Number Types and Functions to Store Data

1. Number Types
   - change of basis
2. Functions to Store Data
   - a composite data structure: the list
   - an application of shared references

MCS 320 Lecture 7
Introduction to Symbolic Computation
Jan Verschelde, 17 June 2024

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Binary and Decimal Notations of Numbers

The basic number types are

- the integers, rationals, reals, and complex numbers,
- denoted respectively by $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{R}$, $\mathbb{C}$.

Internally, all numbers are stored in binary.

The real number 0.1 has no exact binary representation,
in contrast to its decimal representation which agrees with $1/10$.

We define

- for any real number,
- given a bound on the size of the denominator,

the nearby rational approximation with a bounded denominator.

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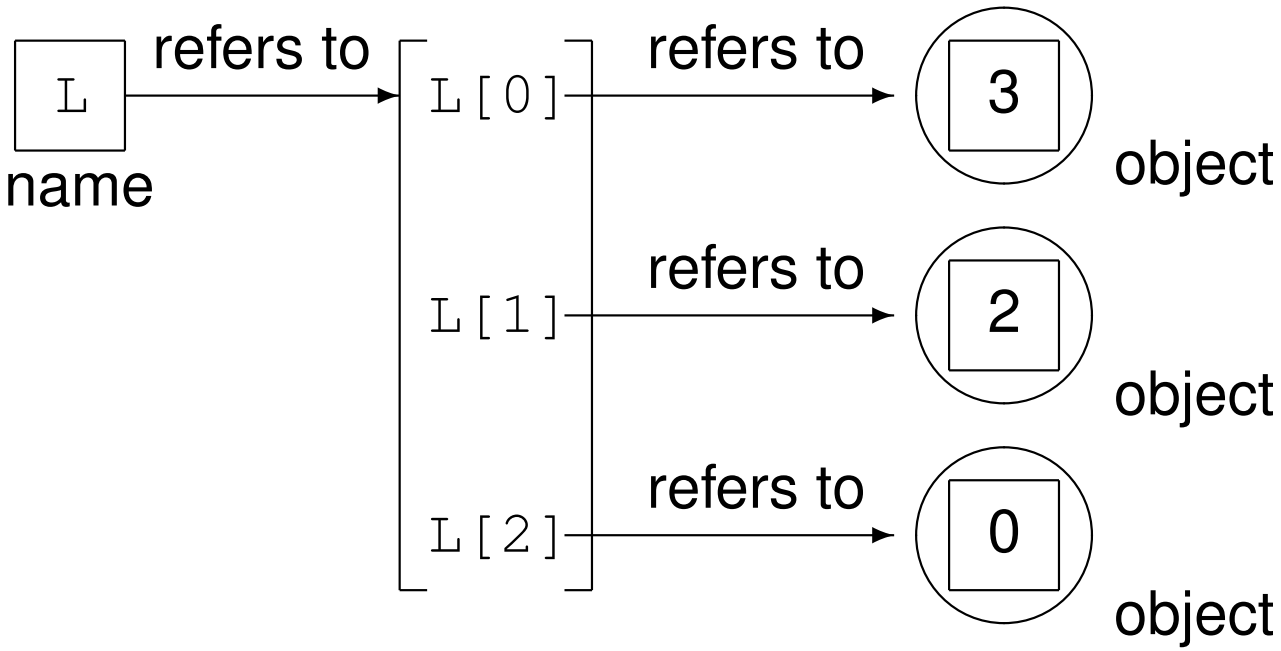
a composite data structure: the list

After the assignment `L = [3, 2, 0]`, we have:



The `L = [3, 2, 0]` defined the names `L[0]`, `L[1]`, and `L[2]`.

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Functions to Store Data

Consider the definition of the function:

```
def fun(item, data=[]):
    data.append(item)
    print(data)
```

- `data` is the default argument, initialized to a list,
- `data.append(item)` appends `item` to `data`.

The first time the function is called:

1. A list is made in memory and assigned to `data`.
2. The value of `item` is appended to the list `data`.

The next times the function is called:

1. The same list in memory is used as `data`.
2. The value of `item` is appended to the list `data`.