



UC Berkeley EECS
Lecturer
Michael Ball

Computational Structures in Data Science



Data Structures: Linked Lists



Why "Data Structures"? (Next Few lectures)

- Data Structures
 - OOP helps us organize our *programs*
 - Data Structures help us organize our data!
 - You already know lists and dictionaries!
 - We'll see two new ones today
- Enjoy this stuff? Take 61B!
- Find it challenging? Don't worry! It's a different way of thinking.



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Linked Lists



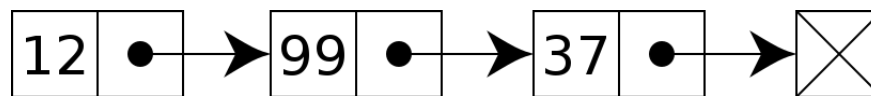
Data Structures

- A data structure is a way to organize or *model* a bunch of independent pieces of data.
 - Lists (arrays)
 - Dictionaries
 - Tuples
- A class, on its own, is *not* necessarily a data structure, it represents a new data type.
 - a “car” or a “person” is an instance of that data type.
 - Lists, Dicts, etc are also data types; their goal is to organize other data.
- These are common patterns that can be used to solve a wide variety of problems.
- Sometimes we’re giving structure to make it easier as a programmer, sometimes we’re trying to be fast or efficient. (Next lecture!)



Linked Lists

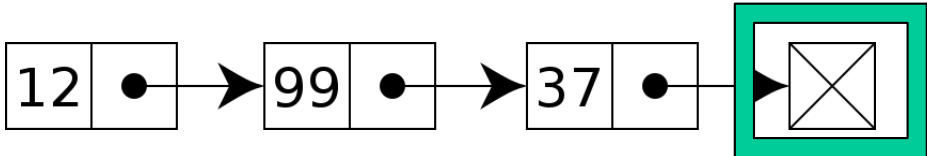
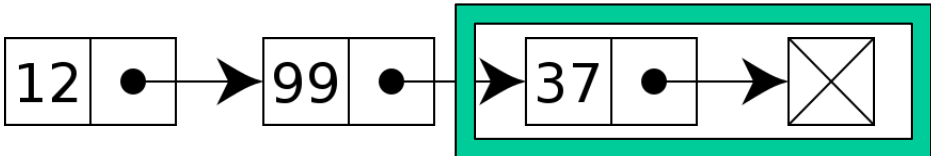
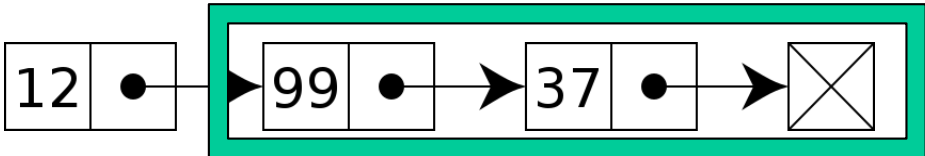
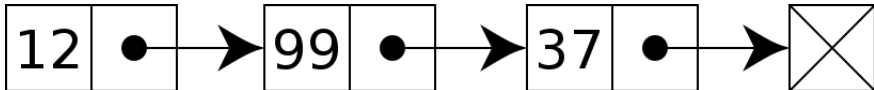
- A Recursive List, sometimes called a "rlist"
- Linked lists contain other linked lists
- A series of items with two pieces:
 - A value, usually called "first"
 - A "pointer" to the rest of the items in the list.



- We'll use a very small Python class "Link" to model this.
- `Link(12, Link(99, Link(37, Link.empty)))`



Recursion Is Implicit



```
self.rest
```

Demo – See the Notebook





Why are linked lists useful?

- Honestly, a list() is easier *most* of the time
 - Python handles all the hard details!
- In terms of *efficiency*: Linked list make it fast to move items around, inserts and deletes.
 - But they are slower to finding any single item.
- In Ants Project: You'll see a list of `Place` objects which are linked together via an entrance and an exit.