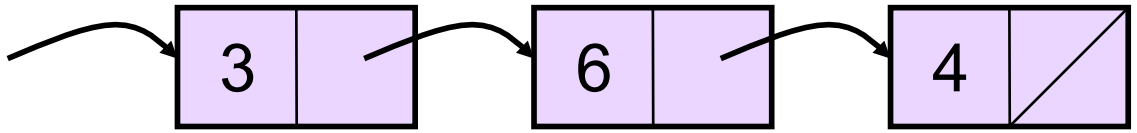
Announcements

MP3 available, due 9/30, 11:59p.

Exam2: 9/25-9/28

```
template<class LIT>
class List {
public:
    List():size(0),head(NULL){}
    ~List(); // also copy constructor, assignment op
    int getSize() const;
    void insert(int loc, LIT e);
    void remove(int loc);
    LIT const & getItem(int loc) const;
private:
    listNode * head;
    int size;
    listNode * Find(listNode * place, int k);
    struct listNode { LIT data; listNode * next;
       listNode(LIT newData):data(newData),next(NULL){}}
    };
```

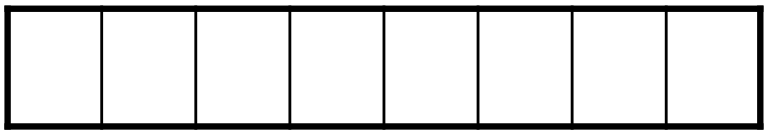
Insert new node in kth position:



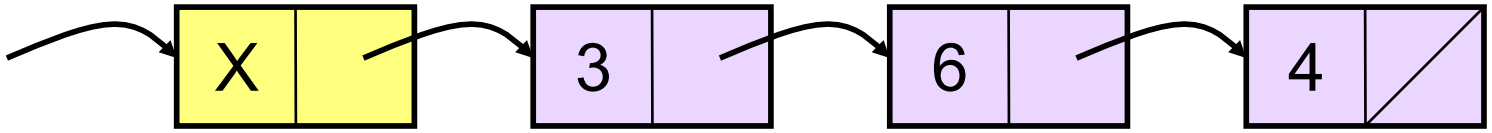

```
void List<LIT>::insert(int k, LIT e) {
        listNode * t = new listNode(e);
        if (k==1) insertAtFront(e);
        else {
                listNode * p = Find(head, k-2);
                t->next = p->next;
                p->next = t;
        }
}
```

Analysis:

insert new kth in array:



Insert new node in kth position with sentinel:

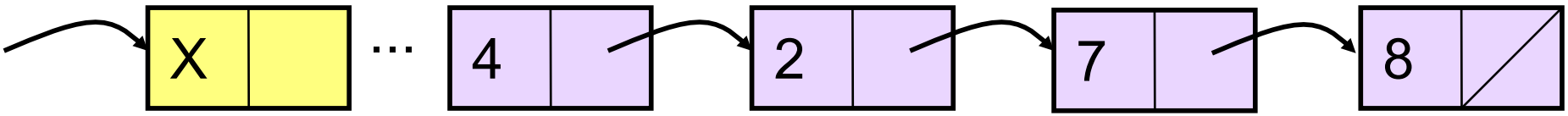



```
void List<LIT>::insert(int k, LIT e) {
        listNode * t = new listNode(e);
        listNode * curr = Find(head, k-1);
        t->next = curr ->next;
        curr->next = t;
}
```

Wow, this is convenient! How do we make it happen?

```
template<class LIT>
List<LIT>::List(){



}
```

Remove node in fixed position (given a pointer to node you wish to remove):

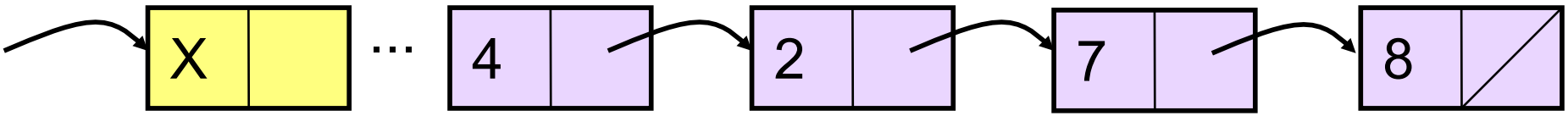


Solution #1:

```
void List<LIT>::removeCurrent(listNode * curr) {

}
```

Analysis:

Remove node in fixed position (given a pointer to node you wish to remove):



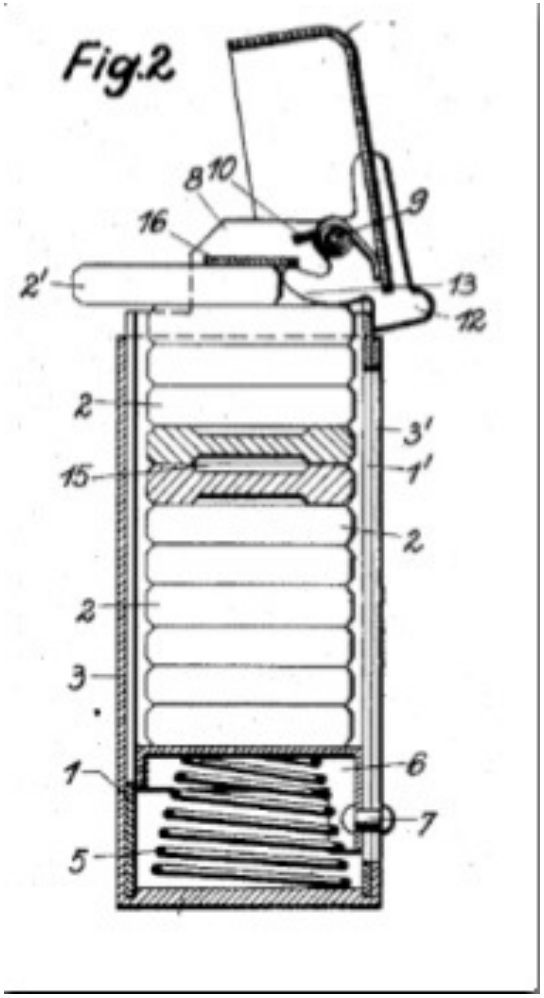
Constant time hack:

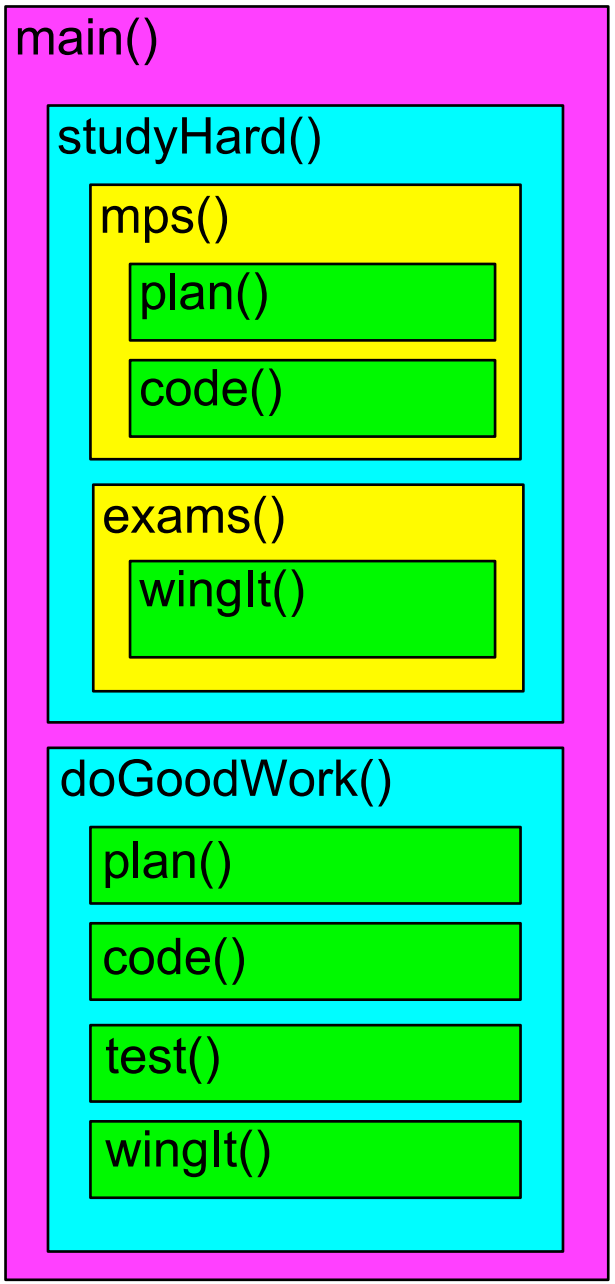
```
void List<LIT>::removeCurrent(listNode * curr) {

}
```

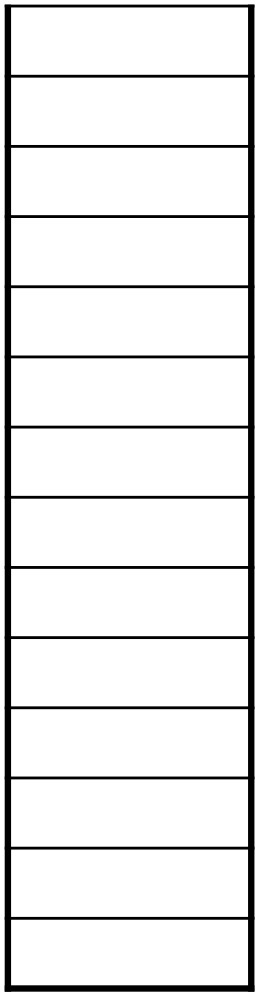
Summary – running times for List functions:

	SLL	Array
Insert/Remove at front:	O(1)	O(1)
Insert at *given* location:	O(1)	O(1)
Remove at *given* location:	O(1) hack	O(n) shift
Insert at *arbitrary* location:	O(1)	O(n) shift
Remove at *arbitrary* location:	O(n) find	O(n) shift

Stacks:







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Stack ADT:

```
template<class SIT>
class Stack {
public:
    Stack();
    ~Stack(); // also copy
    constructor, assignment op
    bool empty() const;
    void push(const SIT & e);
    SIT pop();
private:
        ?

};
```

push(3)

push(8)

push(4)

pop()

pop()

push(6)

pop()

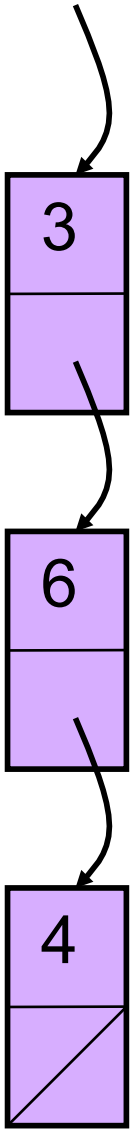
push(2)

pop()

pop()

Stack linked memory implementation:

```
template<class SIT>
class Stack {
public:
    Stack();
    ~Stack(); // etc.
    bool empty() const;
    void push(const SIT & e);
    SIT pop();
private:
    struct stackNode {
        SIT data;
        stackNode * next;
    };
    stackNode * top;
    int size;
};
```




```
template<class SIT>
SIT Stack<SIT>::pop(){




}
```

```
template<class SIT>
void Stack<SIT>::push(const SIT & d){
stackNode * newNode = new stackNode(d);
newNode->next = top;
top = newNode;
}
```

Stack array based implementation:

```
template<class SIT>
class Stack {
public:
     Stack();
     ~Stack(); // etc.
     bool empty() const;
     void push(const SIT & e);
     SIT pop();
private:
     int capacity;
     int size;
     SIT * items;
};
```

```
template<class SIT>
Stack<SIT>::Stack(){
     capacity = 4;
     size = 0;
     items = new SIT[capacity];
}
```

```
template<class SIT>
void Stack<SIT>::push(const SIT & e){
     if (size >= capacity) {
       // grow array somehow
     }
     items[size] = e;
     size ++;
}
```