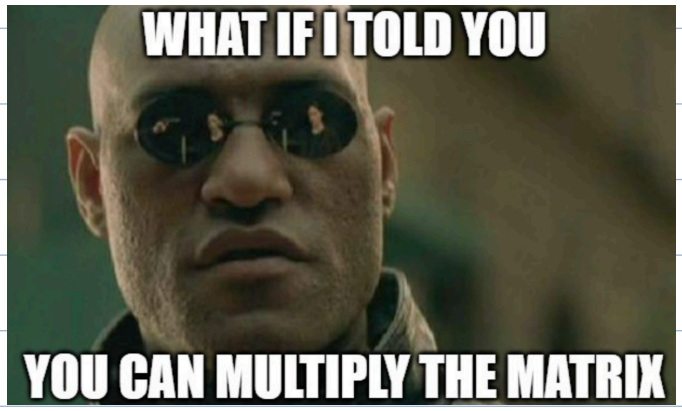
Agenda

- Sorting
- Matrix Multiplication
    - `np.dot`
    - `@` operator
    - `np.matmul`
- Vectorization
- Broadcasting



Sorting

- `np.sort` returns a sorted copy of an array.

We can directly call `sort` method on array but it can change the original array as it is an inplace operation.

Code

```
a.sort() # sorting is performed inplace
a
```

Element-wise Multiplication

Element-wise multiplication in NumPy involves multiplying corresponding elements of two arrays with the same shape to produce a new array where each element is the product of the corresponding elements from the input arrays.

Takeaway:

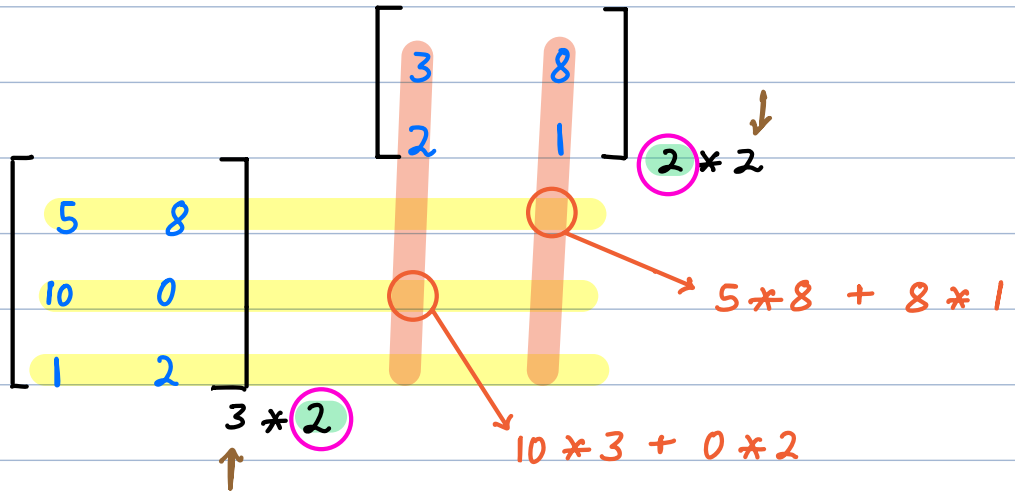
- Array * Number → WORKS
- Array * Array (same shape) → WORKS
- Array * Array (different shape) → DOES NOT WORK

Matrix Multiplication

Rule: Number of columns of the first matrix should be equal to number of rows of the second matrix.

- (A,B) * (B,C) -> (A,C)
- (3,4) * (4,3) -> (3,3)

np.dot(a, b)
np.matmul(a, b) / a @ b



Important:

- `dot()` function supports the vector multiplication with a scalar value, which is not possible with `matmul()`.
- `Vector * Vector` will work for `matmul()` but `Vector * Scalar` won't.

Vectorization

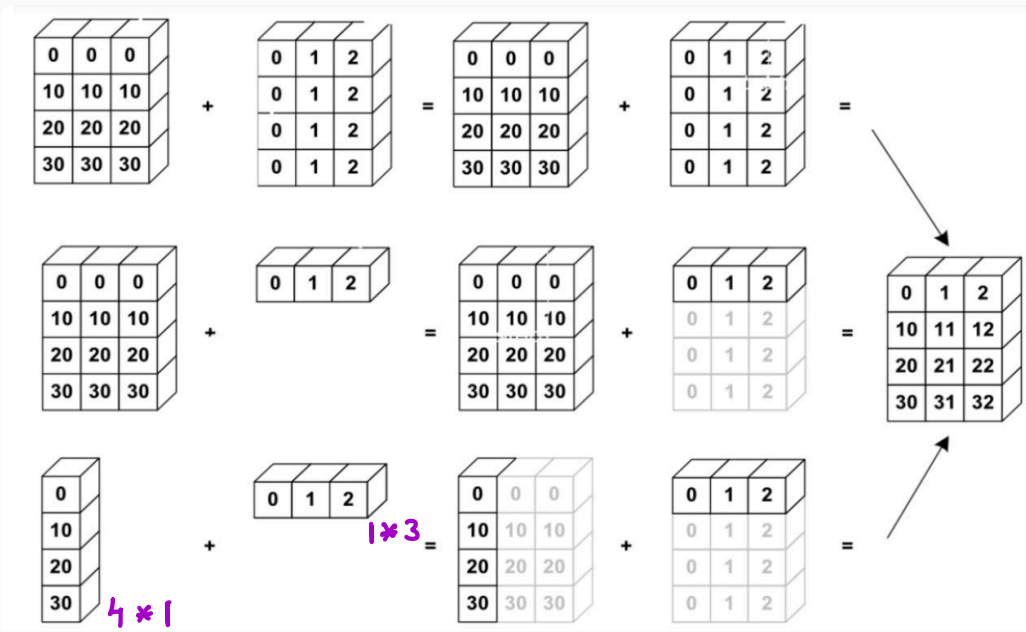
Vectorization in NumPy refers to performing operations on entire arrays or array elements simultaneously, which is significantly faster and more efficient than using explicit loops.

`np.vectorize()`

- It is a generalised function for vectorization.
- It takes the function and returns an object (which acts like function but can take an array as input and perform the operations).

Broadcasting

Broadcasting in NumPy is the automatic and implicit extension of array dimensions to enable element-wise operations between arrays with different shapes.



Note:

- `numpy.tile(array, reps)` constructs an array by repeating `a` the number of times given by reps along each dimension.
- `np.tile(array, (repetition_rows, repetition_cols))`

Broadcasting in 2D Arrays

- A + A (same shape) → WORKS ✓
- A + A (1D) → WORKS ✓
- A + number → WORKS ✓
- A + A (different shape but still 2D) → DOES NOT WORK ✗