Phyton list of list

$$a = [\ [1,2]\ ,\ [3,4]\ ]$$

$a[0] = [1,2]$

- $a[0][0] = 1$
- $a[0][1] = 2$

$a[1] = [3,4]$

- $a[1][0] = 3$
- $a[1][1] = 4$

$$a = \begin{bmatrix} [1,2] , & [3,4] \end{bmatrix}$$

Seen as matrix

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$b = \begin{bmatrix} [1,2,3], [4,5,6], [7,8,9], \\ [10,11,12] \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix}$$

Many matrix operation will fail if we use default list of list Phyton

```
a = [ [1,2] , [3,4] ]
```

instead we use numpy array

```
a = numpy.array [ [1,2] , [3,4] ]
```

to represent matrix

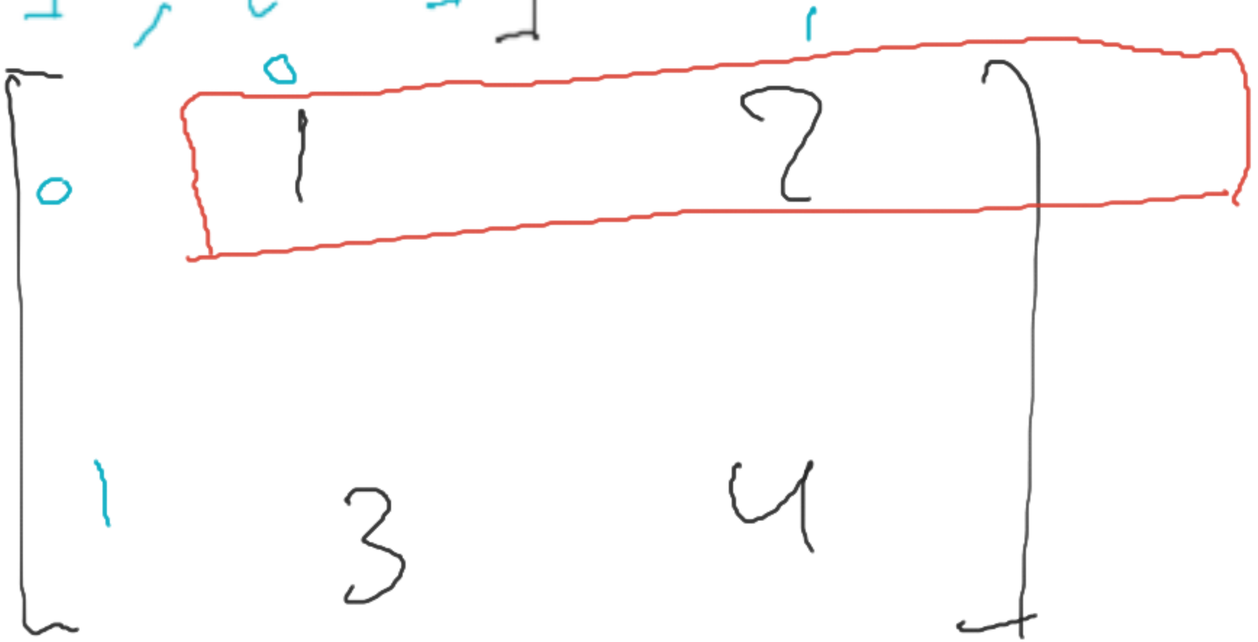
$a = [\,[1,2]\,,\,[3,4]\,]$

0th row

from 0th column to last column

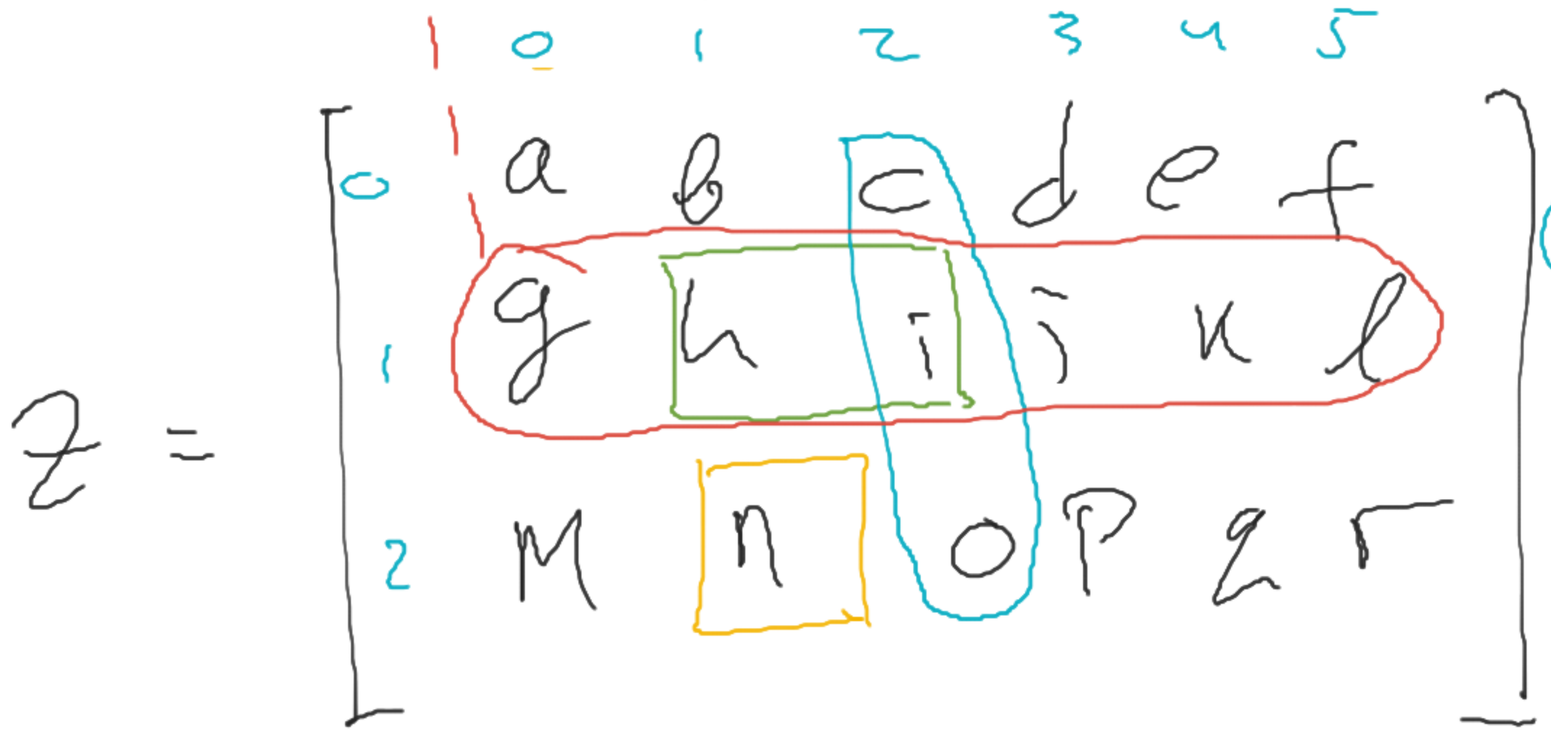
$a[0,:]$

$a =$



$a[0,1]$ = 0th row, 1st column $= 2$

z[1]



z =

z[:, 2]

row = 0 to last column

= ["c", "i", "o"]

2nd row, 1st column

z[2, 1] = "n"

1st row, 1st to 3rd column

z[1, 1:3] = ["h", "i"]

Object Oriented

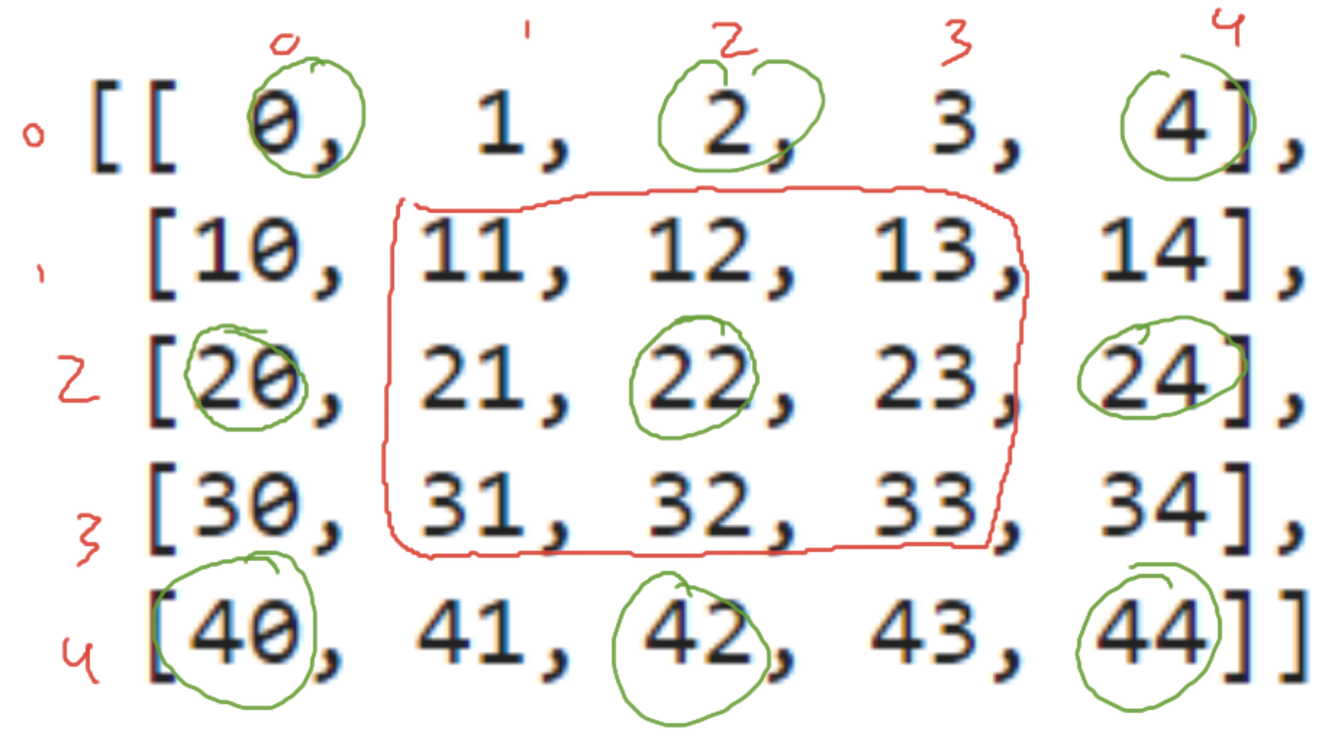
```
class Student

    ~~int age~~
    ~~String name~~

    setAge(self, num)
        self.age = num

    setNation(self, country_name)
        nation = country_name
```

Student
→ nation = "Germany"

Instance

StudentA	StudentB
name: Andy	name: Bob
age: 19	age: 20

StudentA.nation ⟶ "Germany"




```
A[1:4, 1:4]
```

col = from i=1 to i=3

row = from i=1 to i=3

```
A[::2, ::2]
```

column from i=0 to last step every 2 element

row from i=0 to last step every 2 element

array as index

```
    0   1   2   3   4
0 [[ 0,  1,  2,  3,  4],
1  [10, 11, 12, 13, 14],
2  [20, 21, 22, 23, 24],
3  [30, 31, 32, 33, 34],
4  [40, 41, 42, 43, 44]]
```

row_idx = [3,2,3]

A[[0,2]]

row 0, row 2

```
[[ 0,  1,  2,  3,  4],
 [20, 21, 22, 23, 24]]
```

A[row_idx]

```
row 3 [[30 31 32 33 34]
row 2  [20 21 22 23 24]
row 3  [30 31 32 33 34]]
```

=

A[[3,2,3]]

row 3, row 2, row 3

```
[[ 0,  1,  2,  3,  4],
 [10, 11, 12, 13, 14],
 [20, 21, 22, 23, 24],
 [30, 31, 32, 33, 34],
 [40, 41, 42, 43, 44]]
```

A [[1, 2], [3, 3]]

row 1 column 3

row 2 column 3

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \qquad B = \begin{bmatrix} 11 & 12 & 13 \\ 14 & 15 & 16 \\ 17 & 18 & 19 \end{bmatrix}$$

→ $A + 2 = \begin{bmatrix} 1+2 & 2+2 & 3+7 \\ 4+2 & 5+2 & 6+7 \\ 7+2 & 8+2 & 9+2 \end{bmatrix} = \begin{bmatrix} 3 & 4 & 5 \\ 6 & 7 & 8 \\ 9 & 10 & 11 \end{bmatrix}$

→ $A * B = \begin{bmatrix} 1\times11 & 2\times12 & 3\times13 \\ 4\times14 & 5\times15 & 6\times16 \\ 7\times17 & 8\times18 & 9\times19 \end{bmatrix} = \begin{bmatrix} 11 & 24 & 39 \end{bmatrix}$

$$\langle w, x \rangle = \sum w_i x_i \qquad \|x\| = \sqrt{\langle x, x \rangle} = \sqrt{\sum x_i^2}$$

$$w = [1, 2, 3] \qquad x [4\ 4\ 5]$$

np.dot(w, x) $= 1 \cdot 4 + 2 \cdot 4 + 3 \cdot 5$

$= 27$

$$w * x = [1 \times 4 \quad 2 \times 4 \quad 3 \times 5]$$

$$= [4 \quad 8 \quad 8]$$