ecture #4: Simple Pointer Manipulation

ve that for every acute angle $\alpha > 0$,

$$\tan\alpha + \cot\alpha \geq 2$$

pointer hacking.

labs and homework: We'll be lenient about accepting rk and labs for lab1, lab2, and hw0. Just get it done: oint is getting to understand the tools involved. We will ubmissions by email.

free to interpret the absence of a central repository ack of a lab1 submission from you as indicating that you p the course.

be released tonight.

sed.

Small Test of Understanding

keyword **final** in a variable declaration means that the ue may not be changed after the variable is initialized.

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e final IntList aList = new IntList(0, null);

 void modify(int k) {
his.aList.head = k;
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s is *valid*. Although `modify` changes the `head` variable t pointed to by `aList`, it does *not* modify the contents lf (which is a pointer).

Destructive Incrementing

utions may modify objects in the original list to save

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incrList(IntList P, int n) {

crList(P.tail, n);

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 = L; p != null; p = p.tail)
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X = IntList.list(3, 43, 56);
/* IntList.list from HW #1 */
Q = dincrList(X, 2);
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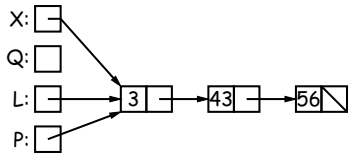

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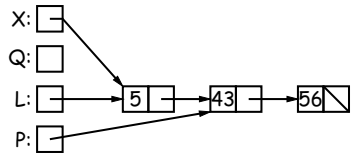

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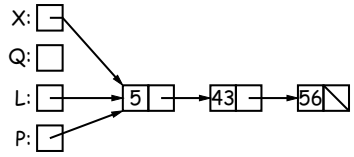

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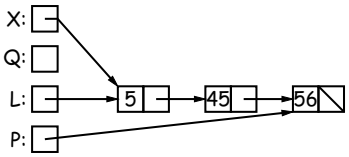

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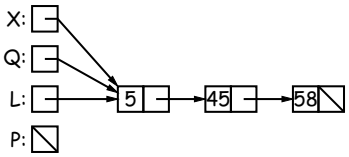

Example: Non-destructive List Deletion

[2, 1, 2, 9, 2], we want `removeAll(L,2)` to be the new

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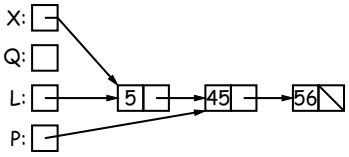

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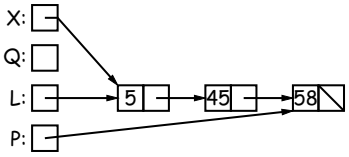

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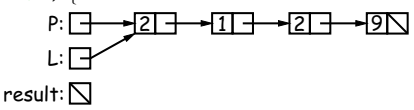

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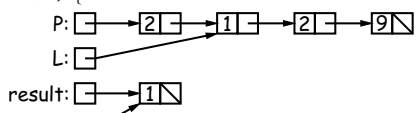

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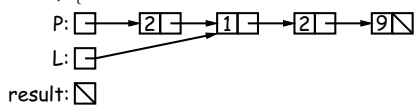

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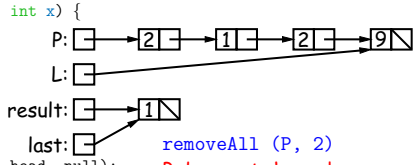

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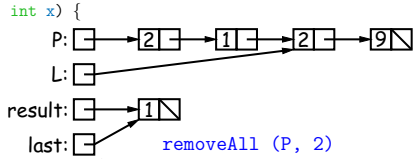

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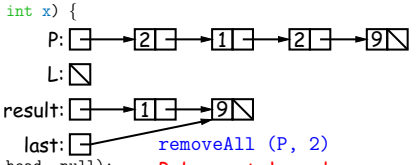

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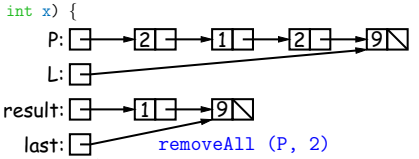

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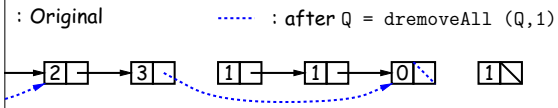


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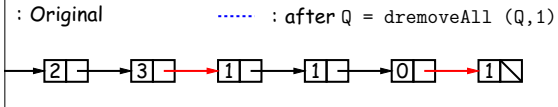


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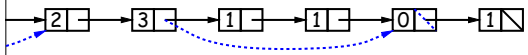


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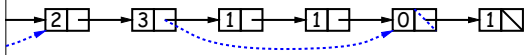


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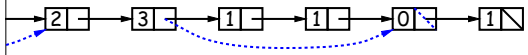


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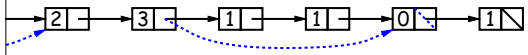


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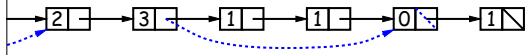


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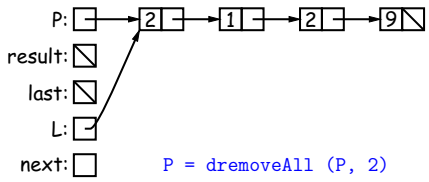

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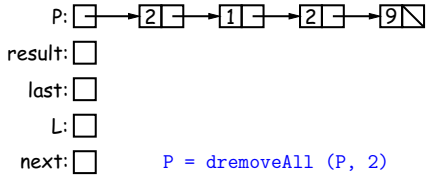

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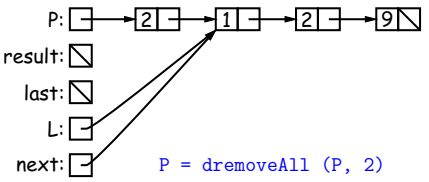

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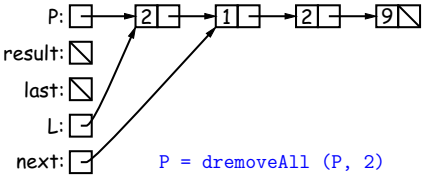

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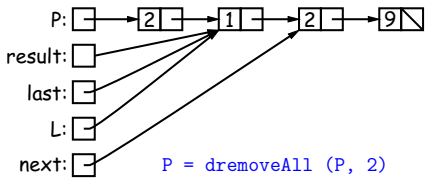

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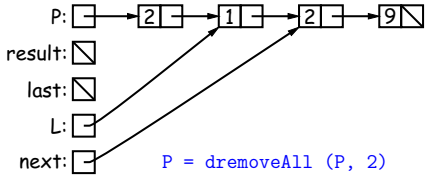

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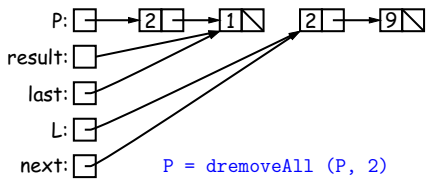

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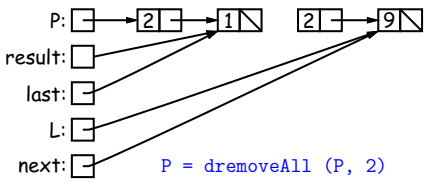

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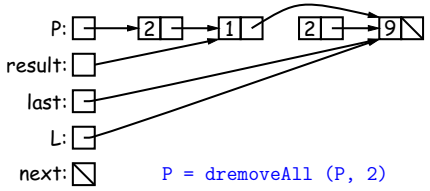

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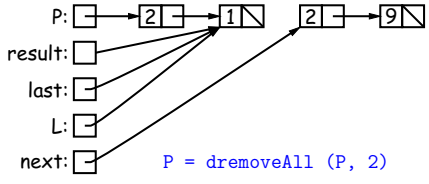

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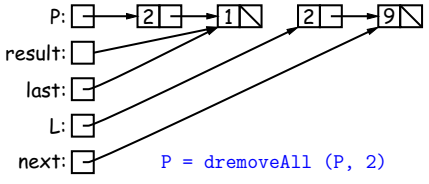

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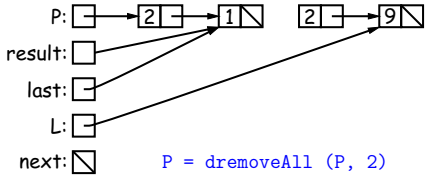

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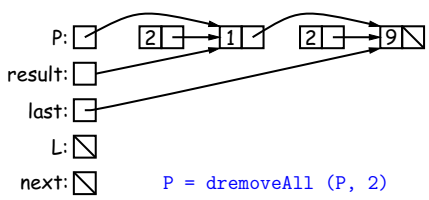

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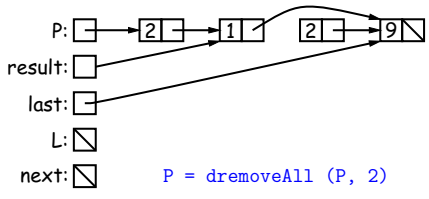

P = dremoveAll (P, 2)

Relationship to Recursion

to see this is to consider an equivalent recursive pro-

```
g Invariant, produce a situation where Inveriant
 and condition is false. */
 {
riant assumed true here.
dition) {
 body
Invariant must be true here.
p()
Invariant true here and condition false.
```

variant is the precondition of the function **loop**.

ntains the invariant while making the condition false.

range that our actual goal is implied by this post-condition.

e: How to Write a Loop (in Theory)

a description of how things look on *any arbitrary itera-*
oop.

tion is known as a *loop invariant,* because it is always
tart of each iteration.

y then must

m any situation consistent with the invariant;

gress in such a way as to make the invariant true again.

```
riant must be true here
(condition) { // condition must not have side-effects.
Invariant will necessarily be true here.)
body
nvariant must again be true here

riant true and condition false.
```

p gets the desired answer whenever *Invariant* is true
n false, our job is done!

nple: Loop Invariant for dremoveAll

```
lting from removing all X's from L
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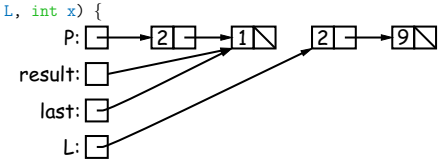

P = dremoveAll (P, 2)

** Invariant:

- `result` points to the list of items in the final result except for those from L onward.
- `L` points to an unchanged tail of the original list of items in `L`.
- `last` points to the last item in `result` or is null if `result` is null.