LEC 06

CSE 123

LinkedIntList

BEFORE WE START

Talk to your neighbors:

What's your favorite form of potato?

Instructor: James Wilcox

Questions during Class?

Raise hand or send here

sli.do #cse123

Announcements

- Great job on Quiz 0!!
- R1 and P0 feedback released!
- Creative Project 1 due tonight at 11:59pm
  - Submit *something* so we can provide some feedback!
- Programming Project 1 releases tomorrow
  - One of the trickier assignments in the course
  - 2 weeks to complete this one! Feel free to take a breather if necessary but get started sooner than later

LinkedIntList

Reminder: Implementing Data Structures

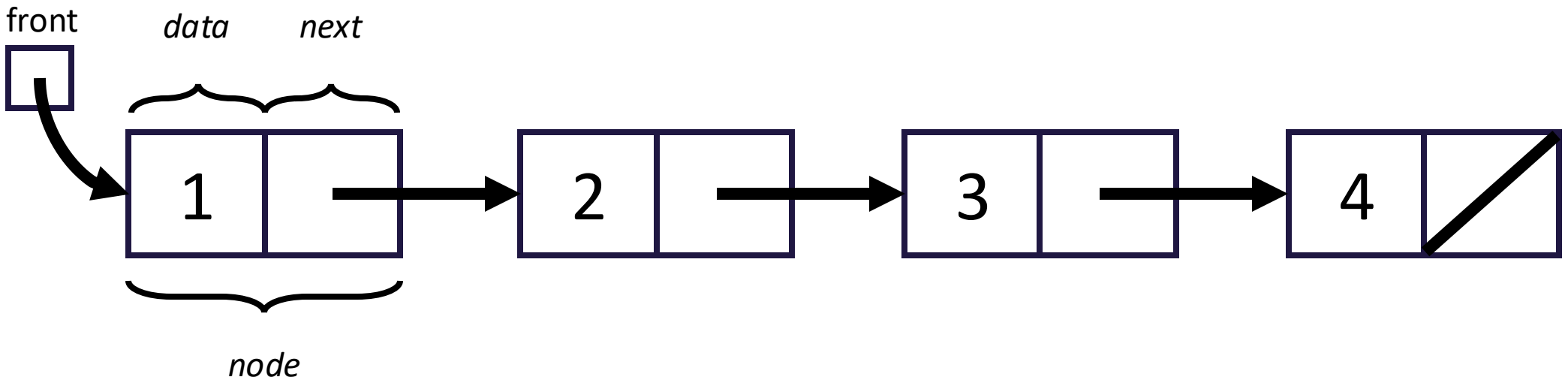
- No different from designing any other class!
  - Specified behavior (`List` interface):

Method	Description
`add(E value)`	Adds the given value to the end of the list
`add(int index, E value)`	Adds the given value at the given index
`remove(E value)`	Removes the given value if it exists
`remove(int index)`	Removes the value at the given index
`get(int index)`	Returns the value at the given index
`set(int index, int value)`	Updates the value at the given index to the one given
`size()`	Returns the number of elements in the list

  - Choose appropriate fields based on behavior
- Just requires some thinking outside the box

LinkedIntList

- Goal: leverage non-contiguous memory usage
  - How? LinkedNodes!
- What field(s) do we need to keep track of?
  - `ListNode front;  // First node in the chain`



LinkedIntList cont.

- Now that we have a `LinkedIntList` class, will a client ever need to interact with a `ListNode`?
  - No! Not something they should have to worry about
- How can we abstract `ListNodes` away from them?
  - Leaving them in a public file is pretty obvious…

- What if we made `ListNode` a private class inside `LinkedIntList`?
  - We can still access it (just like private fields)
  - Clients won't even know the class exists!
- Do fields need to be private if the entire class is private?

Reminder: Iterating over `ListNodes`

- General pattern iteration code will follow:

```
ListNode curr = front;
while (curr != null) {
    // Do something

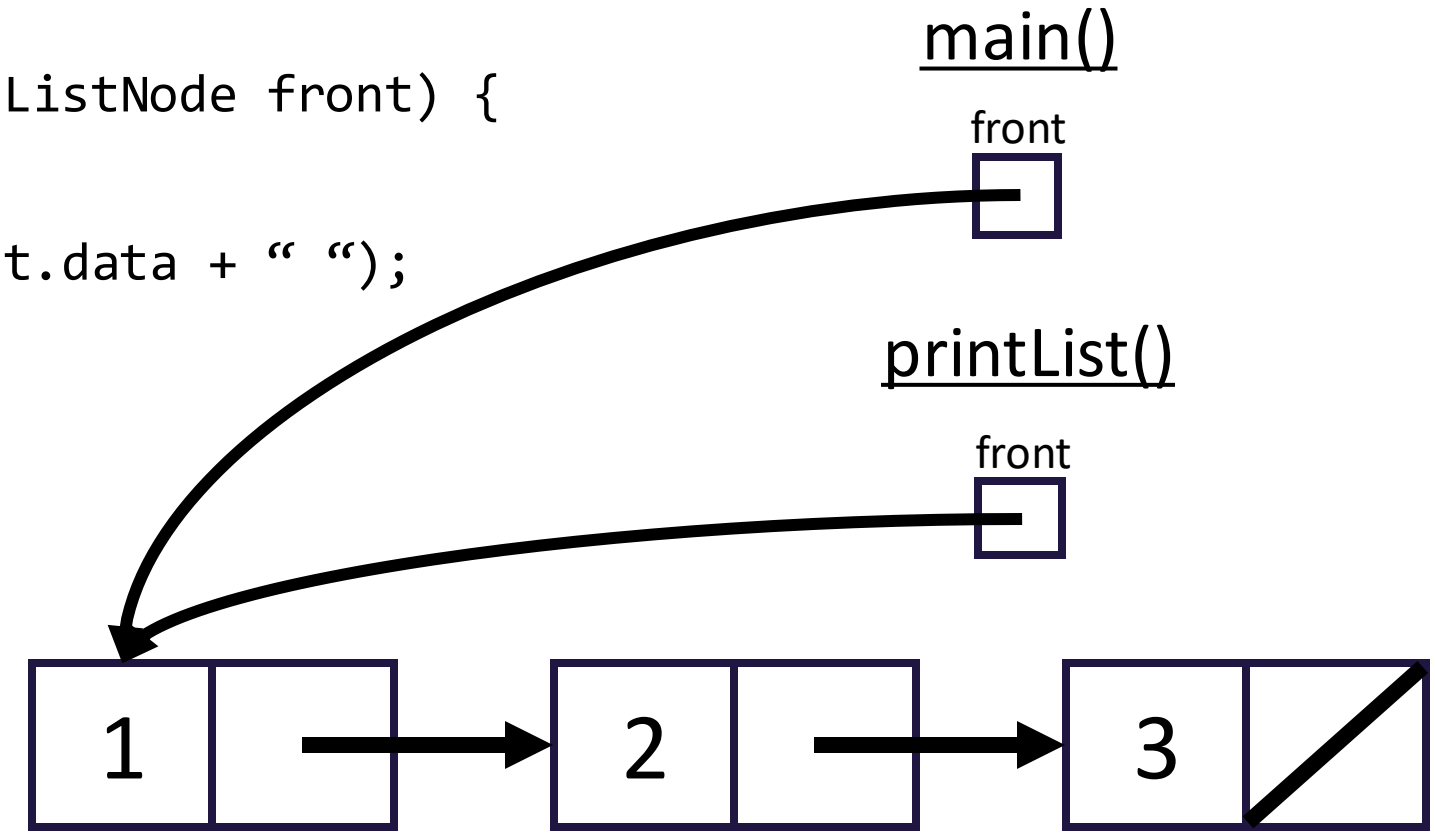
    curr = curr.next;
}
```

Why do we need a `ListNode curr`?

Why curr?

```
public static void main(String[] args) {
    ListNode front = new ListNode(1, new ListNode(2, new ListNode(3)));
}

public static void printList(ListNode front) {
    while (front != null) {
        System.out.print(front.data + " ");
        front = front.next;
    }
    System.out.println();
}
```



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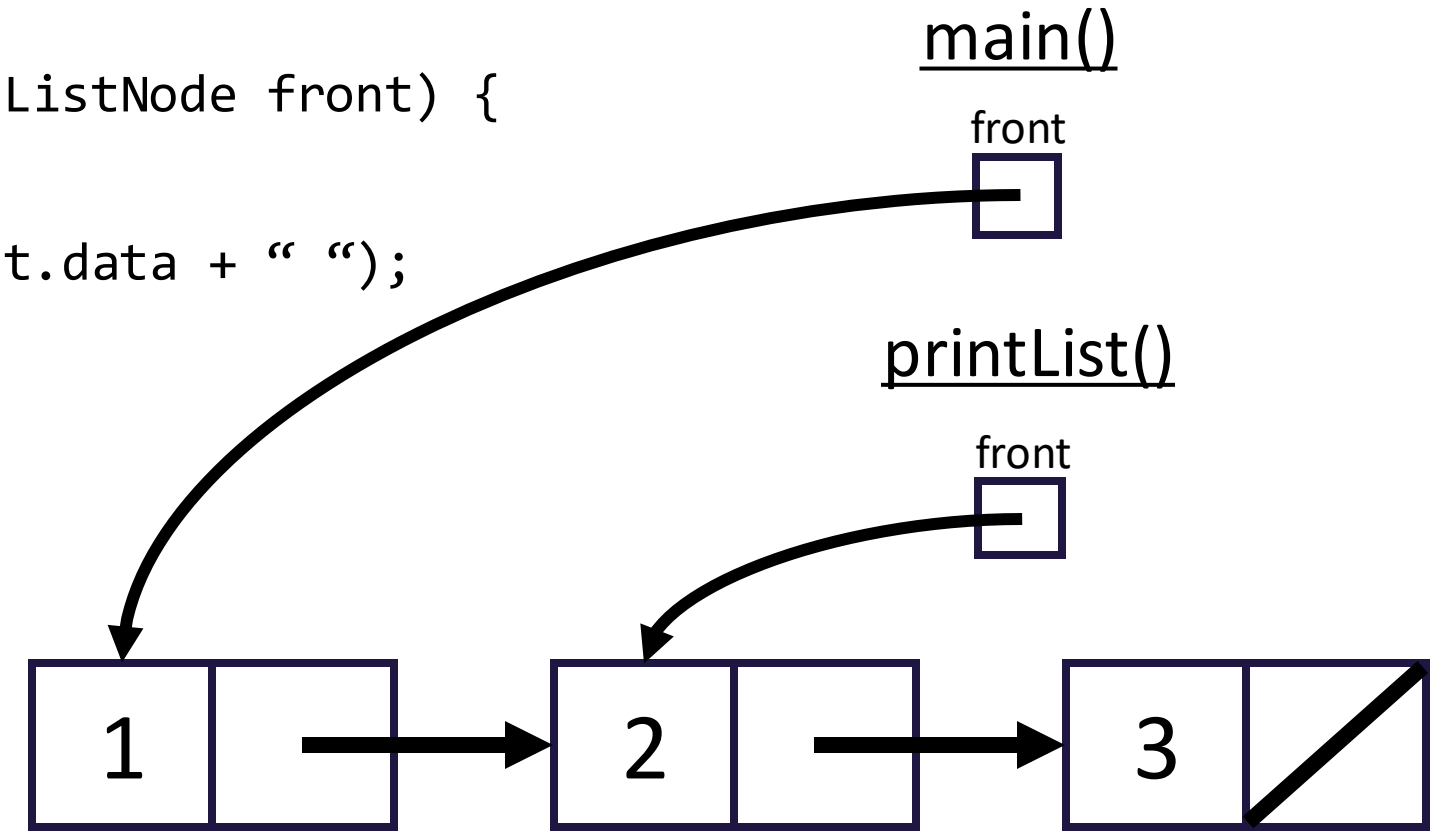

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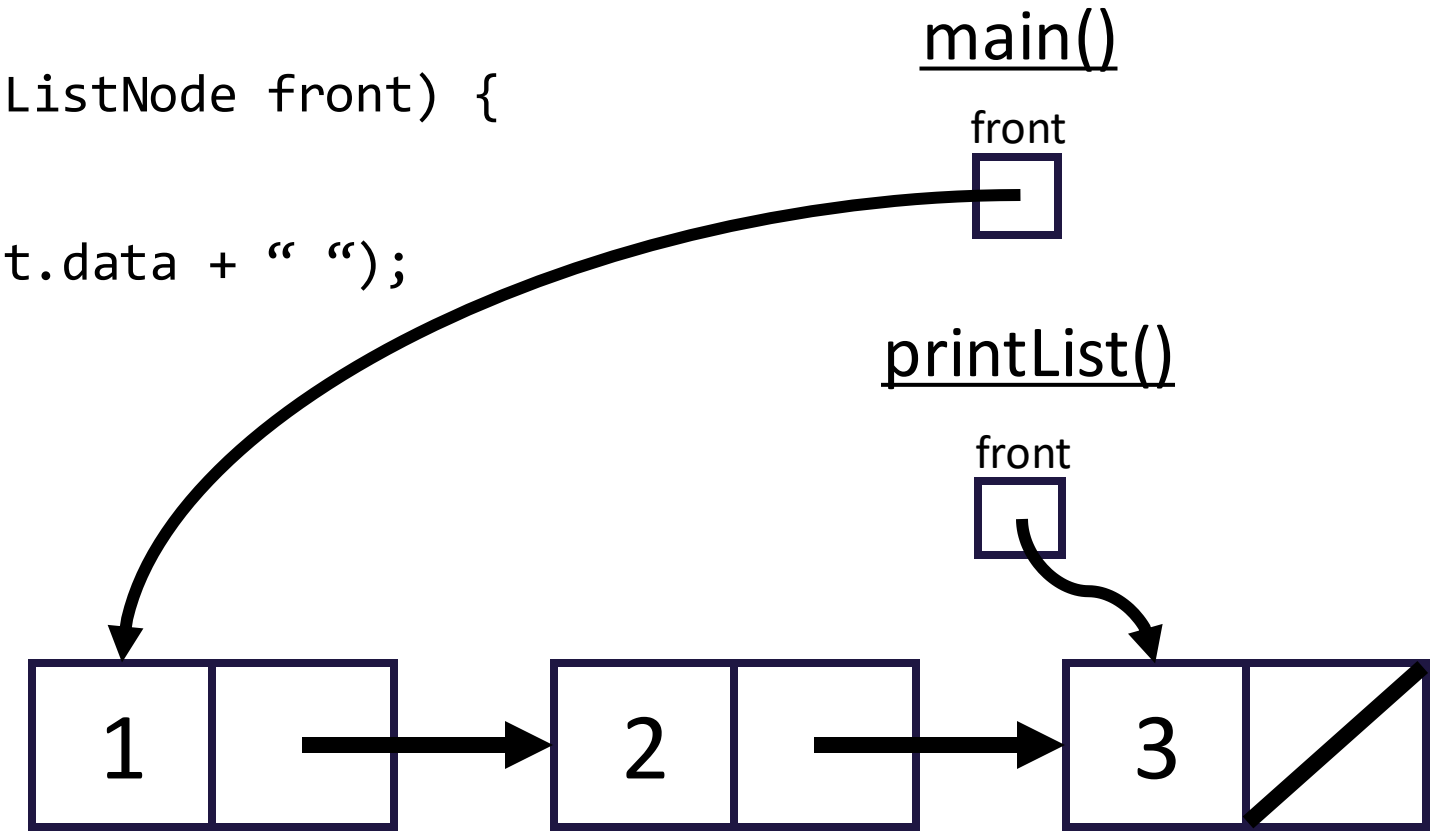

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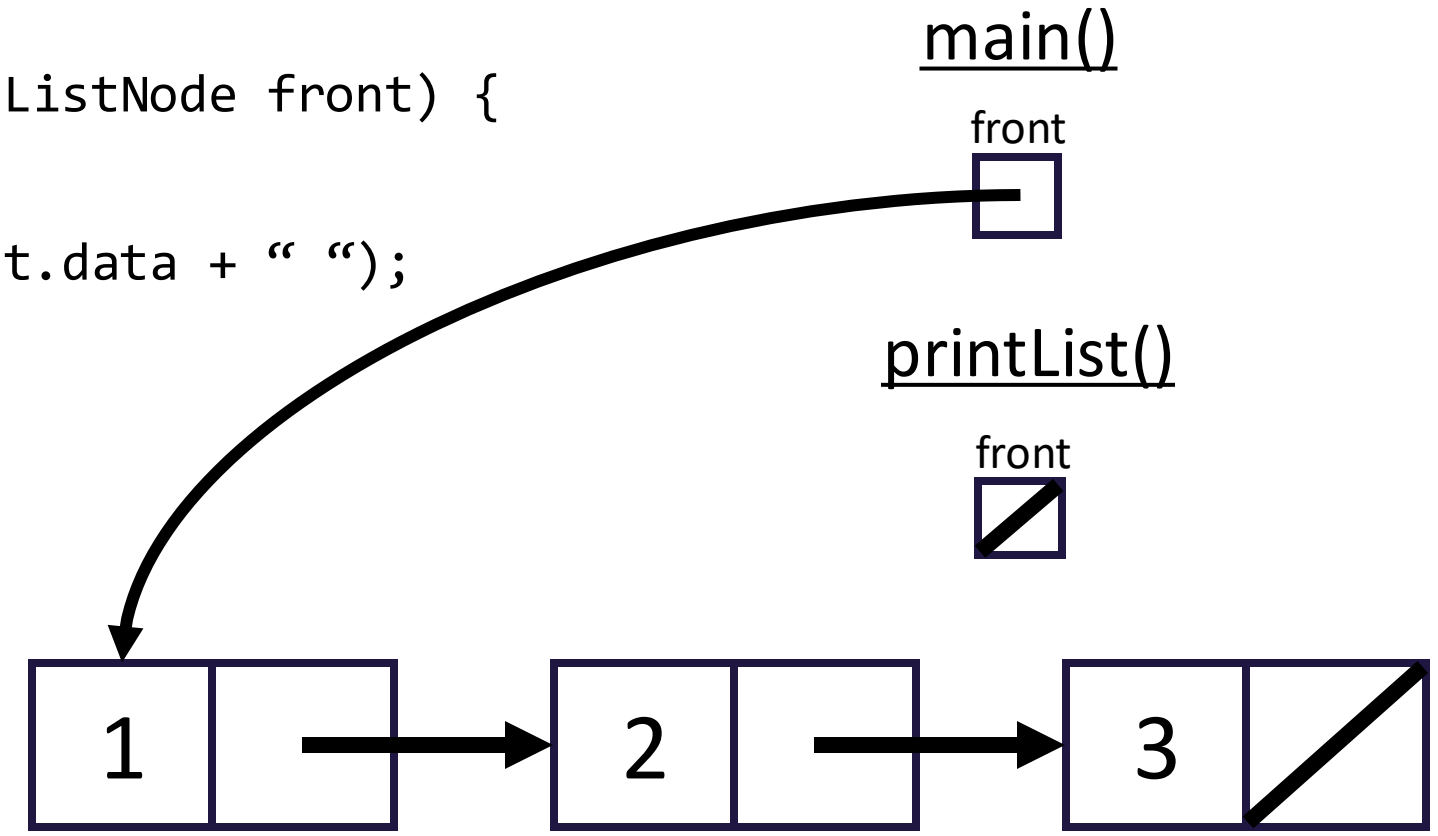

Why curr?

```
public class LinkedIntList {
    private ListNode front;

    public void printList() {
        while (front != null) {
            System.out.print(front.data + " ");
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        }
    }
}
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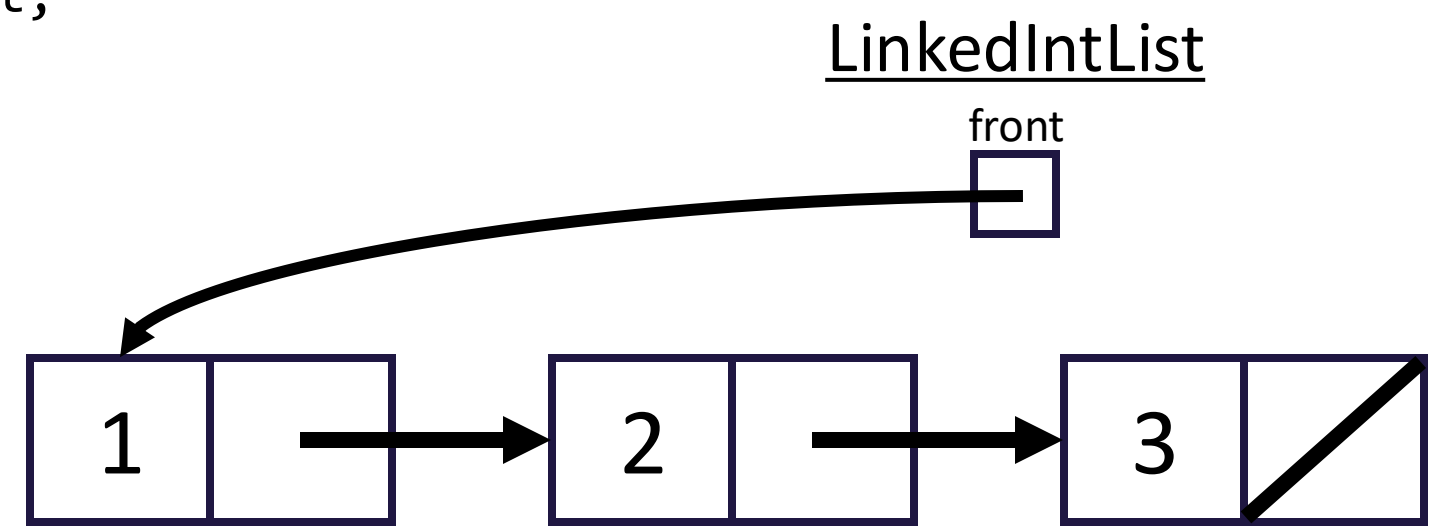

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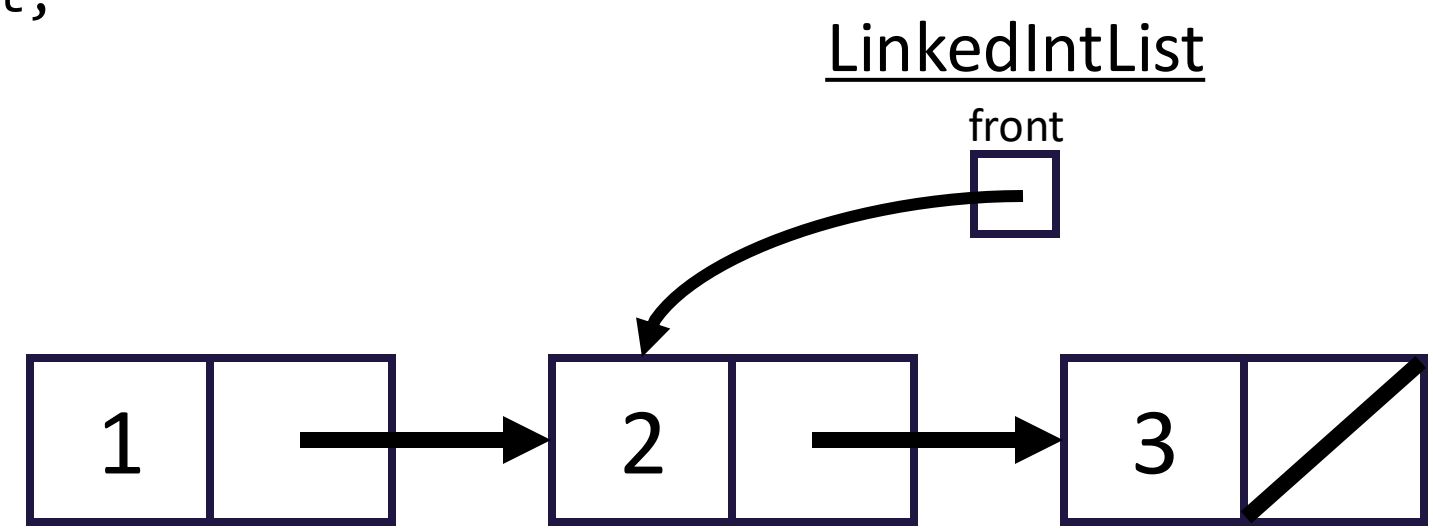

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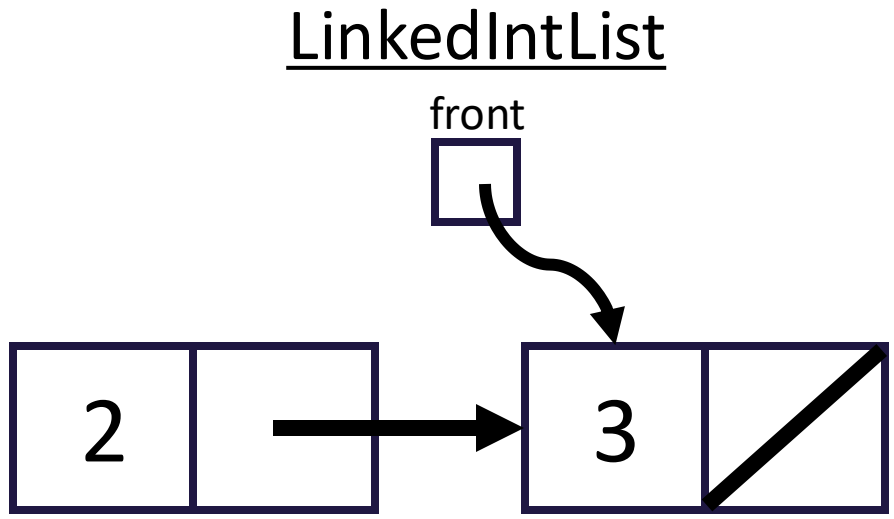

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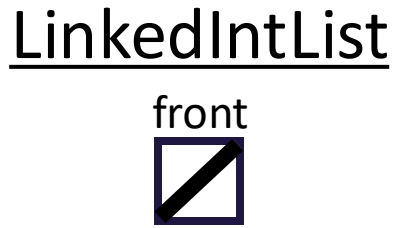
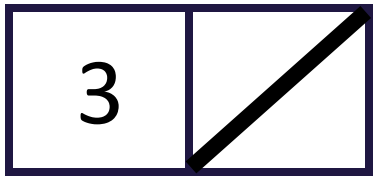


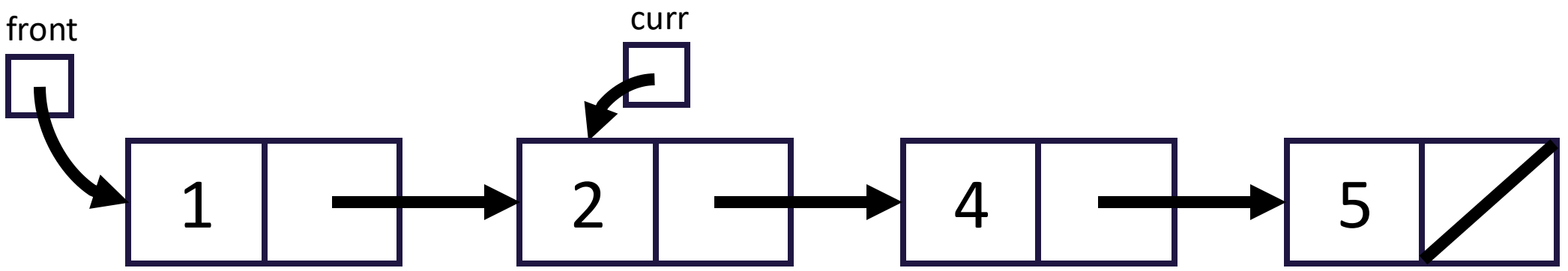
Modifying front now modifies the list!



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

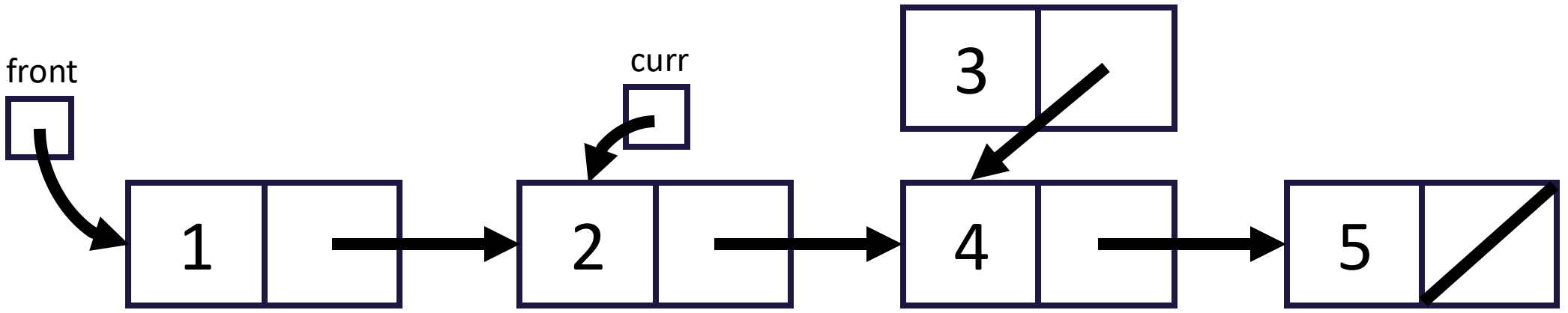
- Does changing `curr` actually update our chain?
  - What will?



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

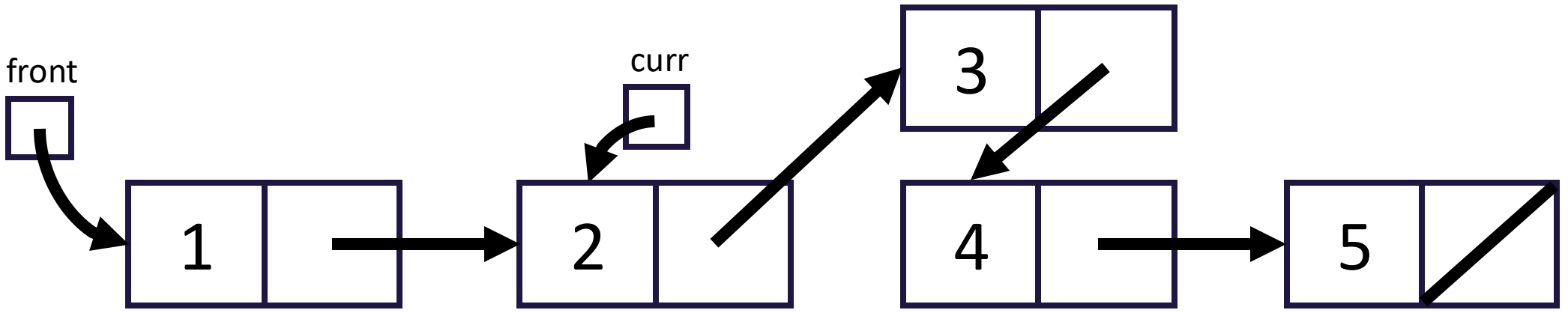
- Does changing `curr` actually update our chain?
  - 1. Make a new node storing 3 pointing to 4



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

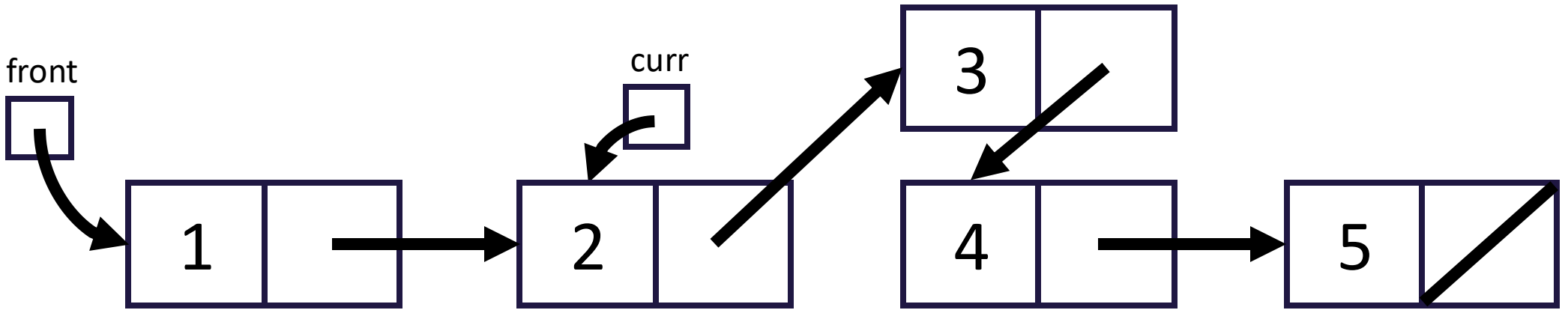
- Does changing `curr` actually update our chain?
  - 1. Make a new node storing 3 pointing to 4
  - 2. Make 2 point to 3



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

- Does changing `curr` actually update our chain?
  - `curr.next = new ListNode(3, curr.next);`



Modifying LinkedLists

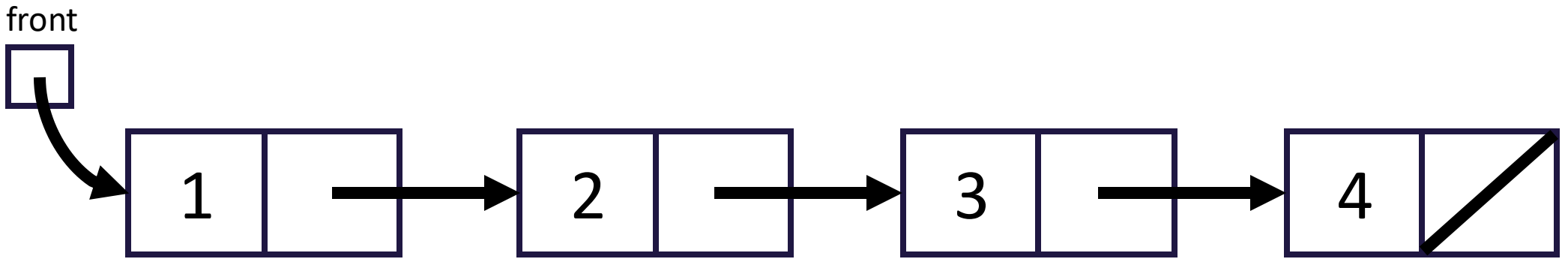
- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

- Does changing `curr` actually update our chain?
  - What will? Changing `curr.next`

Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 0 node before 1

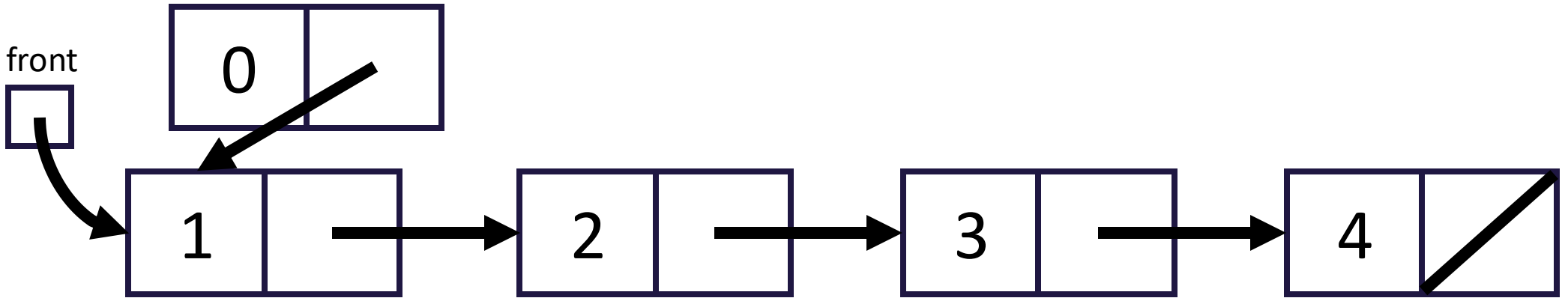
- Is there anyway for us to do this with `curr`?
  - No!



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 0 node before 1

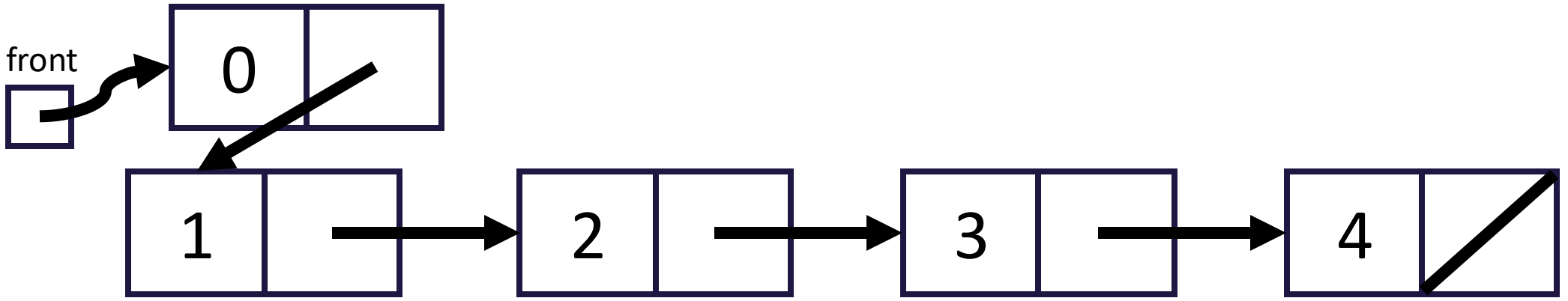
- Is there anyway for us to do this with `curr`?
  - 1. Make a new node storing 0 pointing to 1



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 0 node before 1

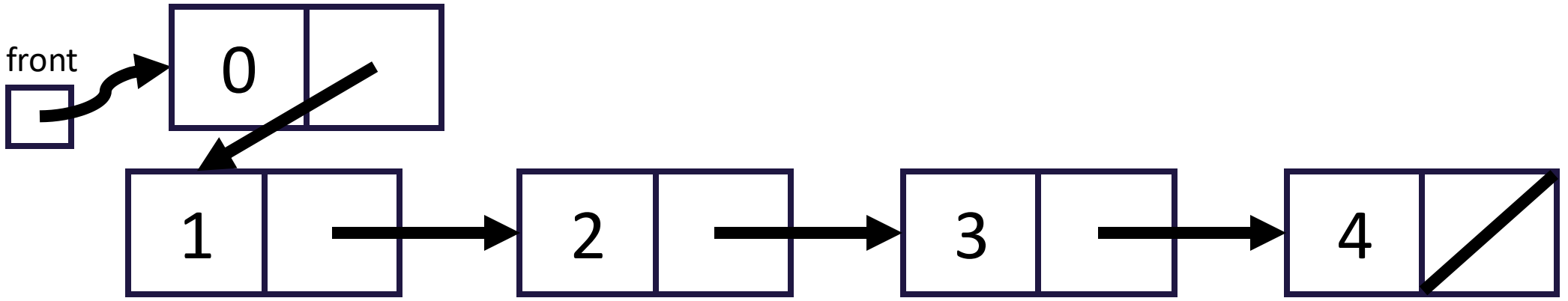
- Is there anyway for us to do this with `curr`?
  - 1. Make a new node storing 0 pointing to 1
  - 2. Make front point to 0



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 0 node before 1

- Is there anyway for us to do this with `curr`?
  - `this.front = new ListNode(0, this.front);`



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
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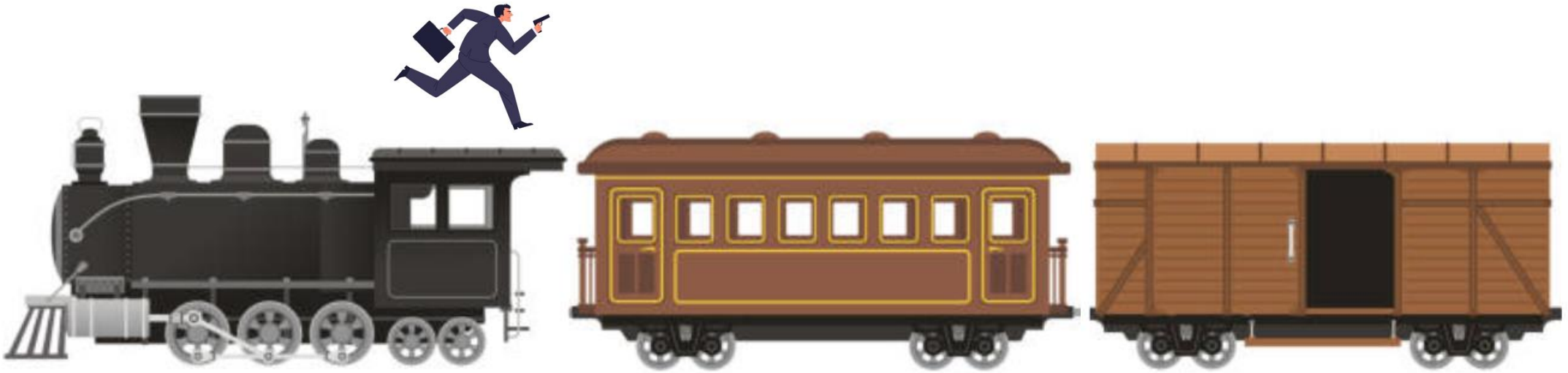
- So, what will actually change our list?
  - Changing `curr.next`, changing `front`
  - Need to **stop one early** to make changes



Modifying LinkedLists

- Remember: using a `curr` variable to iterate over nodes
- We want to insert a 3 node between 2 and 4

- 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?