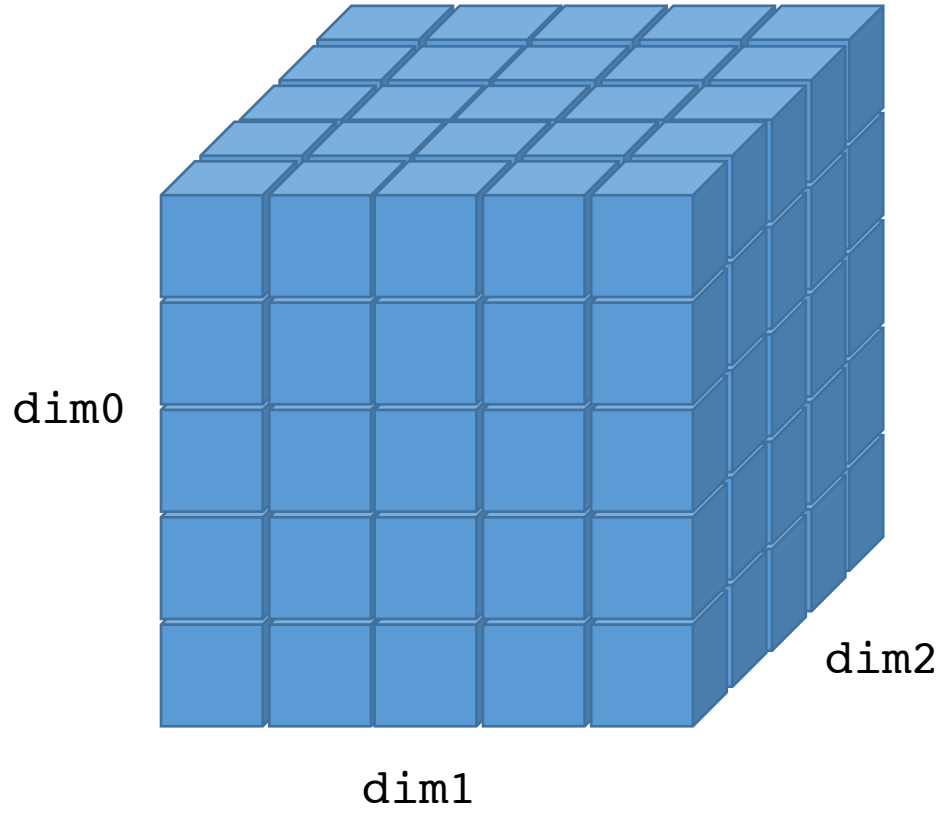
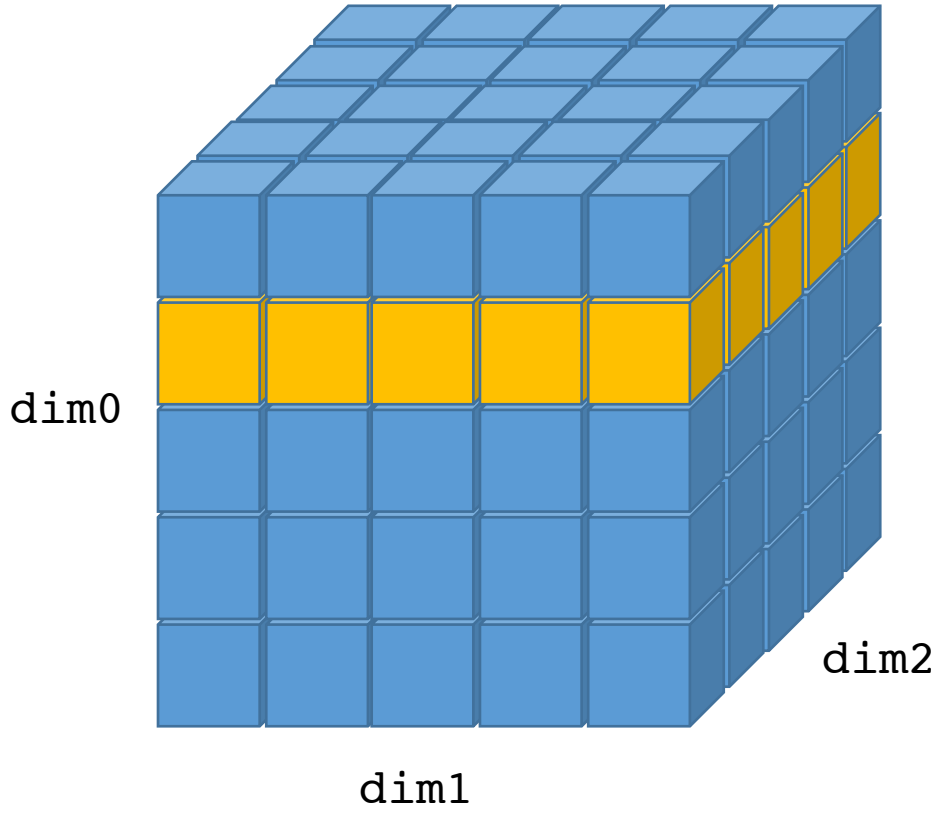
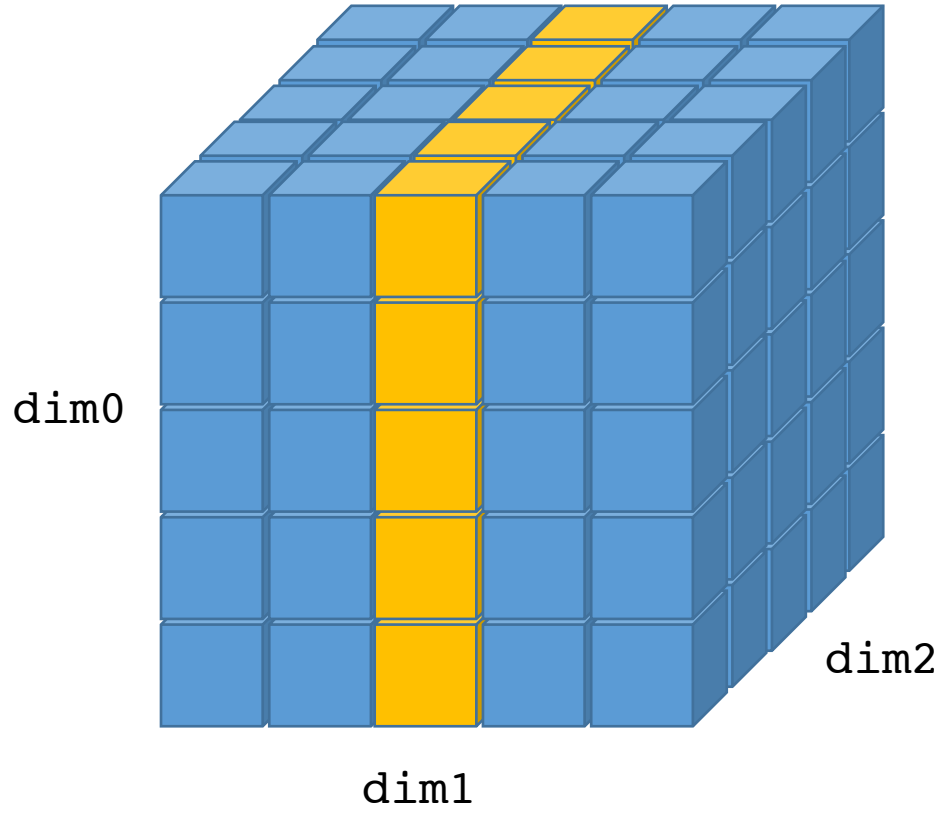
```
X = np.ones((5,5,5))
```



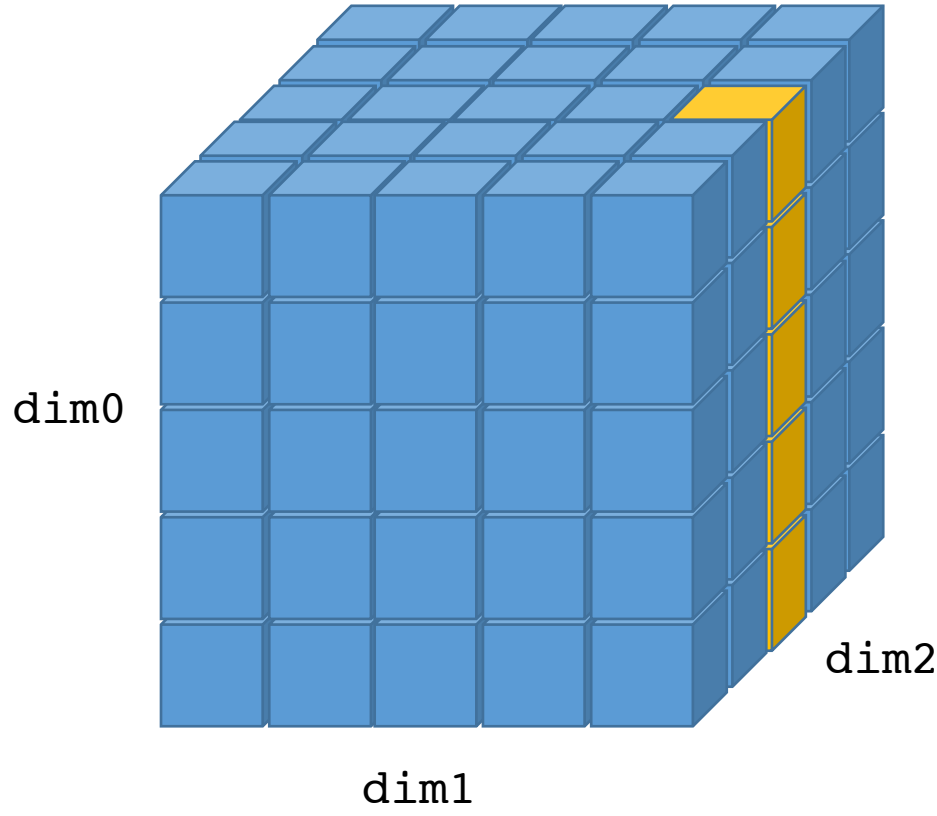
```
X = np.ones((5,5,5))
A = X[1,:,:]
```



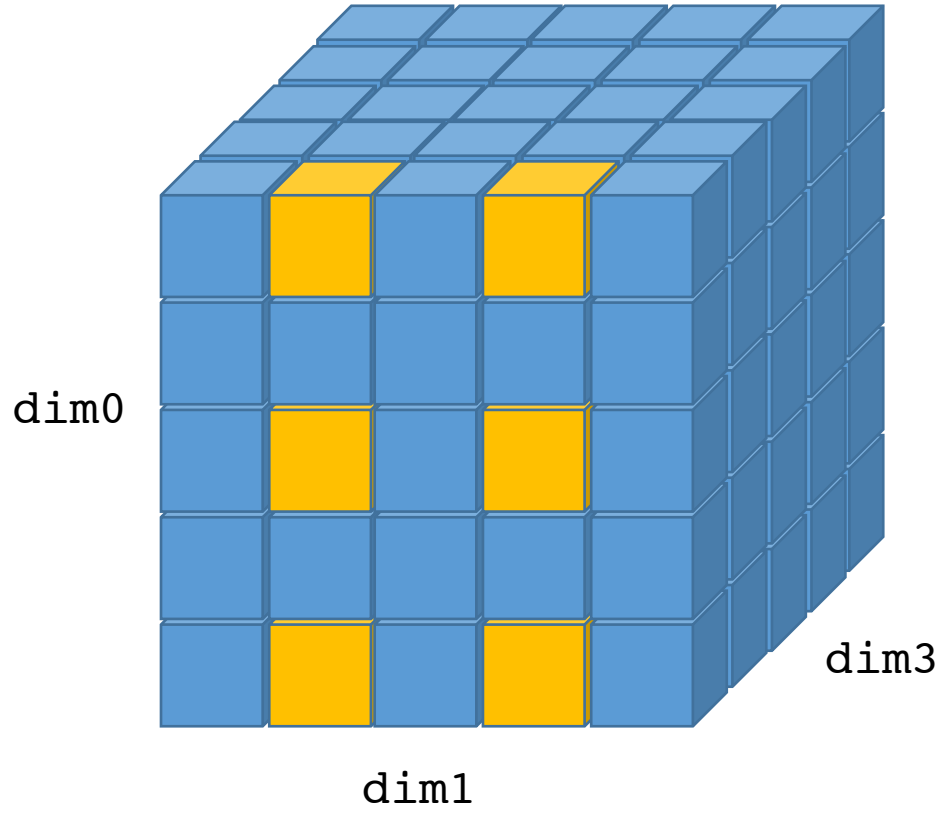
```
X = np.ones((5,5,5))
A = X[1,:,:]
B = X[:,2,:]
```



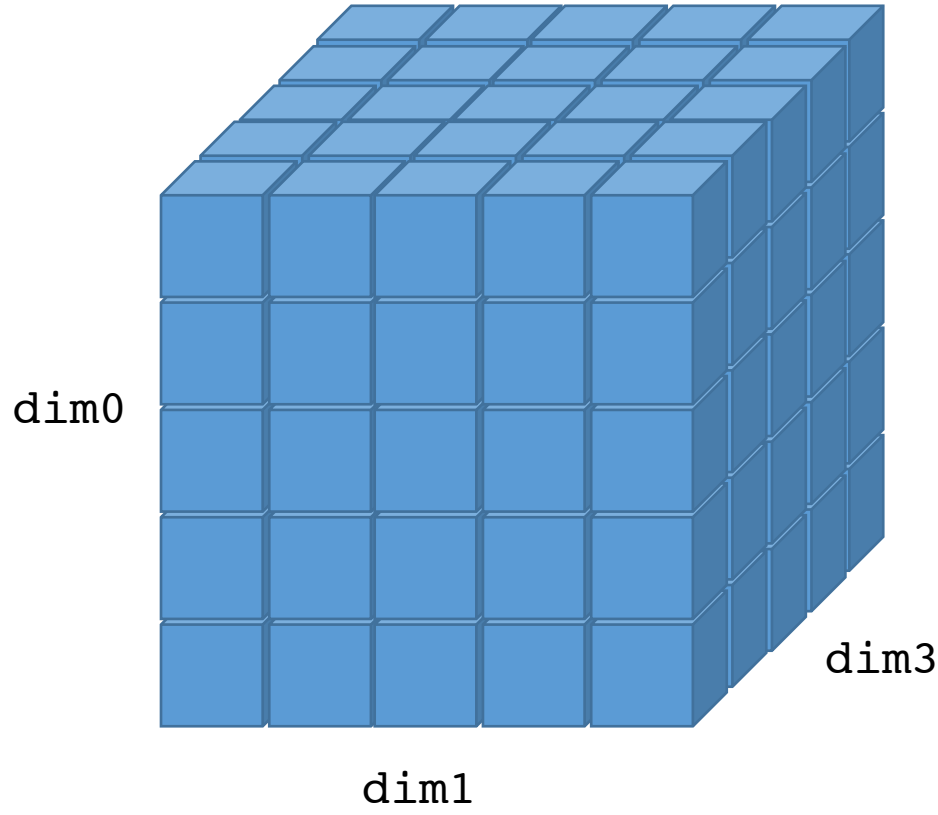
```
X = np.ones((5,5,5))
A = X[1,:,:]
B = X[:,2,:]
C = X[:,4,2]
```



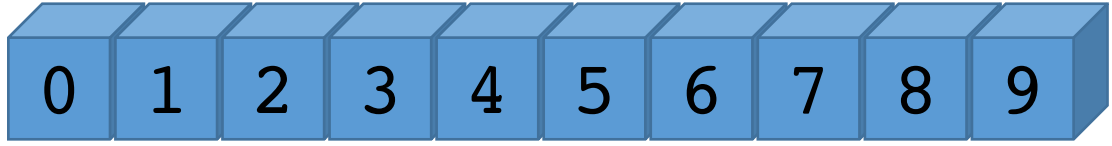
```
X = np.ones((5,5,5))
A = X[1,:,:]
B = X[:,2,:]
C = X[:,4,2]
D = X[::2,1::2,0]
```



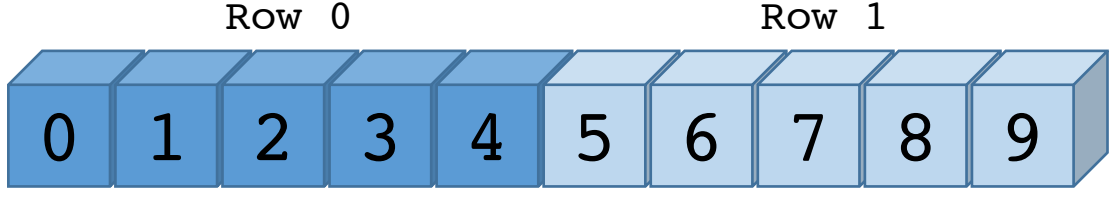
```
X = np.ones((5,5,5))
A = X[1,:,:]
B = X[:,2,:]
C = X[:,4,2]
```



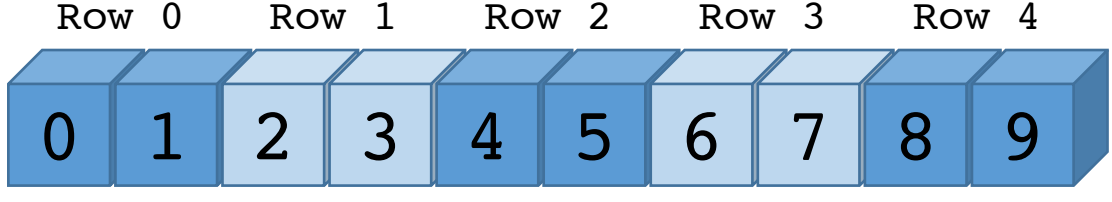
```
X = np.ones(10)
```



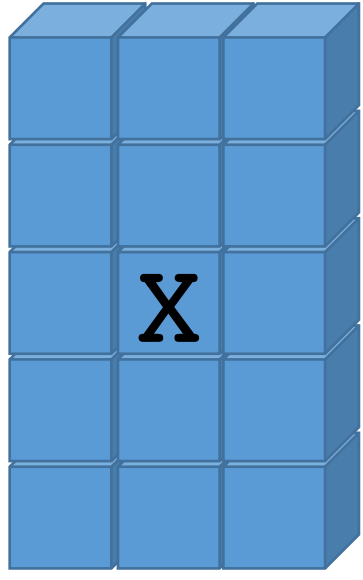

```
X.reshape((2,5))
```

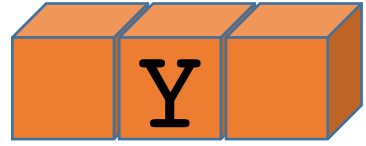



```
X.reshape((5,2))
```

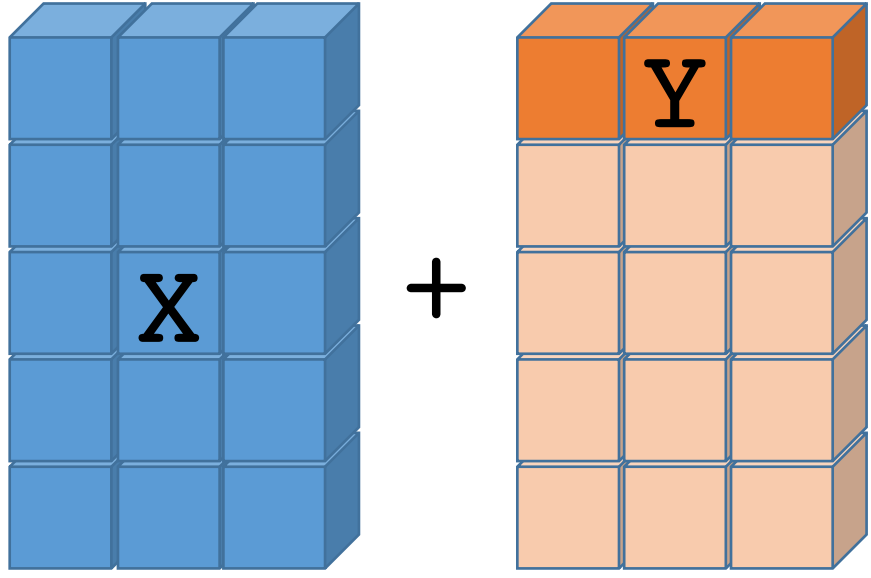


```
X = np.ones((5,3))
Y = np.ones(3)
```

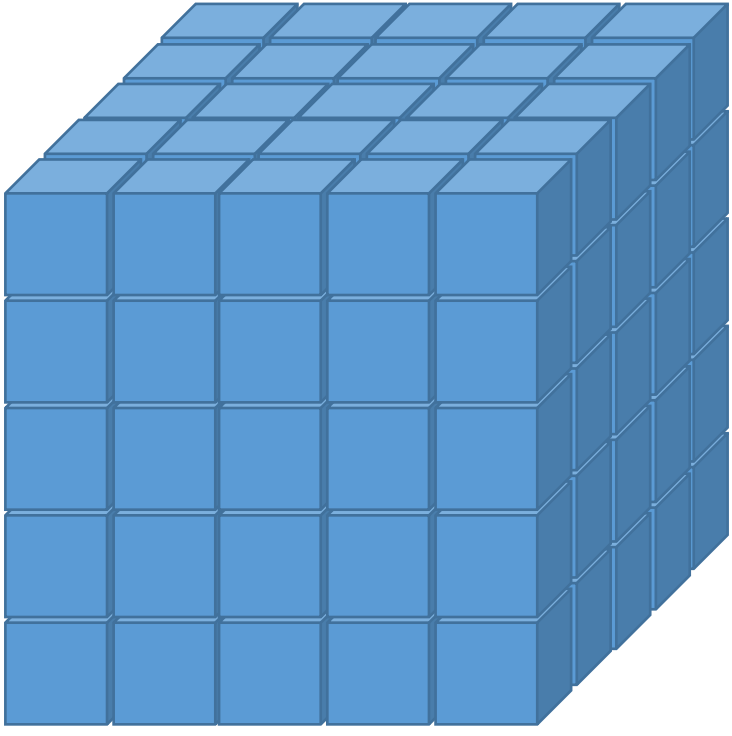




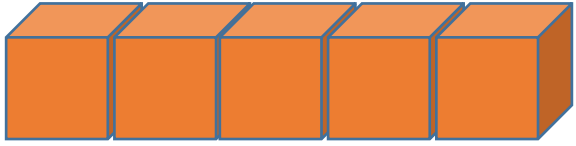
```
X = np.ones((5,3))
Y = np.ones(3)
Z = X + Y
```



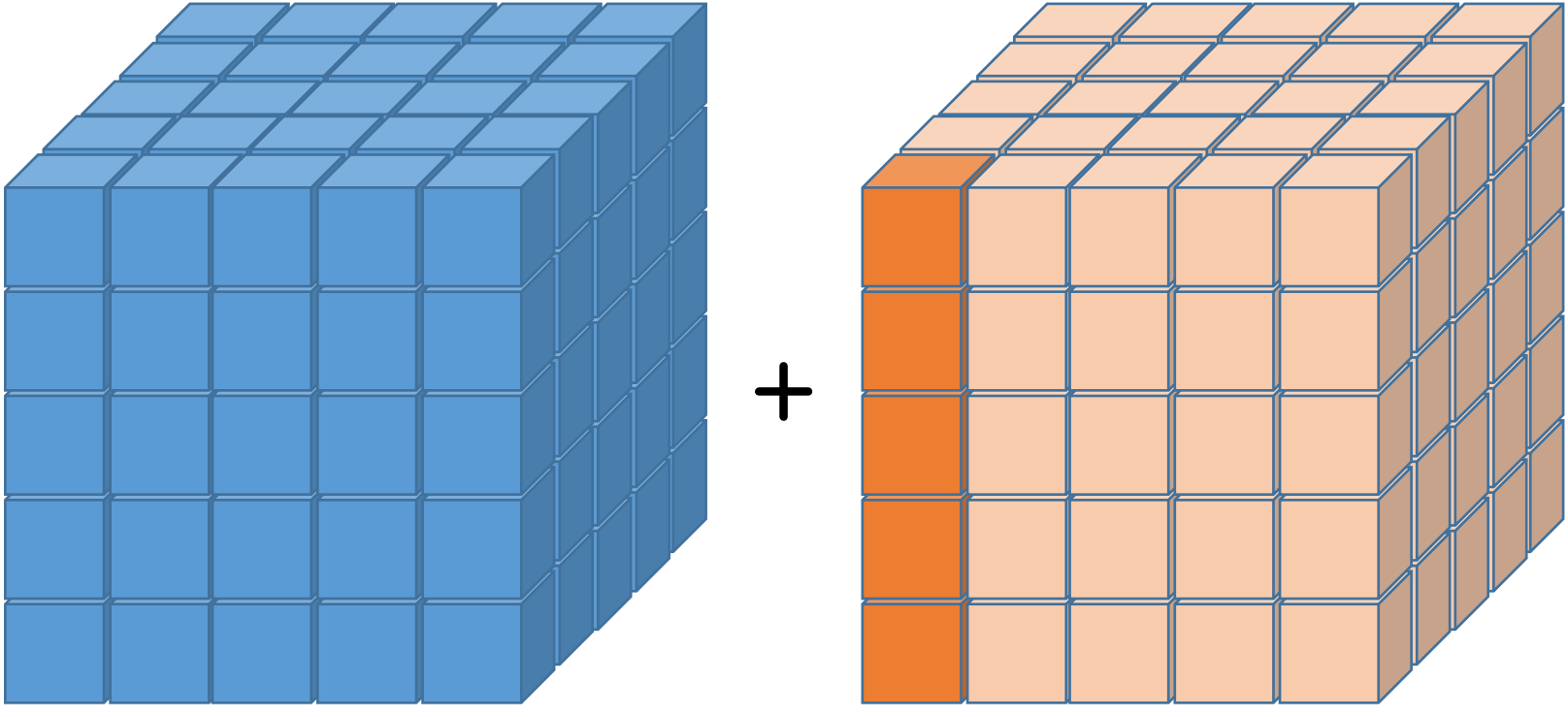
```
X = np.ones((5,5,5))
```



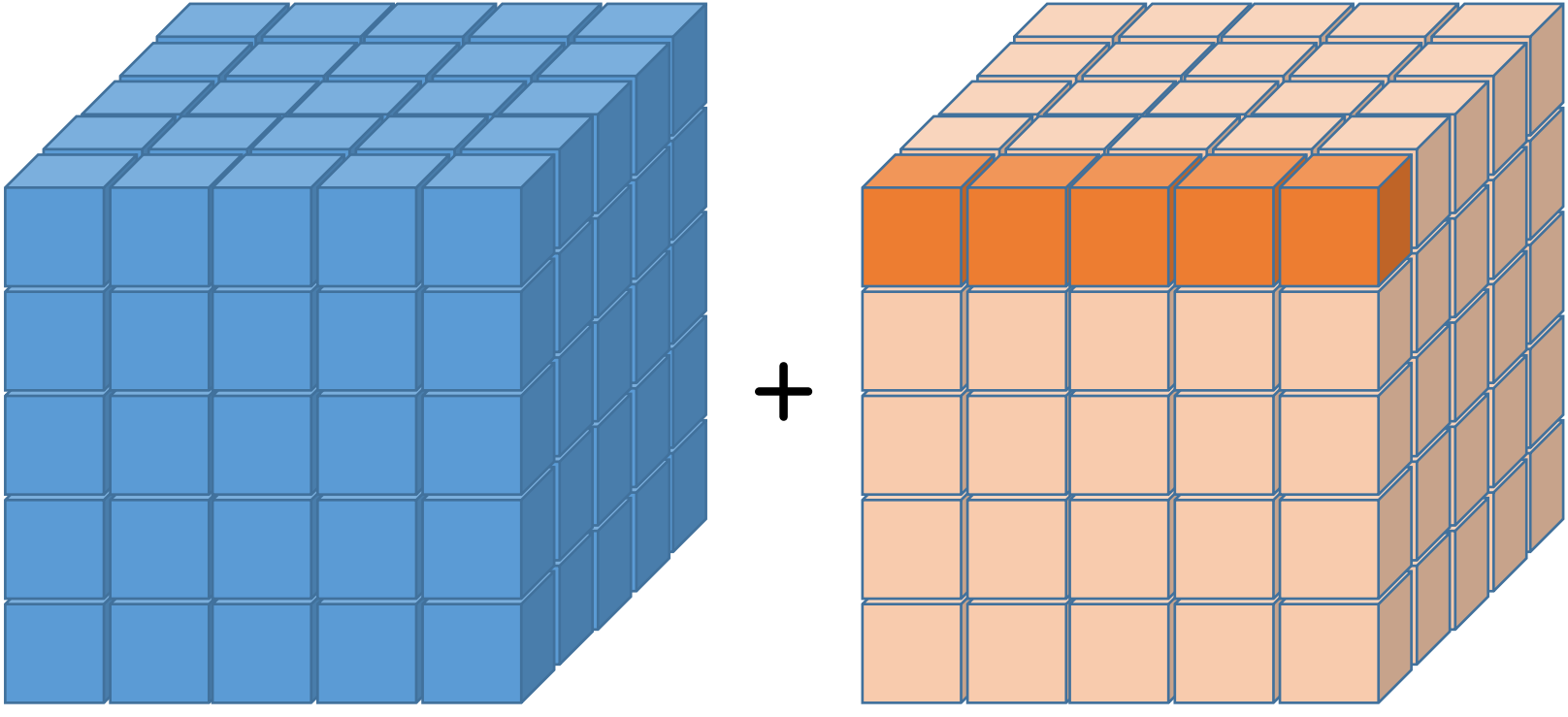
```
Y = np.ones(5)
```



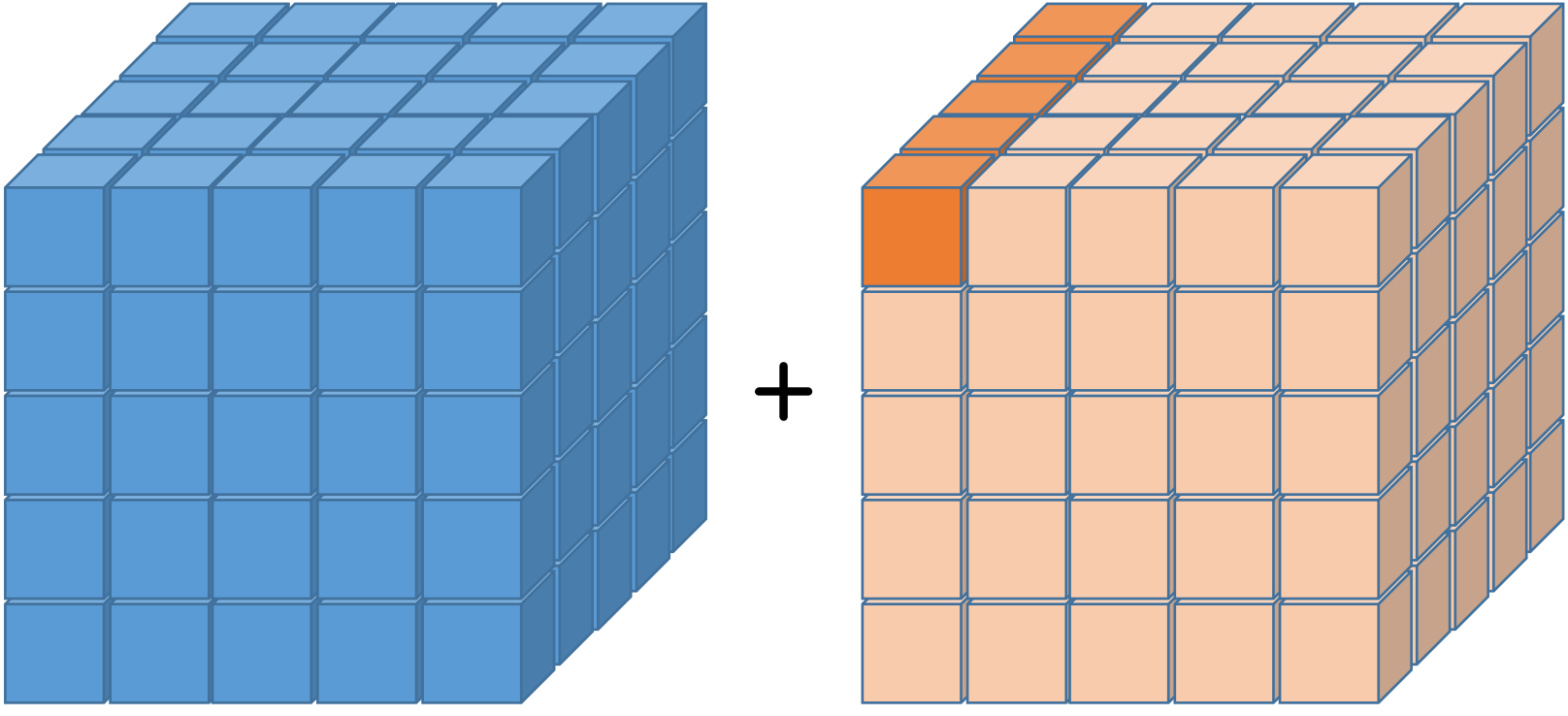
```
Z = X + Y.reshape((5,1,1))
```

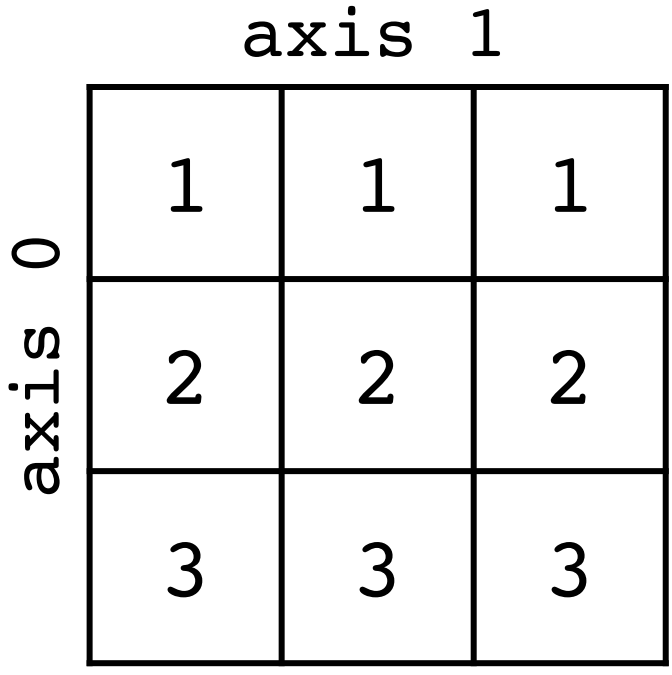


```
Z = X + Y.reshape((1,5,1))
```

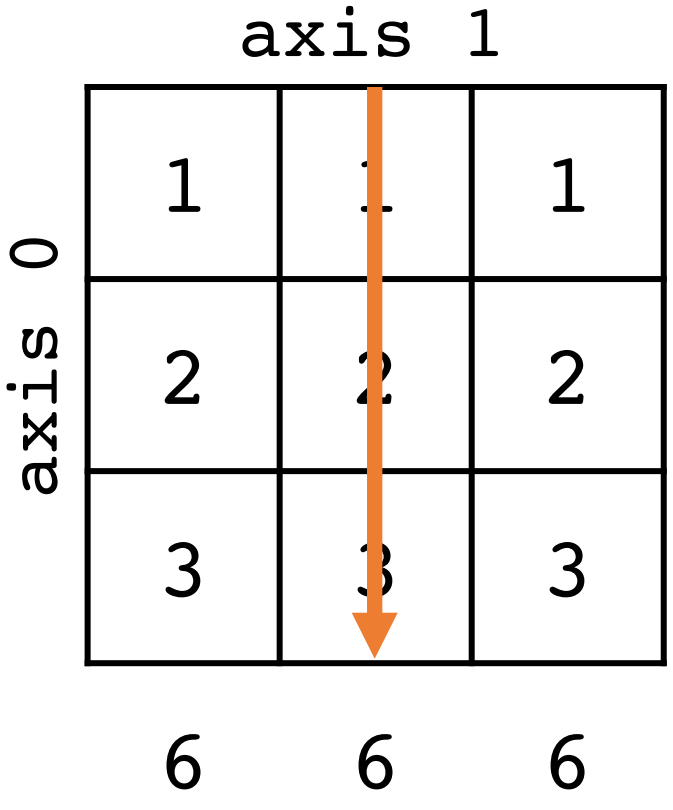


```
Z = X + Y.reshape((1,1,5))
```

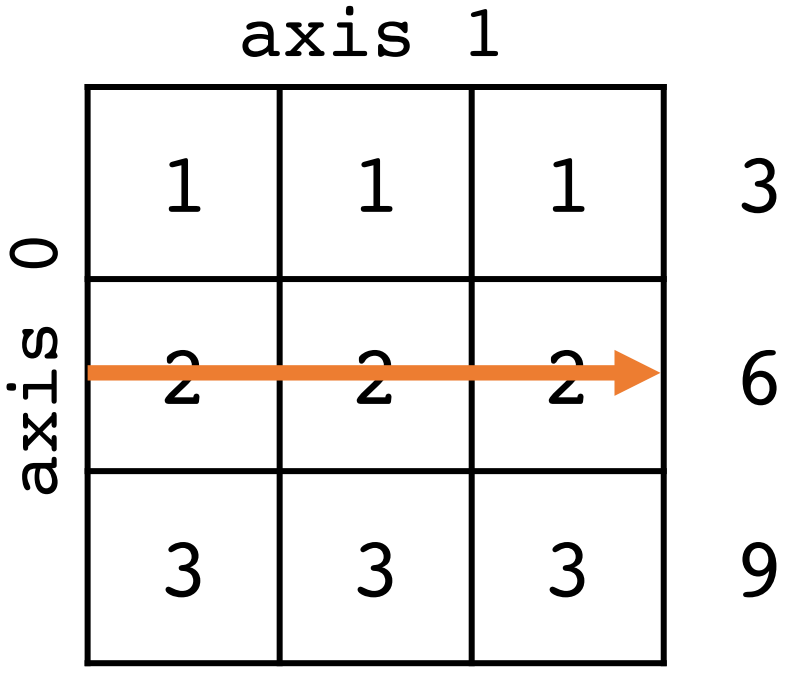


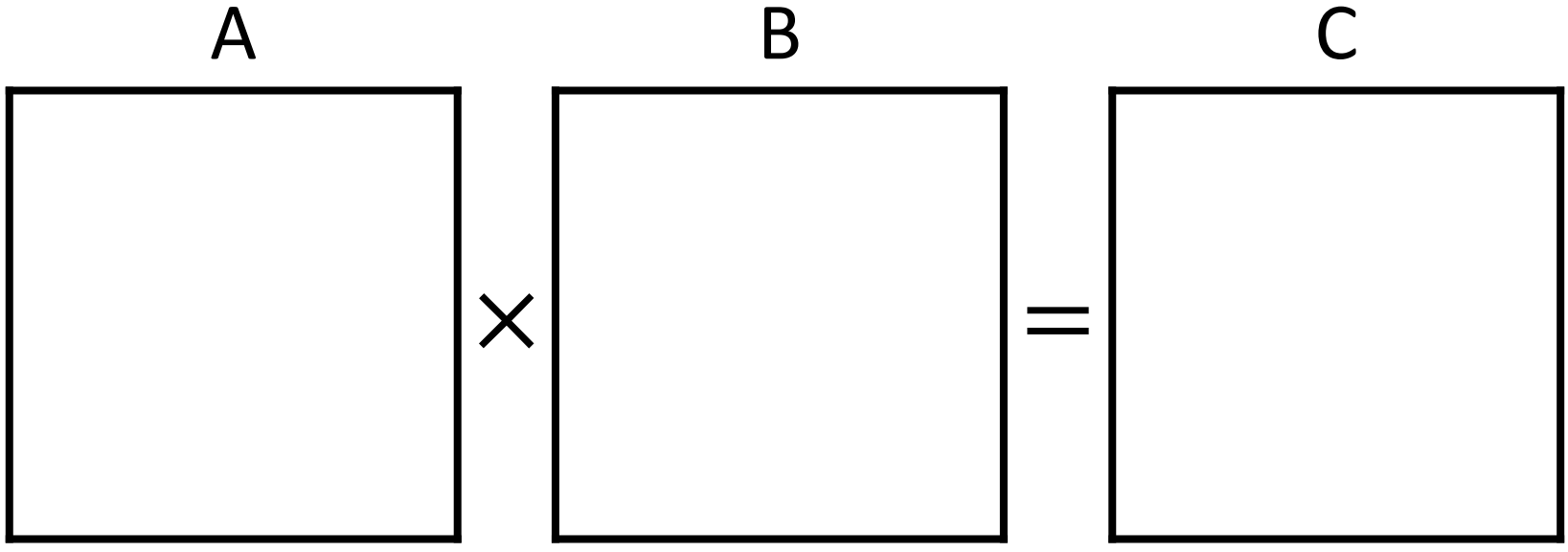

axis 1
axis 0
1
1
1
2
2
2
3
3
3

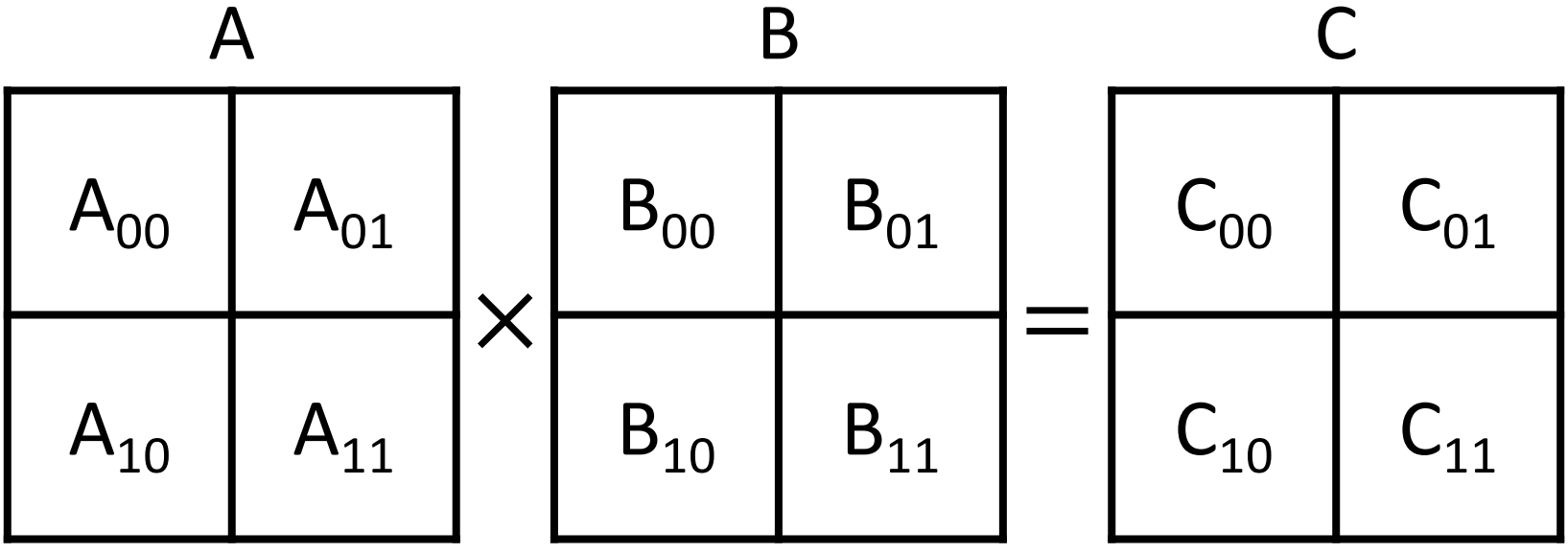
`X.sum(axis = 0)`

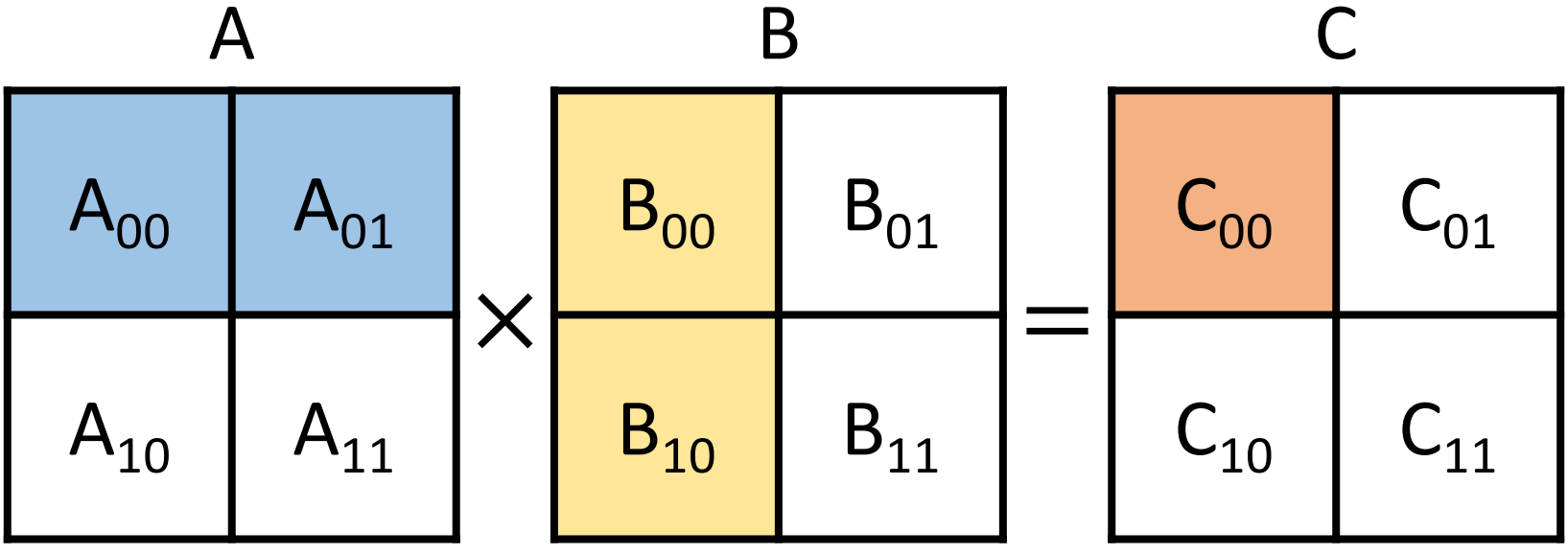


`X.sum(axis = 1)`

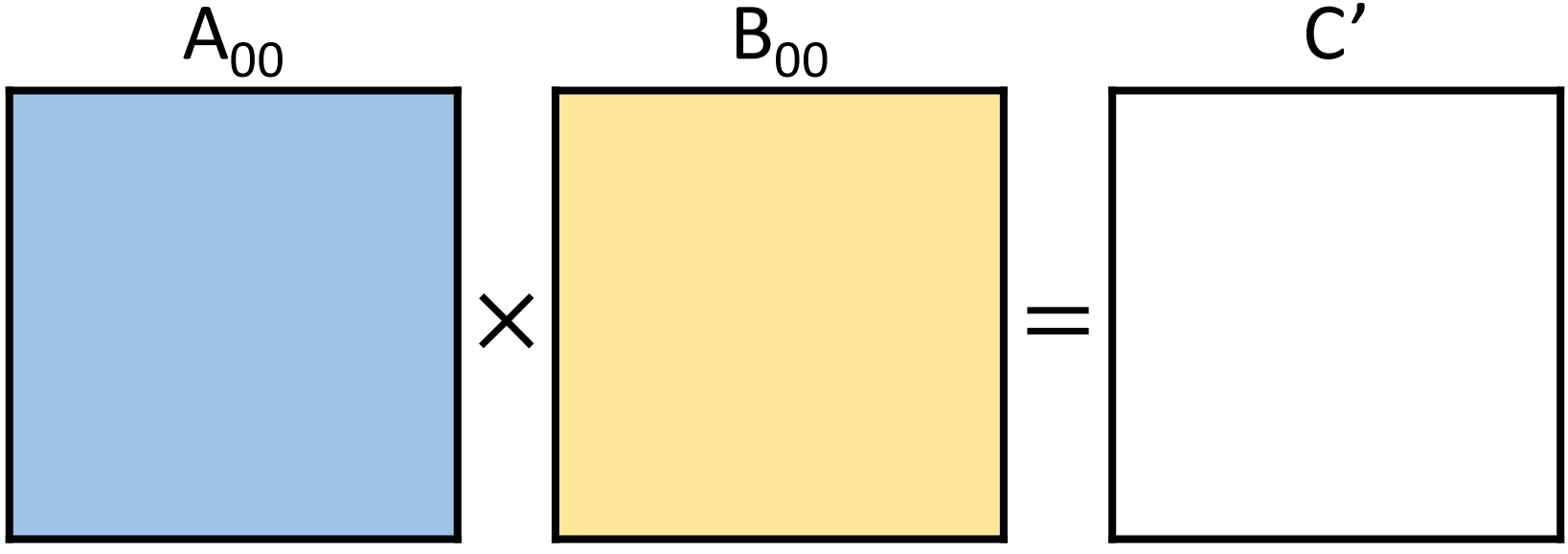


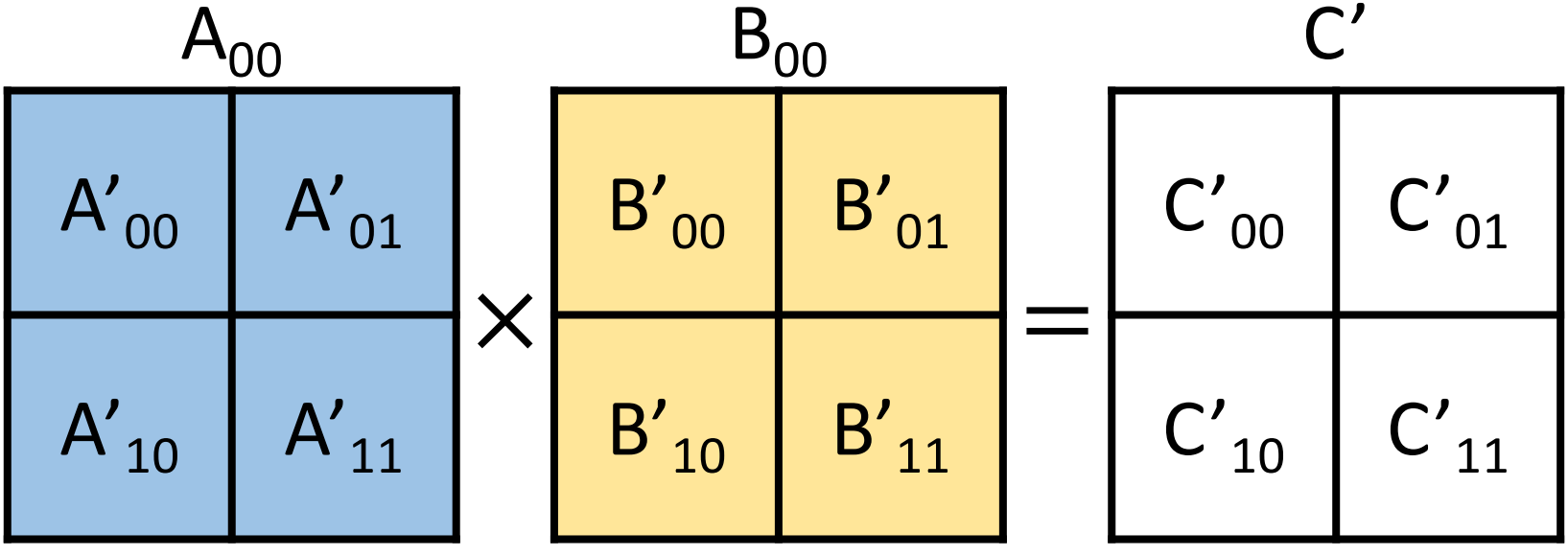

A
B
C

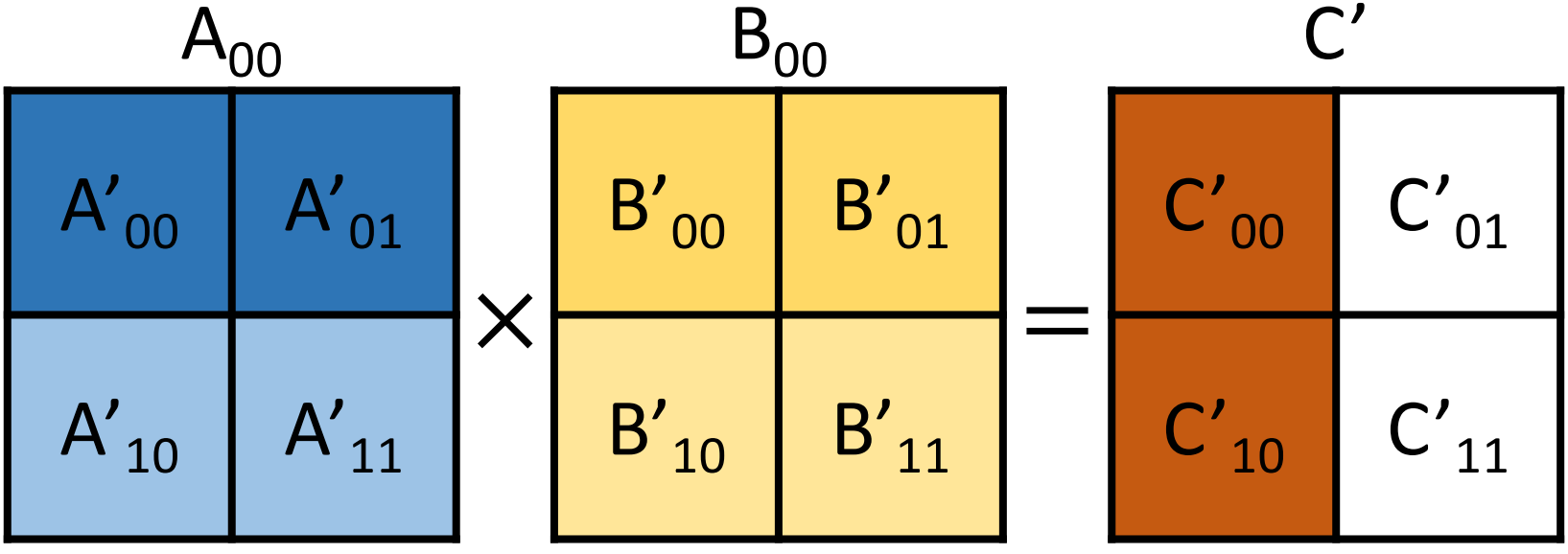

A
B
C
A_{00}
A_{01}
A_{10}
A_{11}
×
B_{00}
B_{01}
B_{10}
B_{11}
=
C_{00}
C_{01}
C_{10}
C_{11}



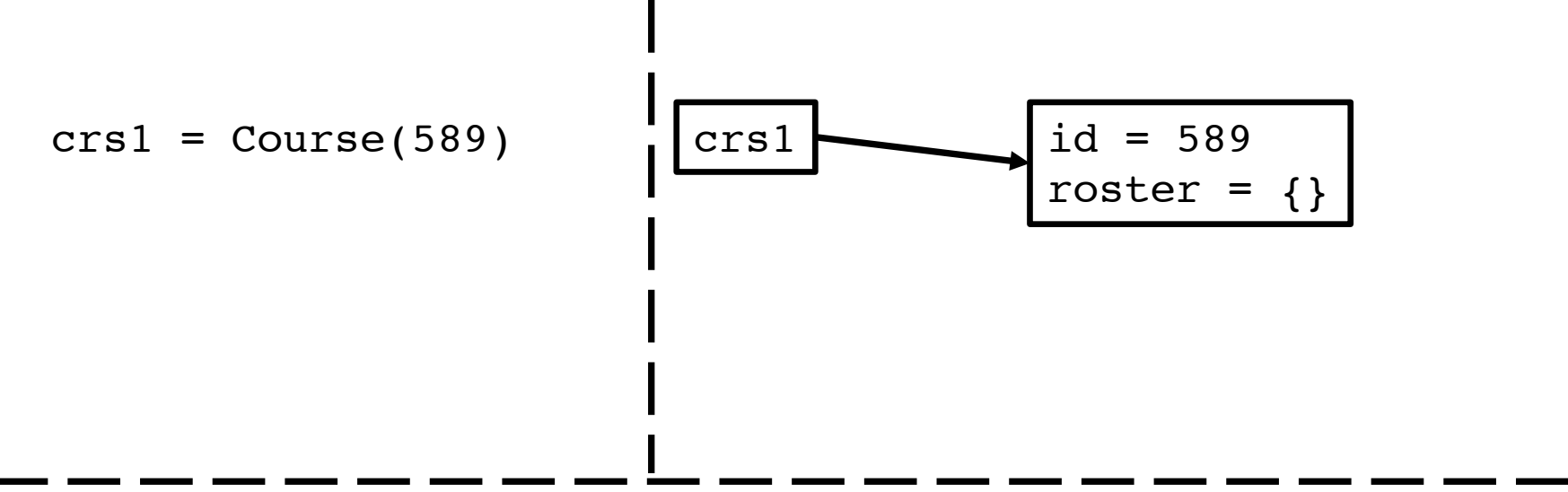
$$C_{00} = A_{00}B_{00} + A_{01}B_{10}$$


A_{00}
B_{00}
C’
×
=

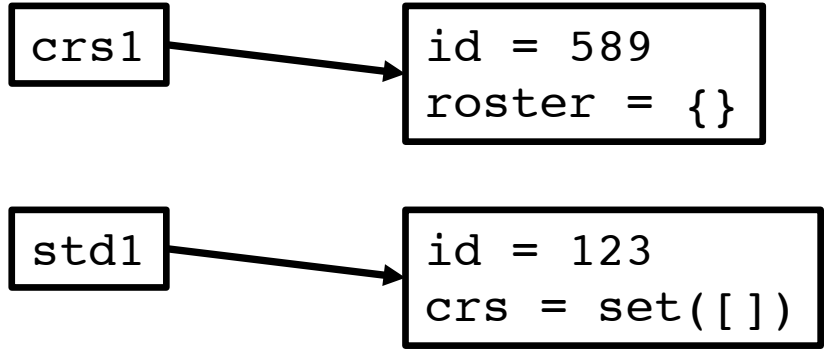

A00
B00
C’
A’00
A’01
A’10
A’11
×
B’00
B’01
B’10
B’11
=
C’00
C’01
C’10
C’11



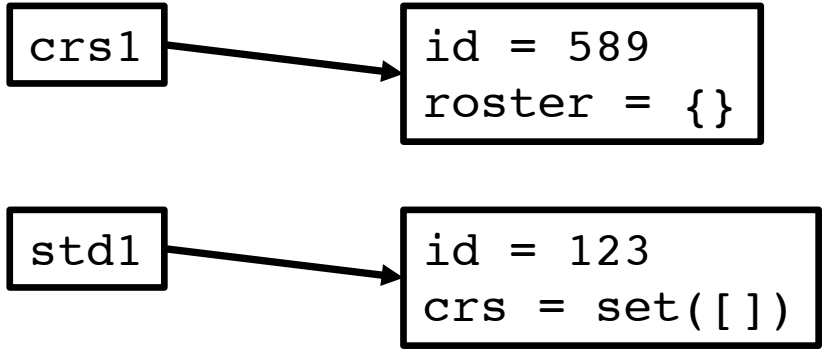
$$C'_{00} = A'_{00}B'_{00} + A'_{01}B'_{10}$$


crs1 = Course(589)
crs1
id = 589
roster = {}

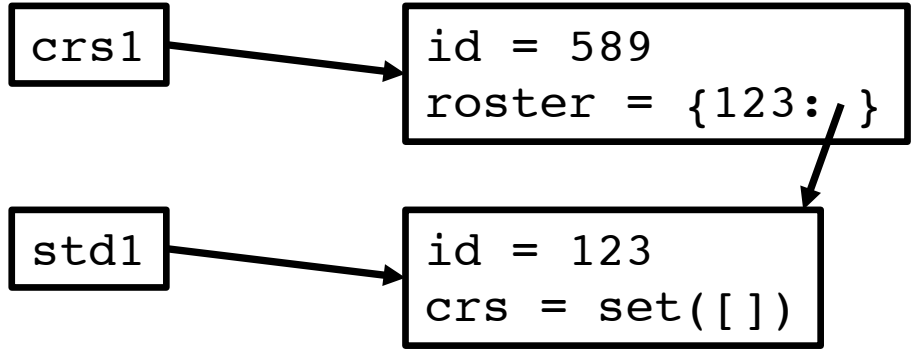
```
crs1 = Course(589)
sdt1 = Student(123)
```



```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
```

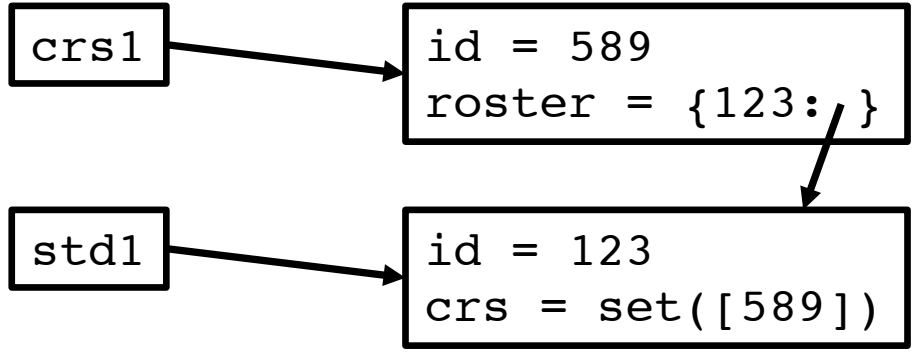


```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
```



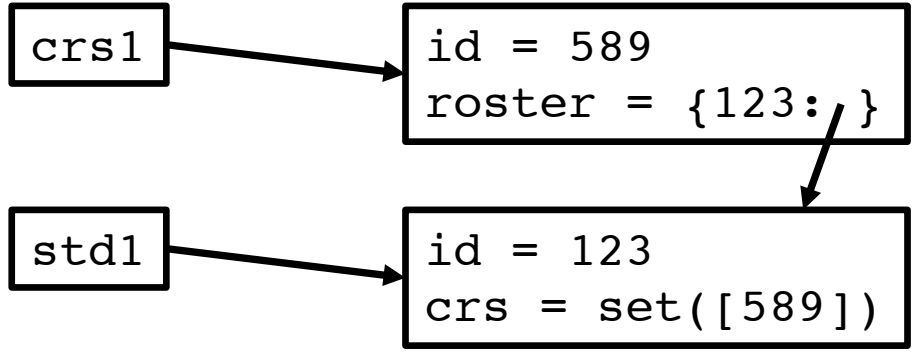

```
self.roster[student.id] = student
```

```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
```

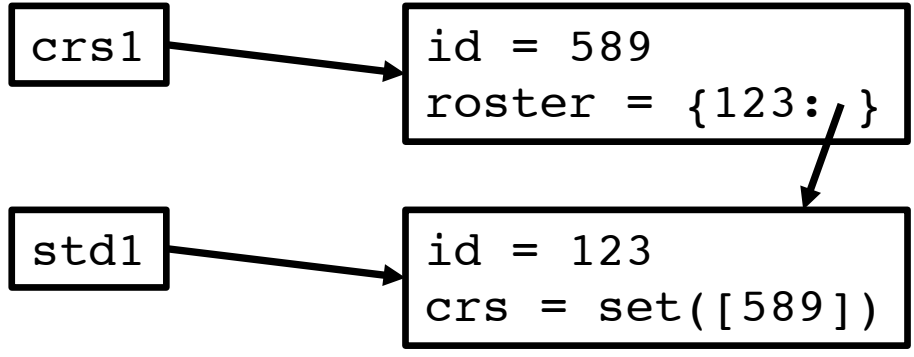



```
self.roster[student.id] = student
student.roster.add(self.id)
```

```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
crs1.drop_student(123)
```

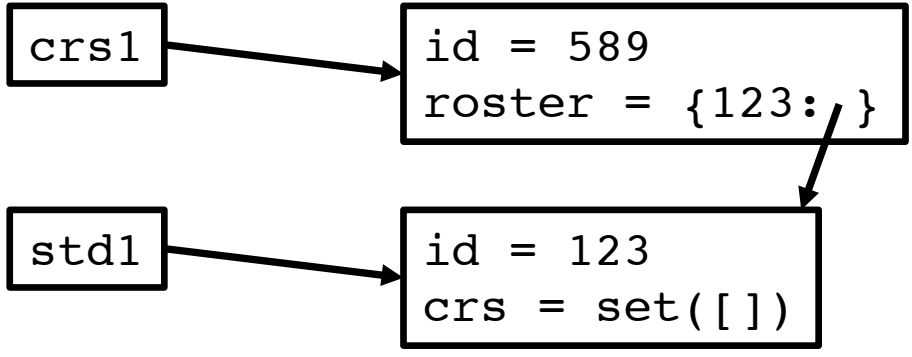


```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
crs1.drop_student(123)
```



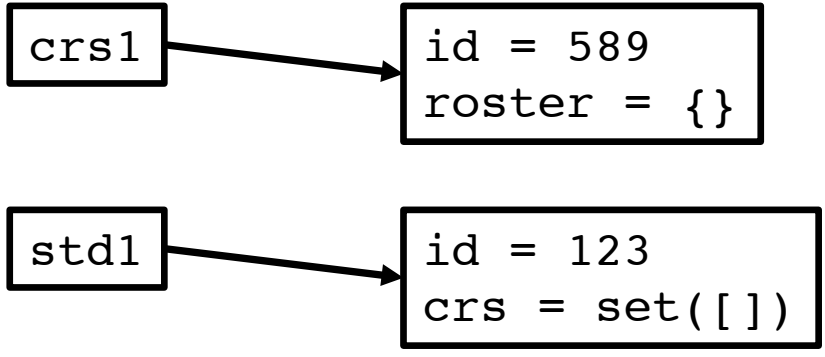

```
student = self.roster[student_id]
```

```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
crs1.drop_student(123)
```




```
student = self.roster[student_id]
student.crs.remove(self.id)
```

```
crs1 = Course(589)
sdt1 = Student(123)
crs1.add_student(sdt1)
crs1.drop_student(123)
```




```
student = self.roster[student_id]
student.crs.remove(self.id)
del self.roster[student_id]
```

$$\begin{bmatrix} 1 & 0 & 2 \\ 0 & 0 & 3 \\ 4 & 5 & 0 \end{bmatrix}$$

indptr:

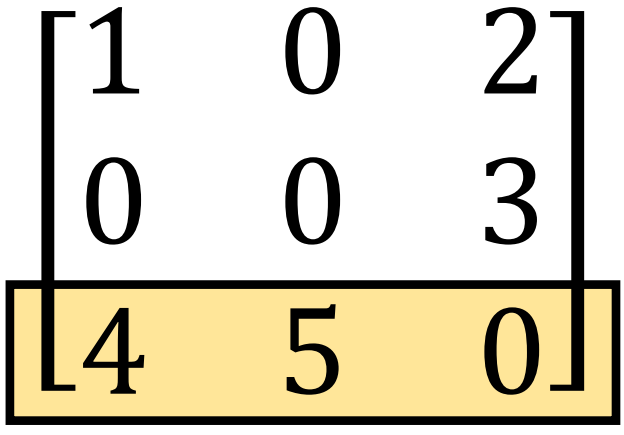
[0,2,3,5]

indices:

[0,2,2,0,1]

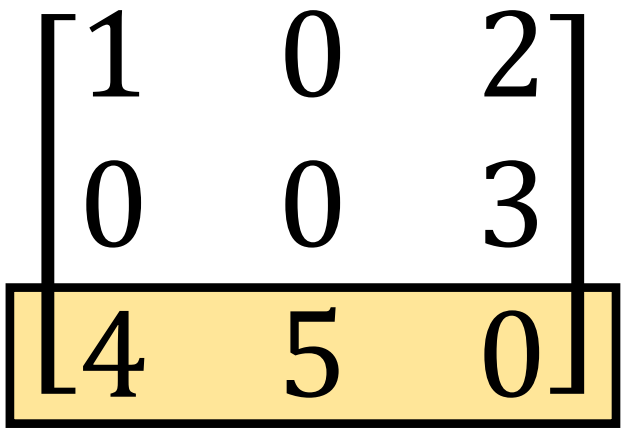
data:

[1,2,3,4,5]




```
row = A[i,:]
```

```
indptr:
  [0,2,3,5]
indices:
  [0,2,2,0,1]
data:
  [1,2,3,4,5]
```



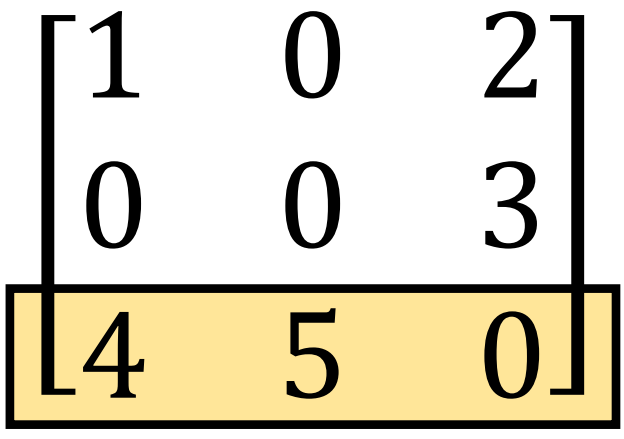

```
row = A[i,:]
s=indptr[i]
e=indptr[i+1]
```

```
indptr:
```

s e

```
[0,2,3,5]
```

```
indices:
[0,2,2,0,1]
data:
[1,2,3,4,5]
```




```
row = A[i,:]
s=indptr[i]
e=indptr[i+1]
row=data[s:e]
```

s e

```
indptr:
  [0,2,3,5]
indices:
  [0,2,2,0,1]
data:
  [1,2,3,4,5]
```