Interfaces and Linked Lists

4/6/26

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Administrivia

- HW 2 (test cases for Book) due Wednesday (4/8)

Recall: Abstract data types (ADTs)

- Set of operations supported on a particular kind of data
- Does not include implementation details
- Our example: List (ordered collection of items)
  - add, remove, get(i), size, etc

Implementation of List: ArrayList

- Array-based implementation of the List ADT

```
ArrayList<Point> list = new ArrayList<Point>();

Point p = new Point(x, y);
list.add(p);

for(int i=0; i<list.size(); i++) {
        Point p = list.get(i);
        //do something with p
}
```

Interface: Java’s way to express an ADT

- Essentially a list of method signatures

```
public interface List<T> {
        public void add(T item);
        public int size();
        public T get(int index);
        …
}
```

Using an interface

```
public class ArrayList<T> implements List<T> {
    //must have methods for all promised signatures
}
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- Allows variable to store **<u>any</u>** implementing type:

```
List<String> list = new ArrayList<String>();
```

Using an interface

```
public class ArrayList<T> implements List<T> {
        //must have methods for all promised signatures
}
```

- Allows variable to store **any** implementing type:

```
List<String> list = new ArrayList<String>();
```

- Can define operation on any implementing type:

```
public String mostCommon(List<String> list) {
        //find string with most occurrences for any List
```

We saw this in Lab 2

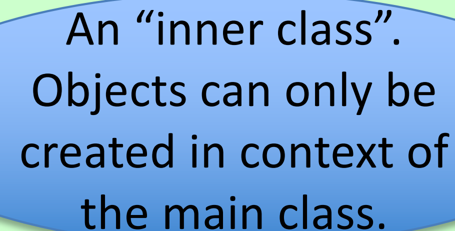
- PrintQueue interface defines some behavior
- WorkingPrintQueue (implements PrintQueue) does this correctly; all the methods work as advertised
- BadPrintQueue (implements PrintQueue) almost does this, but has a bug with some incorrect behavior
- You wrote test cases in terms of a PrintQueue p
  - When p referenced a WorkingPrintQueue, all the tests pass
  - When p referenced a BadPrintQueue, at least one failed

LinkedList

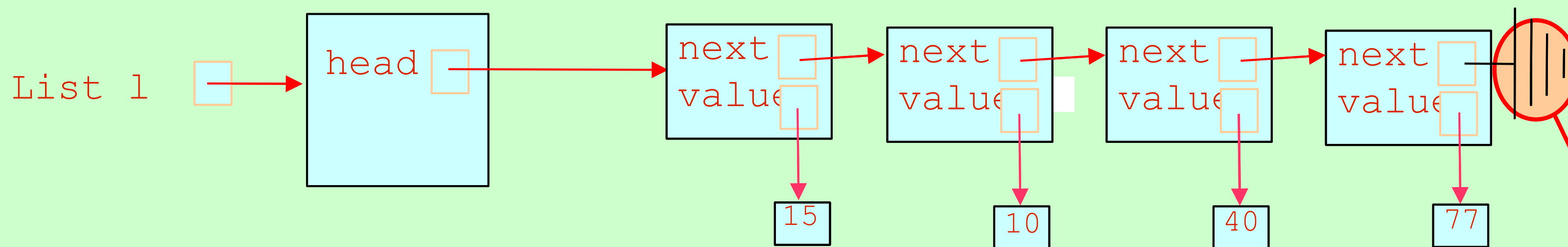
```
public class OurLinkedList<T> implements OurList<T> {
  private Node head;
  //optionally: could have size

  public class Node {
    public T value;
    public Node next;

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

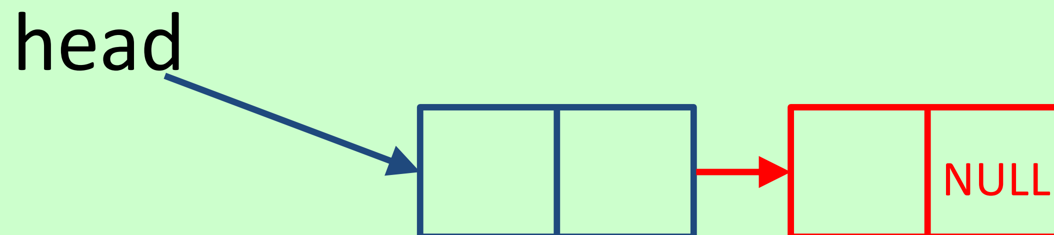


How our class looks in memory



-“head” points to first node

Null next pointer means “end of the list”



What line of code will correctly complete this method?

```
public void addFront(T newItem) {
   Node newNode = new Node(newItem, head);
      ________________________;
}
```

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

B) `head = head.next;`

C) `head = newNode;`

D) `newNode.next = head;`

Question to think about/discuss: what is the purpose or effect of passing `head` as an argument here?

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Question to think about/discuss: what is the purpose or effect of passing `head` as an argument here?

We implement size() by traversing the list. Which of the following tests if curr is at the end of the list? (i.e. what should go in the blank?)

```
public int size() {
   Node curr = head;
   int count = 0;
   while(___) {
    count++;
      ...
   }
   return count;
}
```

A. curr == head
B. curr != null
C. curr.next != head
D. curr.next != null
E. Not exactly one of the above

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Which of the following advances curr to point to the next Node? (i.e. what should go in the blank?)

```
public int size() {
    Node curr = head;
    int count = 0;
    while(curr != null) {
        count++;
        ___
    }
    return count;
}
```

A. curr++;
B. curr.next;
C. curr = curr.next;
D. Node temp = curr.next;
   curr = temp;
E. Not exactly one of the above

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A. curr++;
B. curr.next;
C. curr = curr.next;
D. Node temp = curr.next;
   curr = temp;
E. Not exactly one of the above (C & D)

Suppose you want to print the contents of a OurLinkedList for debugging. You want a variable curr to refer to each Node in turn. Which of the following does this correctly?

A.
```
Node curr = head;
while(curr != null)  {
    ...
    curr = curr.next;
}
```

B.
```
Node curr = head;
while(curr.next != null)  {
    ...
    curr = curr.next;
}
```

C.
```
Node curr = head.next;
while(curr != null)  {
    ...
    curr = curr.next;
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D.
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}
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D.
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while(curr.next != null)  {
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}
```

E. Not exactly one of the above

```
public boolean contains(T s) {
    //returns whether the list contains value s
```

How many of the following work as the body for the clear method (empties list)?

I. `size = 0;`

II. `head = null;`

III. `head.next = null;`

IV.
```
Node curr = head;
while(curr != null) {
    curr.value = null;
    curr = curr.next;
}
```

A. 0
B. 1
C. 2
D. 3
E. 4

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I. size = 0;

II. head = null;

III. head.next = null;

IV.
```
Node curr = head;
while(curr != null) {
    curr.value = null;
    curr = curr.next;
}
```

A. 0

B. 1 (II.)

C. 2

D. 3

E. 4

What is wrong with this add method?

```
public void add(T toAdd) {      //add to end of the list
    Node curr = head;
    while(curr.next != null)
        curr = curr.next;
    Node newNode = new Node(toAdd, null);
    curr.next= newNode;
}
```

A. Syntax error
B. Doesn’t add the new value
C. Throws exception if list is empty
D. Removes existing value(s) from the list
E. Not exactly one of the above

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