23, 26],
              [30, 14, 44]])
# find the inverse of A
np.linalg.inv(A)
'Output':
array([[ 0.05848375, -0.08483755,  0.01823105],
       [ 0.05054152, -0.00541516, -0.02436823],
       [-0.05595668,  0.05956679,  0.01805054]])
```

NumPy also implements the *Moore-Penrose pseudo inverse*, which gives an inverse derivation for degenerate matrices. Here, we use the **pinv** method to find the inverses of invertible matrices.

```
# using pinv()
np.linalg.pinv(A)
'Output':
array([[ 0.05848375, -0.08483755,  0.01823105],
       [ 0.05054152, -0.00541516, -0.02436823],
       [-0.05595668,  0.05956679,  0.01805054]])
```