CS 240

Data Structures and Algorithms I

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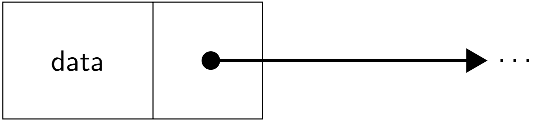
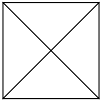
Linked Lists

Ordered sequence of elements represented by:

- Nodes (a.k.a. cons cells)—objects with references to
  - The data stored (`car`, `head`, `first`, . . .)
  - A link to the next node in the list (`cdr`, `tail`, `rest`, . . .)
- Nil—to represent the end of a list





Linked Lists

In Code

Idea: Make a Node<E> class that can be used by a List<E> class

```
class Node<E> {
    // stores the data

    // stores the link

    // constructor
}
```

Question: How do we represent nil?

Creating Linked Lists

Examples

Draw the box-and-arrow diagrams for the following lists:

- `new Node<Integer>(1, null)`

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- `new Node<Integer>(1, new Node<Integer>(2, null))`

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- `new Node<Integer>(1, null)`
- `new Node<Integer>(1, 2)`
- `new Node<Integer>(1, new Node<Integer>(2, null))`
-
```
new Node<Integer>(8,
  new Node<Integer>(6,
    new Node<Integer>(7, null)))
```

Putting It All Together

Idea: want an overall `List<E>` class

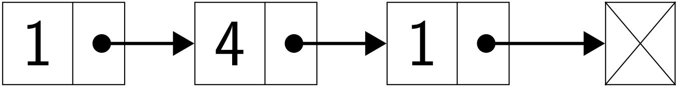
```
class List<E> {
    // stores Node(s)

    // constructor
}
```

Manipulating Linked Lists

What sort of operations could we perform on a list?

Example (Add to Front)

Add the element 3 to the front of the following list:



How would we implement this in the `List<E>` class?

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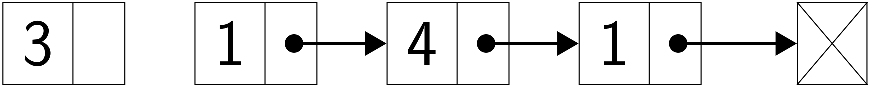

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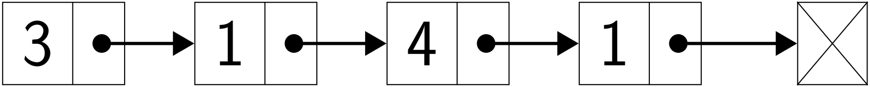

How would we implement this in the `List<E>` class?