

Lecture 17, 15 October 2026

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Programming and Data Structures with Python

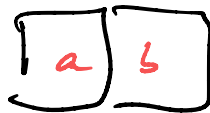
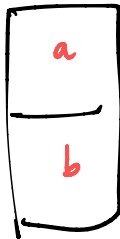
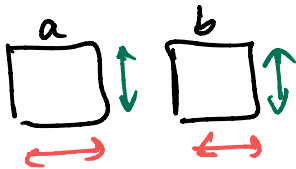
Libraries

time, math, sys - "built in"

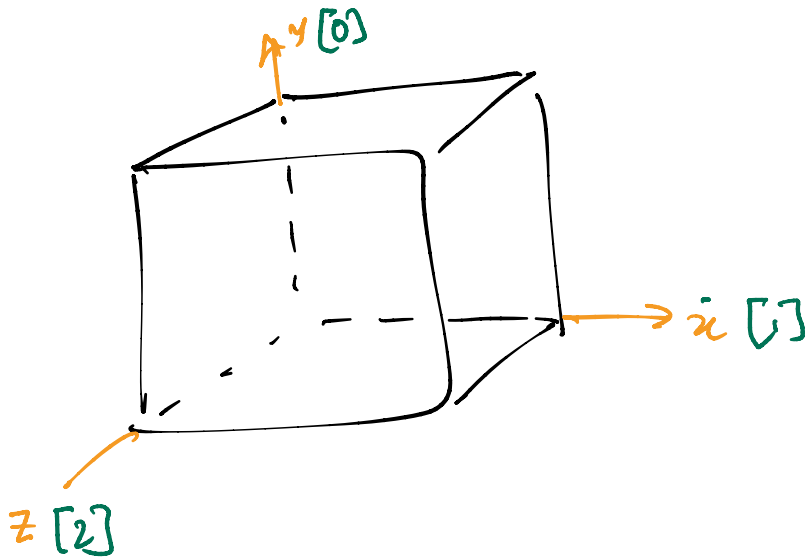
User defined / contributed libraries

numpy - arrays

- Create arrays
- Scalar "broadcasting"
- "Combine" arrays



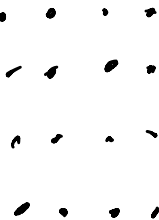
Axes



Images

$$(r, g, b) \times (1, 10, 100)$$

$$= (r, 10g, 100b)$$

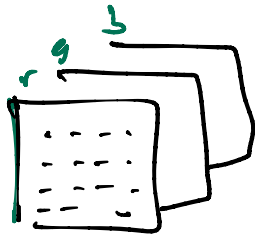


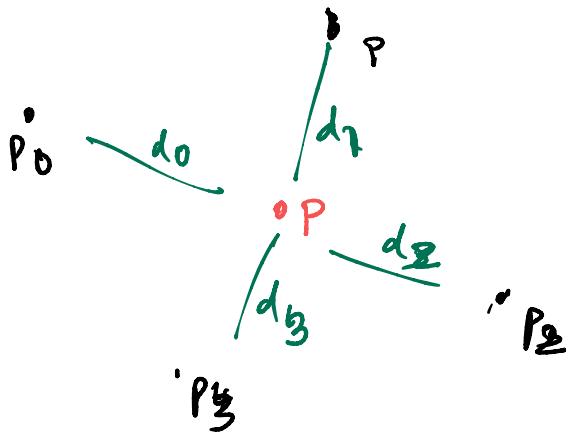
[4x4]

$$\begin{matrix} & \text{x1} & \text{x10} & \text{x100} \\ (r, g, b) & (r, g, b) & \dots \end{matrix}$$

$$(r, g, b) \dots$$

$$\times \underline{3} \times \underline{[1, 3]}$$





Which p_i
is closest
to p ?

$$d = \sqrt{(x_j - x)^2 + (y_j - y)^2}$$

$$(x_j - x^2, y_j - y)^2$$