

## Chapter 2 outline:

- ▶ Mathematical sequences and Python lists (last week Wednesday)
- ▶ Recurrence relations and recursive functions (last week Friday)
- ▶ Functions on lists (Monday)
- ▶ More about functions on lists; sorting (Wednesday)
- ▶ Arrays, vectors, and intervals (**today**)
- ▶ Review for test (next week Monday)
- ▶ Test on Chapters 1 & 2 (next week Wednesday, Sept 24)

## Today:

- ▶ Sequences and sequence-like mathematical objects
  - ▶ Vectors
  - ▶ Intervals
  - ▶ Matrices
- ▶ Python arrays (ndarray)
  - ▶ As vectors
  - ▶ As intervals
  - ▶ As matrices
  - ▶ As data sets

## Goals of this course

- ▶ Write programs in the functional style
- ▶ Think recursively
- ▶ Understand sets, relations, and functions so that they can model real-world (and abstract) information
- ▶ Use formal logic to prove mathematical propositions.

## Concepts of the first two chapters

- ▶ Sets and their operations
- ▶ Sequences
- ▶ Python expressions, types, and functions
- ▶ Python sets and lists
- ▶ Recursive algorithms

## Points of this section

- ▶ Python arrays, like lists, represent sequences.
- ▶ Python arrays have more features than lists, especially multidimensionality.
- ▶ Python arrays model/represent vectors, matrices, intervals, and data sets.

$$\begin{array}{rcl}
 3x_0 & +2x_1 & +\frac{1}{2}x_2 = -\frac{4}{3} \\
 -4x_0 & -x_1 & +10x_2 = 5 \\
 \frac{1}{8}x_0 & +\frac{2}{3}x_1 & +x_2 = 7
 \end{array}$$

$$A\vec{x} = \vec{b} \quad \text{or} \quad \begin{pmatrix} 3 & 2 & \frac{1}{2} \\ -4 & -1 & 10 \\ \frac{1}{8} & \frac{2}{3} & 1 \end{pmatrix} \begin{pmatrix} x_0 \\ x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} -\frac{4}{3} \\ 5 \\ 7 \end{pmatrix}$$



```
a[:2, 1:3].shape
```

```
np.linspace(0., 20., 1000)
```

**For next time:**

*Do Exercises 2.4.(1, 3, 5, 7, 8, 10, 13)*

*Exercises 2.4.(1 and 3) are type-analysis problems to be done on paper.*

*The others are programming exercises. (2.4.7 is a "discovery" problem for which you should write your observations in the notebook.)*

*(No reading or quiz. . . )*