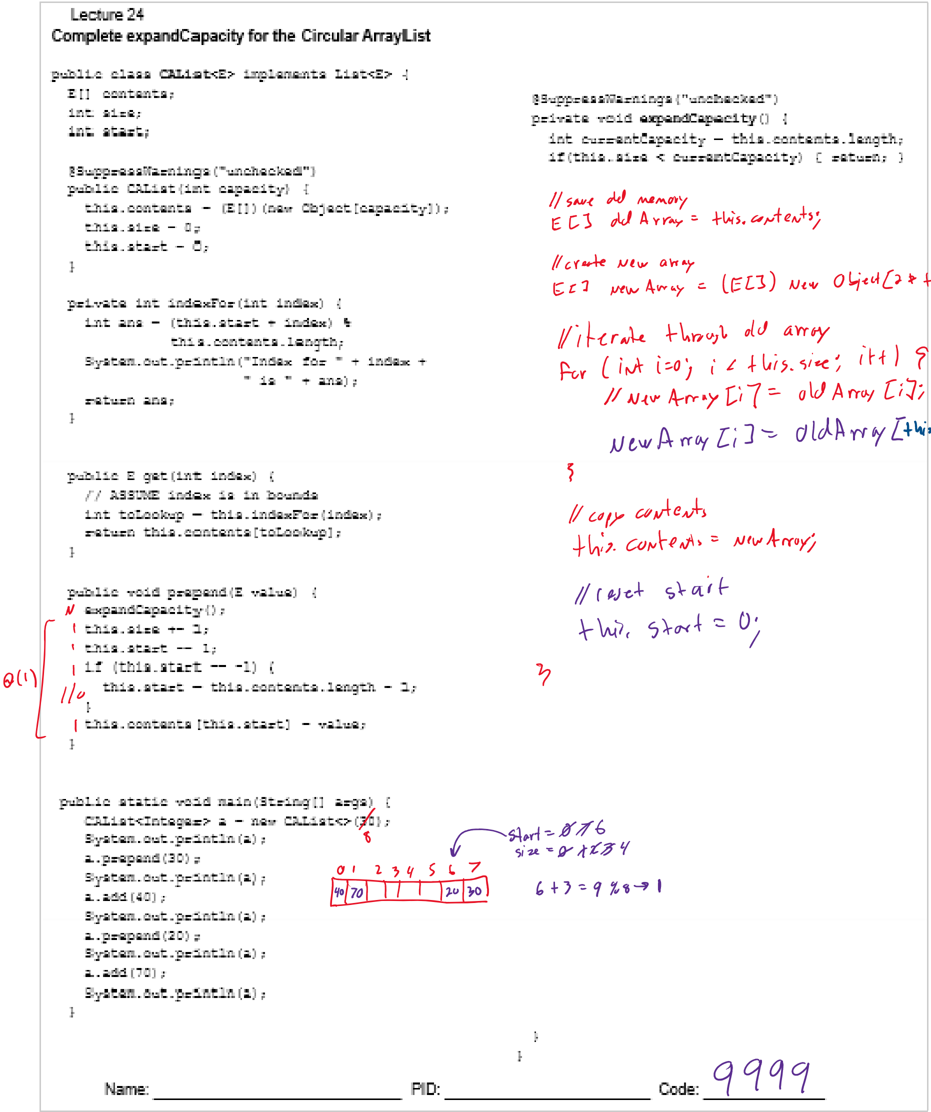
CSE12 - Lecture 24 - Notes

Friday, December 1, 2023 8:00 AM



Lecture 24

Complete expandCapacity for the Circular ArrayList

```
public class CAList<E> implements List<E> {
  E[] contents;
  int size;
  int start;

  @SuppressWarnings("unchecked")
  public CAList(int capacity) {
    this.contents = (E[])(new Object[capacity]);
    this.size = 0;
    this.start = 0;
  }

  private int indexFor(int index) {
    int ans = (this.start + index) %
              this.contents.length;
    System.out.println("Index for " + index +
                       " is " + ans);
    return ans;
  }


  public E get(int index) {
    // ASSUME index is in bounds
    int toLookup = this.indexFor(index);
    return this.contents[toLookup];
  }

  public void prepend(E value) {
N   expandCapacity();
1   this.size += 1;
1   this.start -= 1;
1   if (this.start == -1) {
1/0   this.start = this.contents.length - 1;
    }
1   this.contents[this.start] = value;
  }
```

Θ(1)

```
 public static void main(String[] args) {
   CAList<Integer> a = new CAList<>(~~10~~); 8
   System.out.println(a);
   a.prepend(30);
   System.out.println(a);
   a.add(40);
   System.out.println(a);
   a.prepend(20);
   System.out.println(a);
   a.add(70);
   System.out.println(a);
 }
```

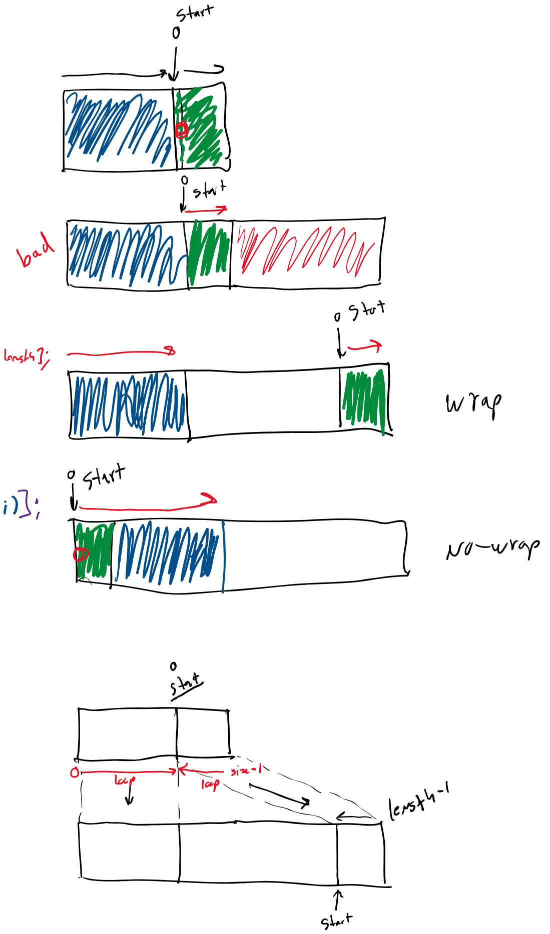
Start = ~~0~~ ~~7~~ 6
size = ~~0~~ ~~1~~ ~~2~~ ~~3~~ 4

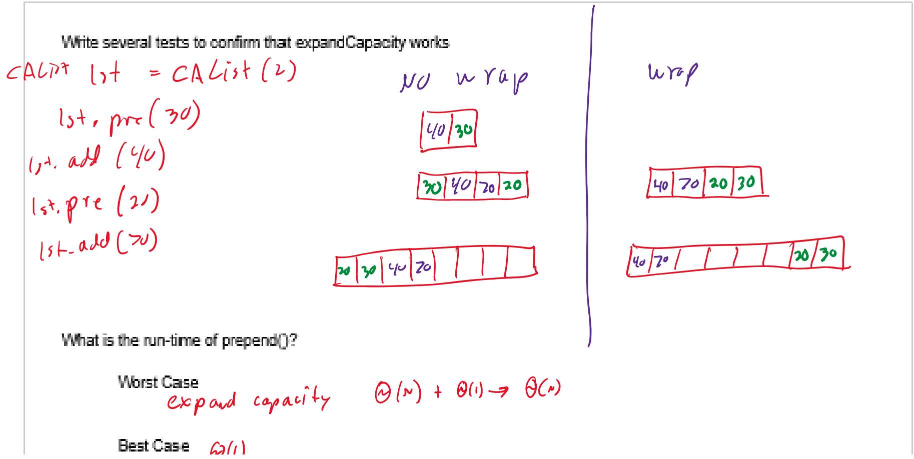
0	1	2	3	4	5	6	7
40	70					20	30

6 + 3 = 9 % 8 → 1

```
  @SuppressWarnings("unchecked")
  private void expandCapacity() {
    int currentCapacity = this.contents.length;
    if(this.size < currentCapacity) { return; }

    // save old memory
    E[] oldArray = this.contents;

    // create new array
    E[] newArray = (E[]) new Object[2 * this.contents.length];

    // iterate through old array
    for (int i=0; i < this.size; i++) {
      // newArray[i] = oldArray[i];

      newArray[i] = oldArray[this.indexFor(i)];
    }

    // copy contents
    this.contents = newArray;

    // reset start
    this.start = 0;

  }
    }
  }
```

Name: ______________ PID: ______________ Code: 9999





Write several tests to confirm that expandCapacity works

CAList lst = CAList(2)

lst.pre(30)

lst.add(40)

lst.pre(20)

lst.add(70)

NO wrap

40	30

30	40	70	20

20	30	40	70				

wrap

40	70	20	30

40	70					20	30

What is the run-time of prepend()?

Worst Case
expand capacity Θ(N) + Θ(1) → Θ(N)

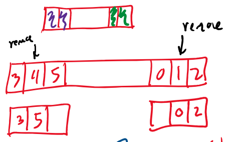
Best Case Θ(1)

Worst Case
expand capacity $\Theta(n) + \Theta(1) \rightarrow \Theta(n)$

Best Case $\Theta(1)$

Average Case $\Theta(1)$ amoritized per prepend

How would implement remove on a Circular ArrayList?

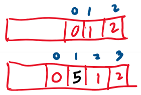


shift down ← < start

>= start → shift up

if start == 0
shift down

How would implement insert on a Circular ArrayList?



insert (1, 5)