LEC 12

CSE 123

Linked Lists with Recursion

Questions during Class?

Raise hand or send here

sli.do #cse123A

BEFORE WE START

Talk to your neighbors:

Best boba in Seattle?

Instructors: Nathan Brunelle

TAs:	Arohan	Ashar	Neha	Rohini	Rushil
	Ido	Zachary	Sebastian	Joshua	Sean
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	Ziao	Kieran	Marcus	Crystal	Eeshani
	Prakshi	Packard	Cora	Dixon	Nichole
	Niyati	Trien	Lawrence	Evan	Cady

Lecture Outline

- Announcements
- Traversing Linked Lists Recursively
- Modifying Linked Lists Recursively

Announcements

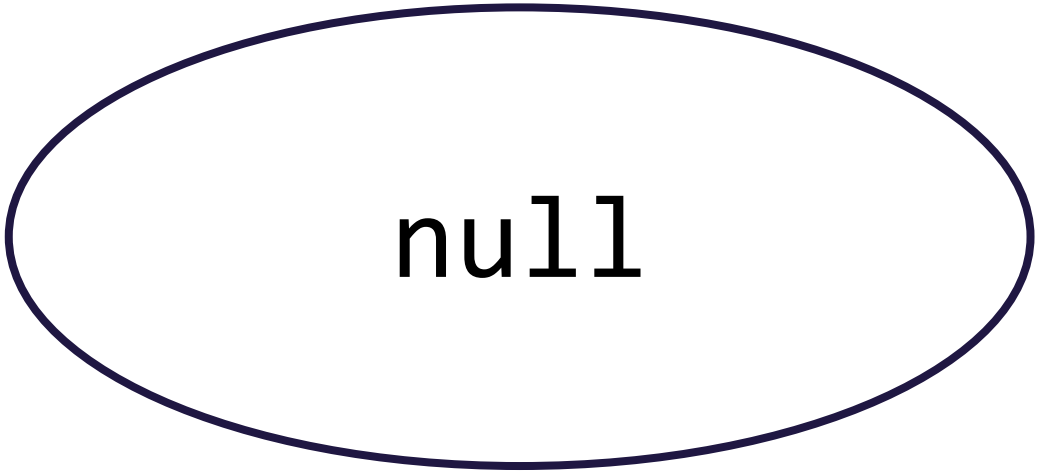
- Creative Project 2 due tonight May 14 at 11:59pm
- Resubmission Cycle 4 is due Fri (May 16) at 11:59pm
  - ***C1***, P1 eligible
- Programming Assignment 2 released tomorrow (May 15)
  - Focused on exhaustive search + recursive backtracking!
- Quiz 1 grades out early next week

Lecture Outline

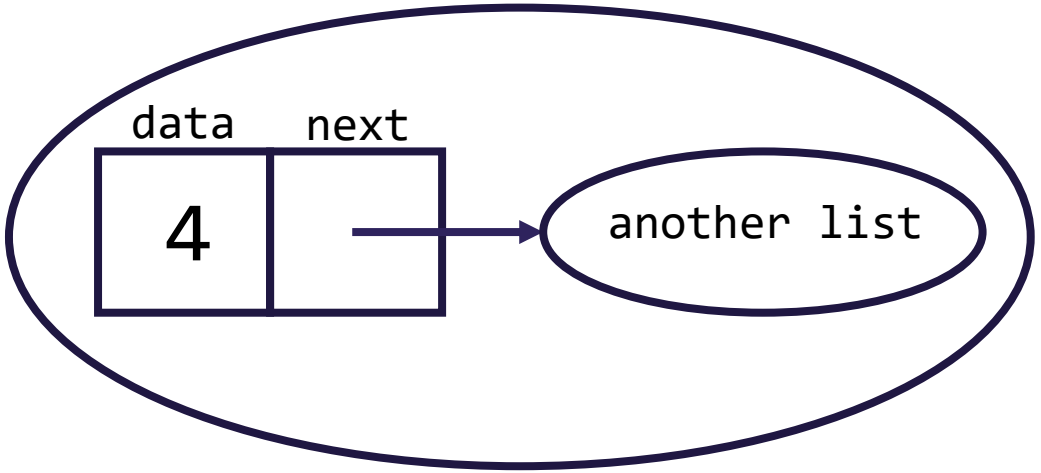
- Announcements
- **Traversing Linked Lists Recursively**
- Modifying Linked Lists Recursively

Linked Lists

- A linked list is either:



Empty list



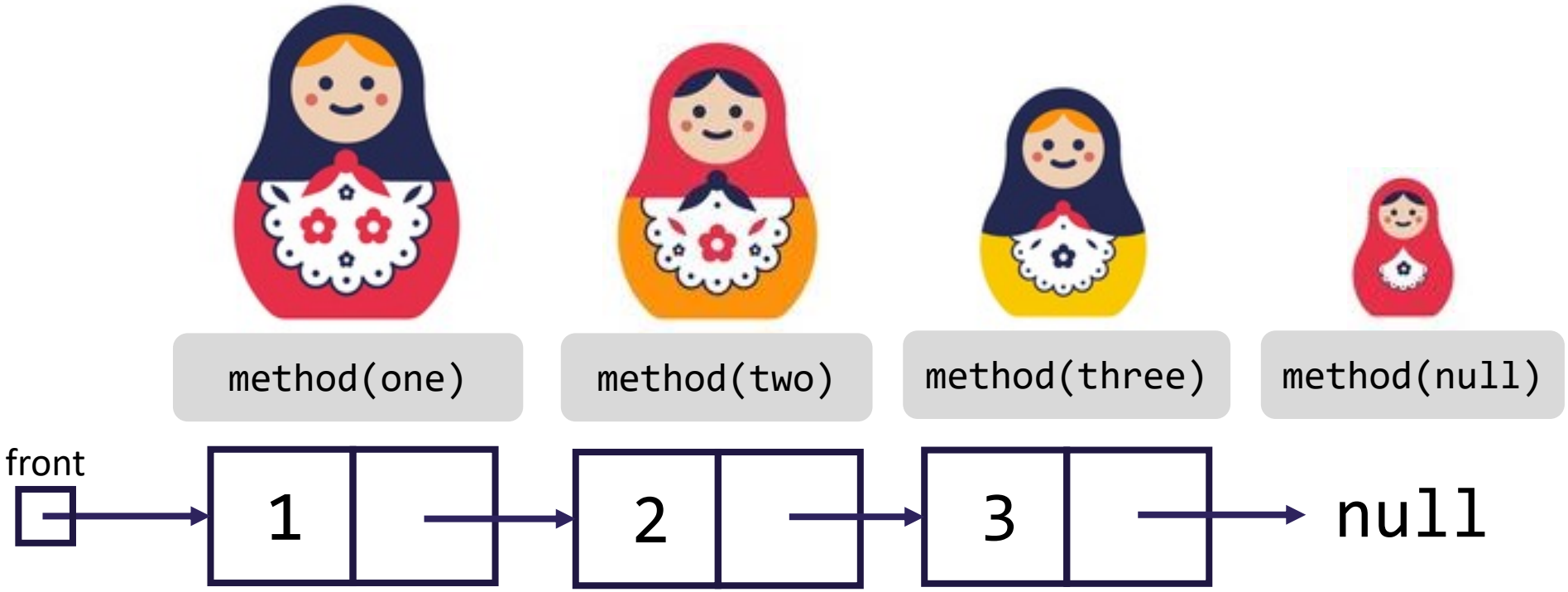
Node w/ another linked list

This is a recursive definition!

A list is either empty or a node with another list!

Recursive Traversals w/ LinkedLists

- Guaranteed base case: empty list
  - Simplest possible input, should immediately know the return
- Guaranteed public / private pair
  - Need to know which sublist you're currently processing (i.e. `curr`)



Lecture Outline

- Announcements
- Traversing Linked Lists Recursively
- **Modifying Linked Lists Recursively**

Modifying LinkedLists [Review]

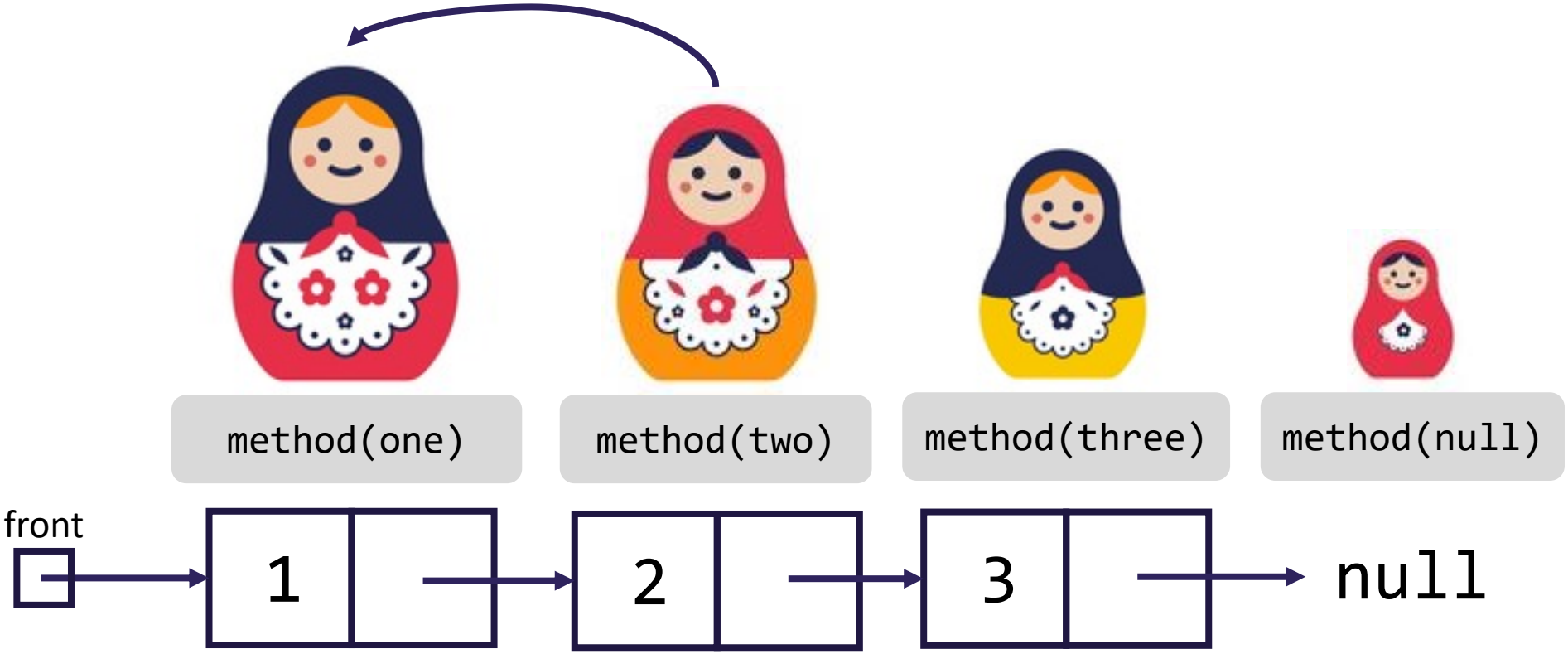
- Remember: using a `curr` variable to iterate over nodes

- Does changing `curr` actually update our chain?
  - What will? Changing `curr.next`, changing `front`
  - Need to **stop one early** to make changes

- Often a number of cases to watch out for:
  - M(iddle) – Modifying node in the middle of the list (general)
  - F(ront) – Modifying the first node
  - E(mpty) – What if the list is empty?
  - E(nd) – Rare, do we need to do something with the end of the list?

Modifying LinkedLists Recursively

- Much easier than iterative solutions!
- No longer need to stop one early
  - Can go right to the point you'd like to make the change



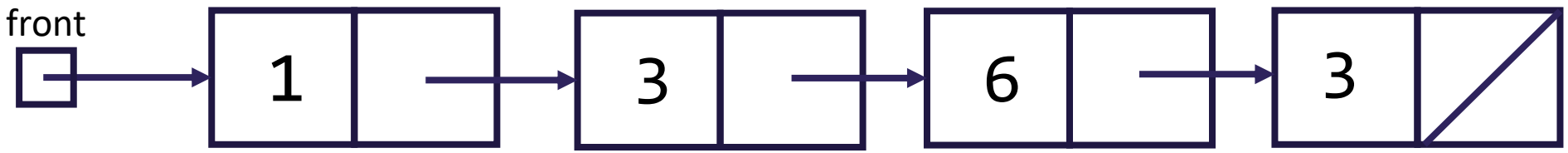
Modifying LinkedLists Recursively

- Much easier than iterative solutions!
- No longer need to stop one early
  - Can go right to the point you'd like to make the change

- How? Return the updated change and catch it!
  - Private pair returns `ListNode` type
  - `curr.next = change(curr.next)` / `front = change(front)`
  - Resulting solutions much cleaner than iterative cases

- We call this pattern **`x = change(x)`**

removeAll Walkthrough




```
private ListNode removeAll(int value, ListNode node) {
    if (node == null) {
        return node;
    } else if (node.data == value) {
        return removeAll(value, node.next);
    } else {
        // x = change(x)
        node.next = removeAll(value, node.next);
        return node;
    }
}
```