CSE 12 – Basic Data Structures and Object-Oriented Design
Lecture 5

Greg Miranda, Spring 2021

This lecture is being recorded

Announcements

- Quiz 5 due Friday @ 12pm
- Survey 2 due Friday @ 11:59pm
- PA1 due tonight @11:59pm
- PA2 released tomorrow (closed PA)

Topics

- Linked List Implementations

So what is a Linked List?

A Linked List is a data structure that implements a List ADT, where elements in the list may appear anywhere in memory, but are "linked" together in a particular order using references or pointers.

Memory Model Diagrams and LinkedLists

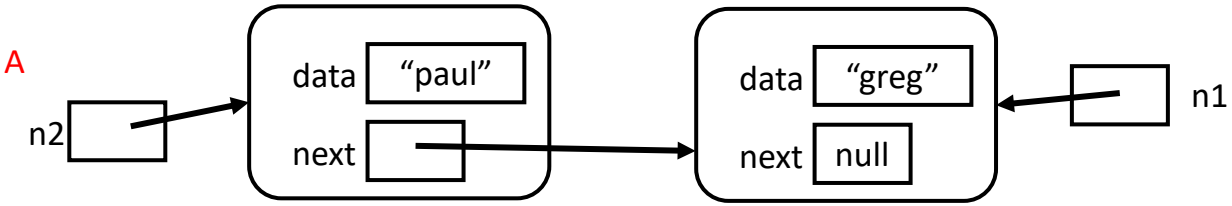
```
class Node {
  String value;
  Node next;
  public Node(String value, Node next) {
    this.value = value;
    this.next = next;
  }
}

// Somewhere else in the code… still inside Node class (can access next)
Node n1 = new Node("paul", null);
Node n2 = new Node("greg", null);
n2.next = n1;
```

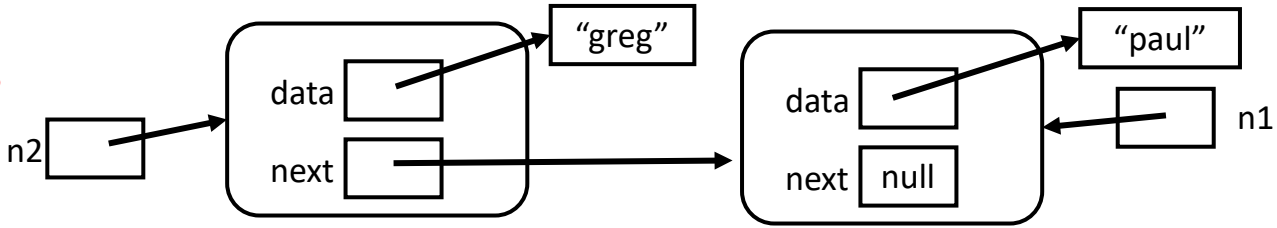
Draw the memory model diagram for this code. Answer choices next slide.

```
Node n1 = new Node("paul", null);
Node n2 = new Node("greg", null);
n2.next = n1;
```

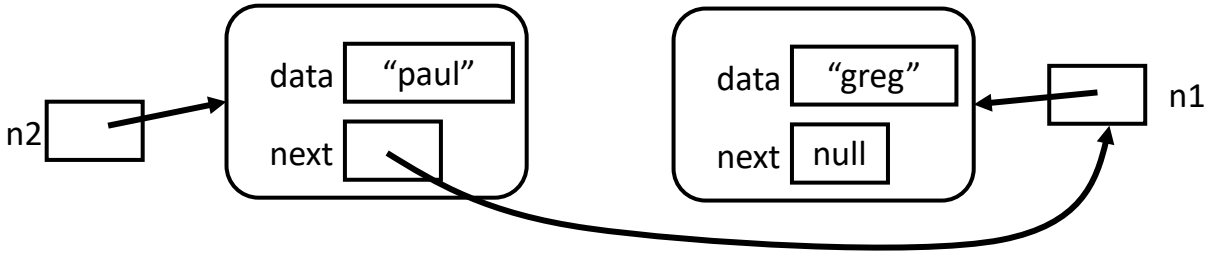
A



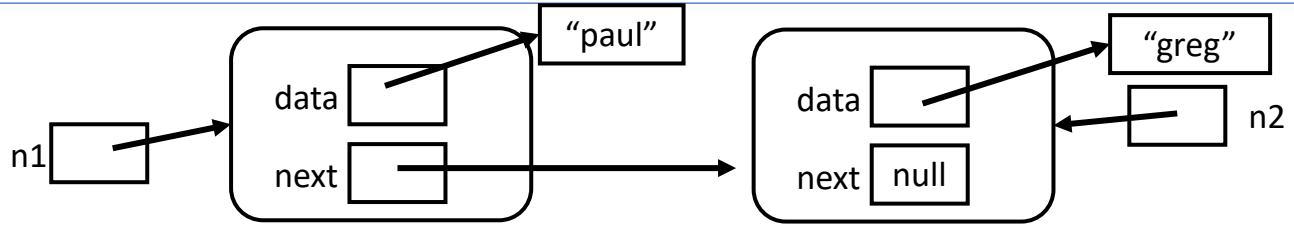
B



C



D

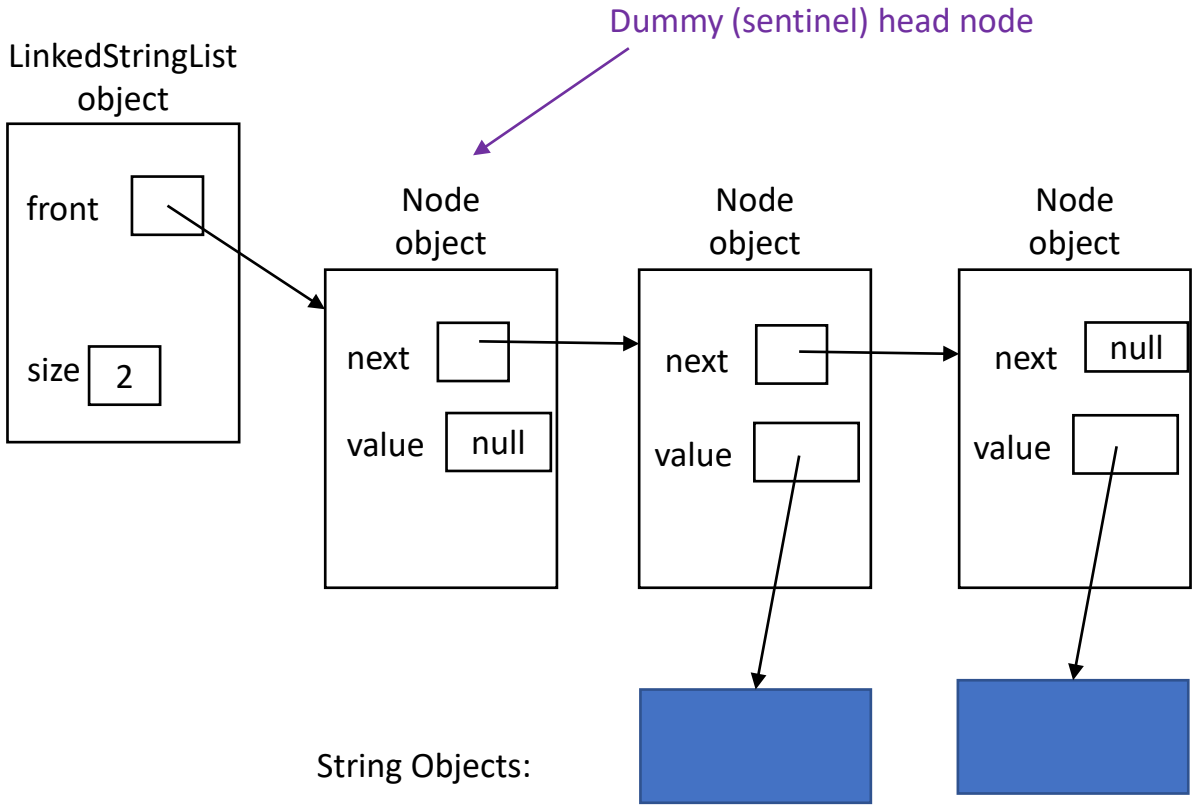


E. None of these

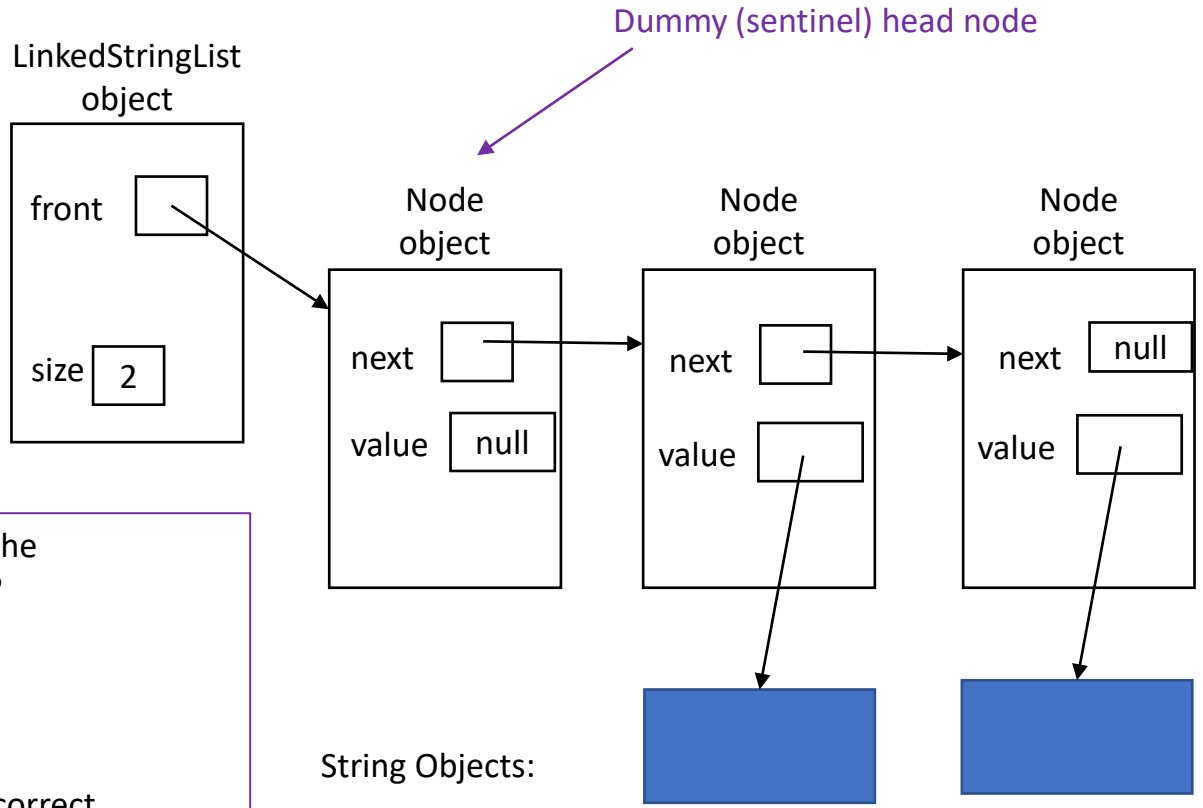
Toward Linked List Implementation

- Linked Lists are implemented with a Node class.
- The Node forms the structure of the list. It contains:
  - A reference to the data stored at that position in the list
  - A reference to the next node in the list
  - Optionally (for a doubly linked list) a reference to the previous node in the list.
- The Linked List itself usually contains only a reference to the first node in the list (head), and sometimes a reference to the last node (tail). It also might store the list's size.

Singly Linked List with sentinel Node: Picture



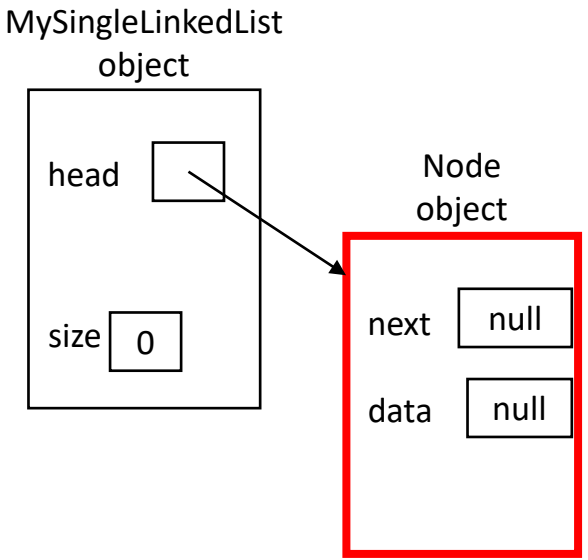
Singly Linked List with sentinel Node: Picture



What type is head in the LinkedStringList class?

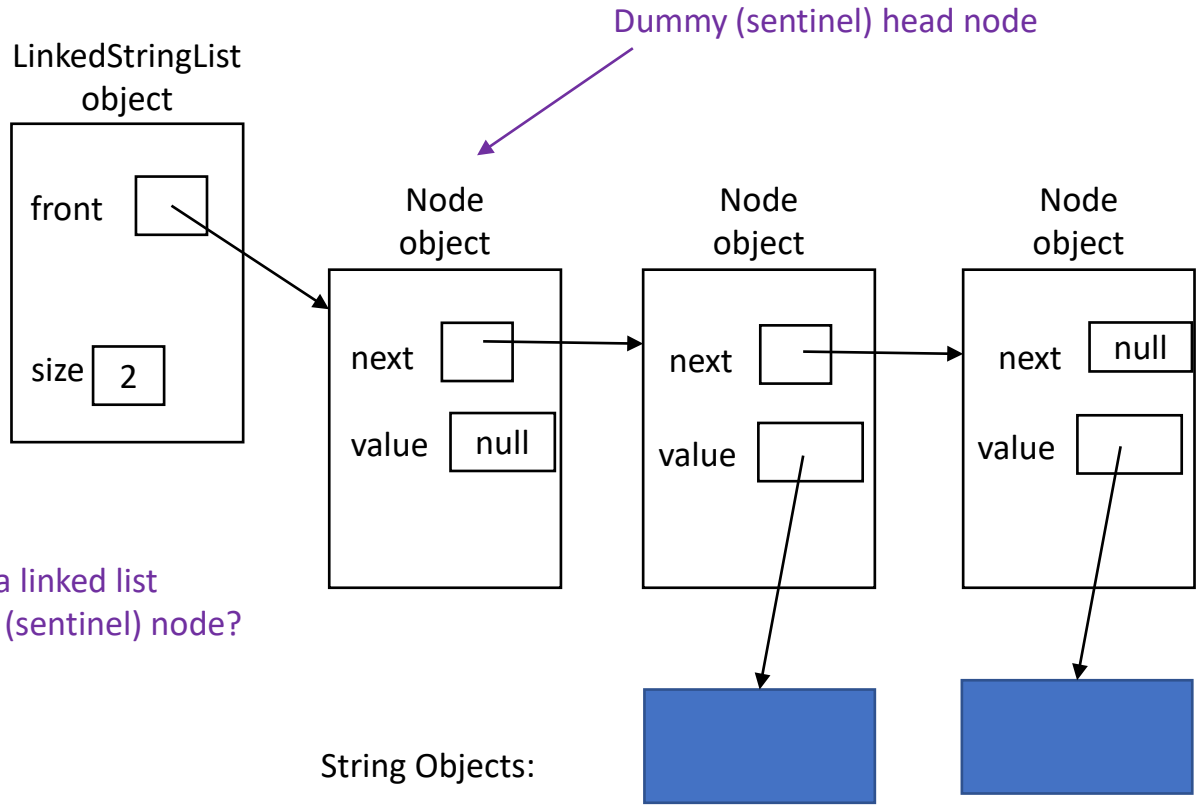
A. Node
B. String
C. LinkedStringList
D. StringList
E. More than one is correct

Empty Singly Linked List with sentinel node



This node is always there!!

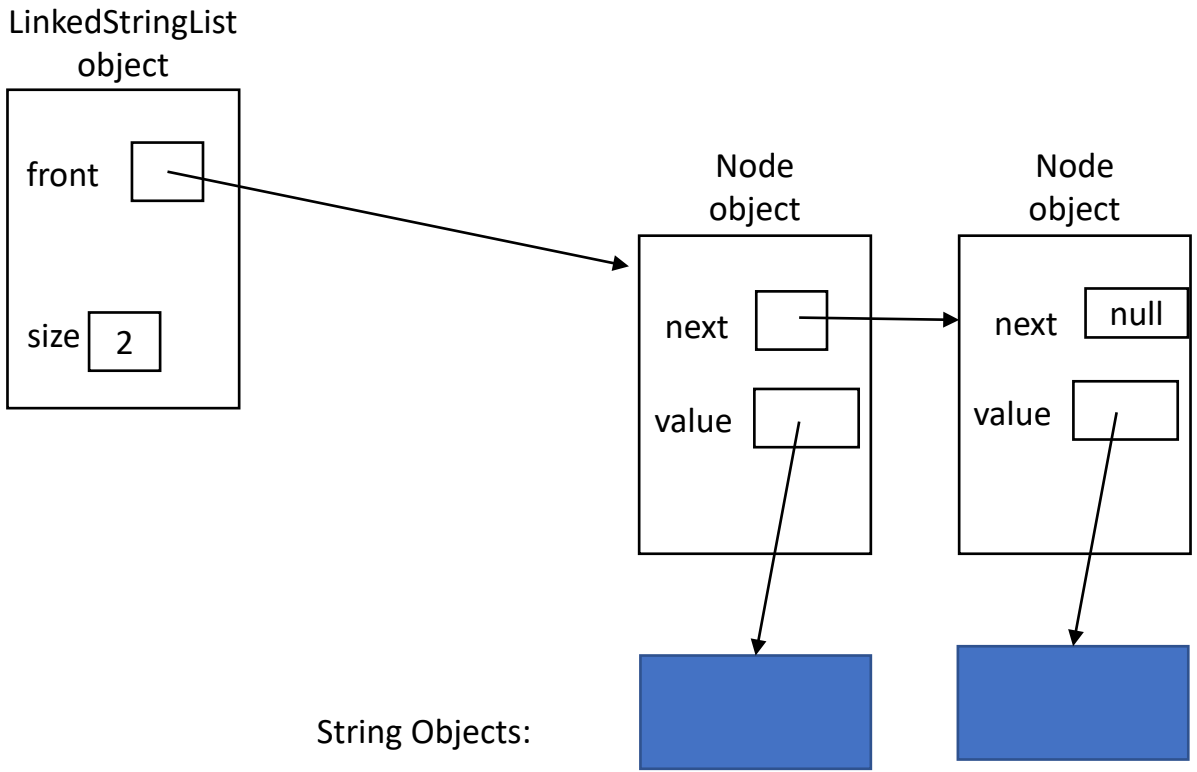
Singly Linked List with sentinel Node: Picture



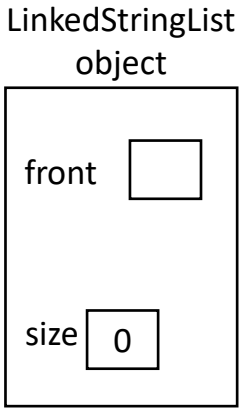
Can you implement a linked list without this dummy (sentinel) node?

A. Yes
B. No

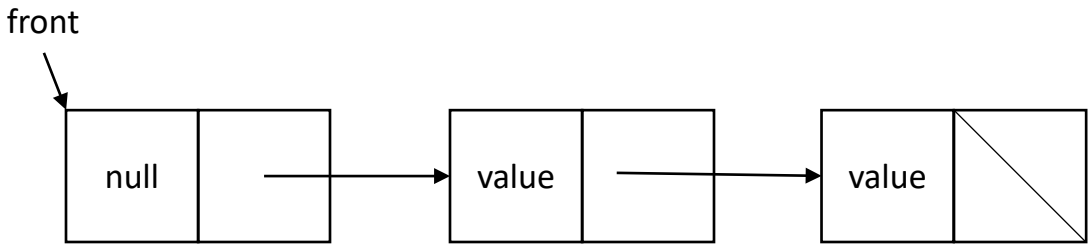
Singly Linked List without sentinel Node: Picture



Empty Single Linked List without sentinel node



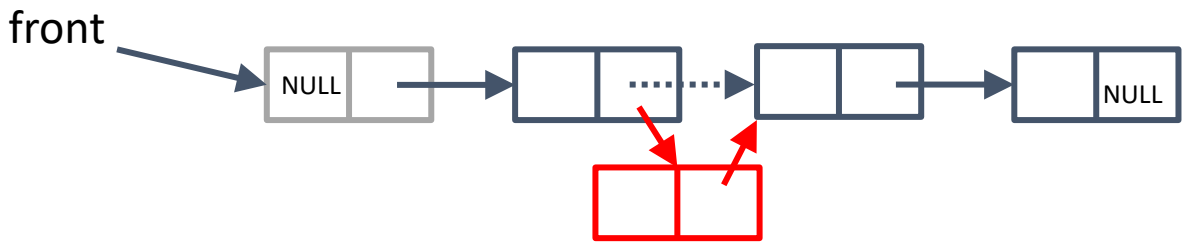
Singly Linked List: Abstracted Picture



Does this list use a sentinel node?

A. Yes
B. No
C. Not sure

myL.insert(1, itm)

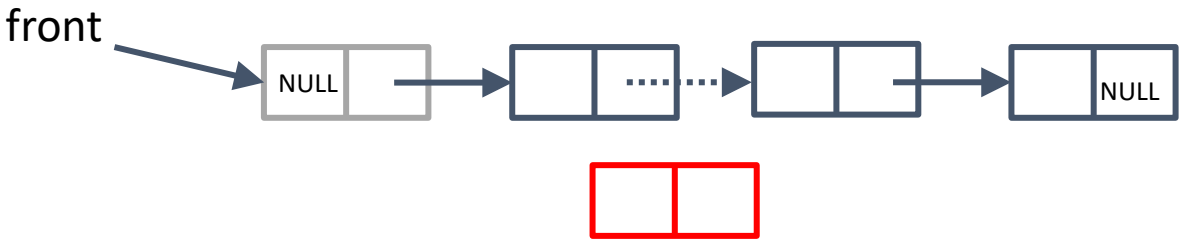



```
// In LinkedStringList class (NOT Node class)
public void insert(int index, String s) {



}
```

```
class Node {
  String value;
  Node next;
  public Node(String value, Node next) {
    this.value = value;
    this.next = next;
  }
}
```



myL.insert(1, itm)

```
public void insert(int index, String s) {
  Node newNode = new Node(s, null);
  if (index<0 || index>size) throw new IndexOutOfBoundsException();
  Node curr = this.front;
  for(int i = 0; i < index; i++) {
    curr = curr.next;
  }
  ____________________________________
  this.size += 1;
}
```

What line of code will complete this method correctly (in the blank)?

A) No line is needed. The code is correct as written.

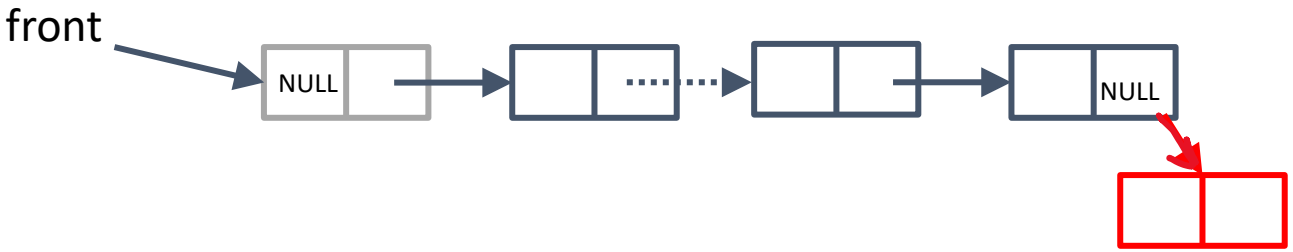
B) `curr.next = newNode;`

C) `curr = newNode;`

D) `newNode.next = curr.next;`

E) None of them is correct

```
class Node {
  String value;
  Node next;
  public Node(String value, Node next) {
    this.value = value;
    this.next = next;
  }}
```



myL.add(itm)

```
public void add(String s) {
  Node curr = this.front;
  while(_____A_____!= null) {
    curr = curr.next;
  }
  _____________B_____________
  this.size += 1;
}
```

What line of code will complete this method correctly for blank A?

A) `curr.next`

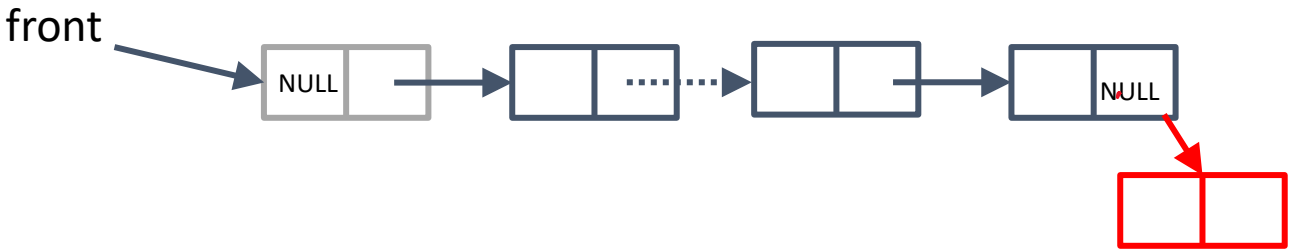
B) `curr`

C) `front`

D) `front.next`

E) None of them is correct

```
class Node {
  String value;
  Node next;
  public Node(String value, Node next) {
    this.value = value;
    this.next = next;
  }}
```



myL.add(itm)

```
public void add(String s) {
  Node curr = this.front;
  while(curr.next != null) {
    curr = curr.next;
  }
  _____B_____
  this.size += 1;
}
```

What line of code will complete this method correctly for blank B?

A) No line is needed. The code is correct as written.

B) `curr.next = new Node(s, curr.next);`

C) `curr = new Node(s, null);`

D) `curr.next = new Node(s, curr);`

E) None of them is correct

```
class Node {
  String value;
  Node next;
  public Node(String value, Node next) {
    this.value = value;
    this.next = next;
  }}
```

LinkedStringList Remove

```
/* Remove the element at the specified index */
void remove(int index);
```

- Write a test case for the LinkedStringList remove method
- Implement the LinkedStringList remove method