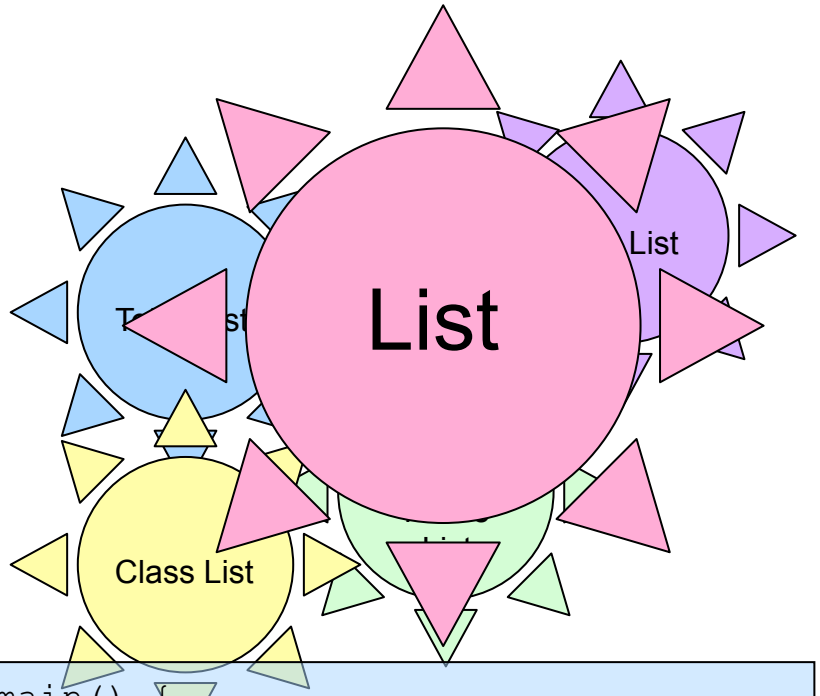
Announcements

MP3 available, due 2/22, 11:59p.

TODAY: another list trick

ADT - Stacks

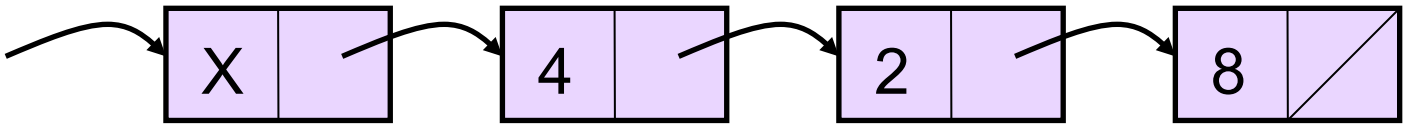
Abstract Data Type (ADT): *description of the functionality of a data structure.*




```
template<class LIT>
class List {
public:
     List();
     //~List();
     int getSize() const;
     void insert(int loc, LIT e);
     void remove(int loc);
     LIT const & getItem(int loc) const;
private:
     //my little secret
};
```

```
int main() {
     List<int> myList;
     myList.insert(1,4);
     myList.insert(1,6);
     myList.insert(1,8);
     myList.insert(3,0);
     myList.insert(4,myList.getItem(2));
     cout << myList.getSize() << endl;
     myList.remove(2);
     cout << myList.getItem(3) << endl;
     return 0;
}
```

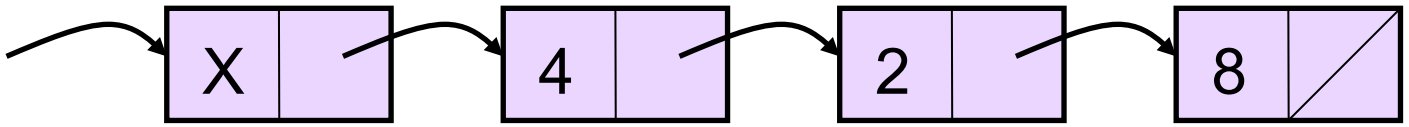
Remove node in fixed position (given a pointer to node you wish to remove):



Solution #1:

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

}
```

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



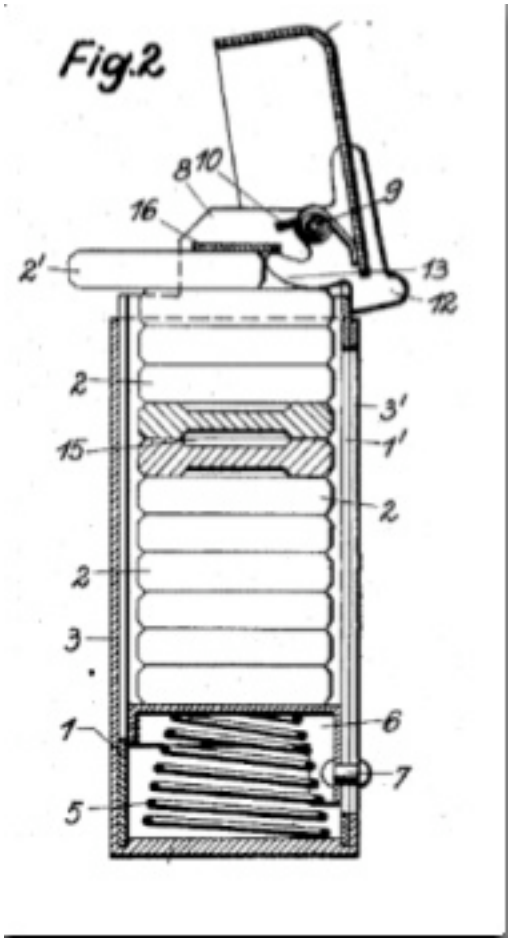
Constant time hack:

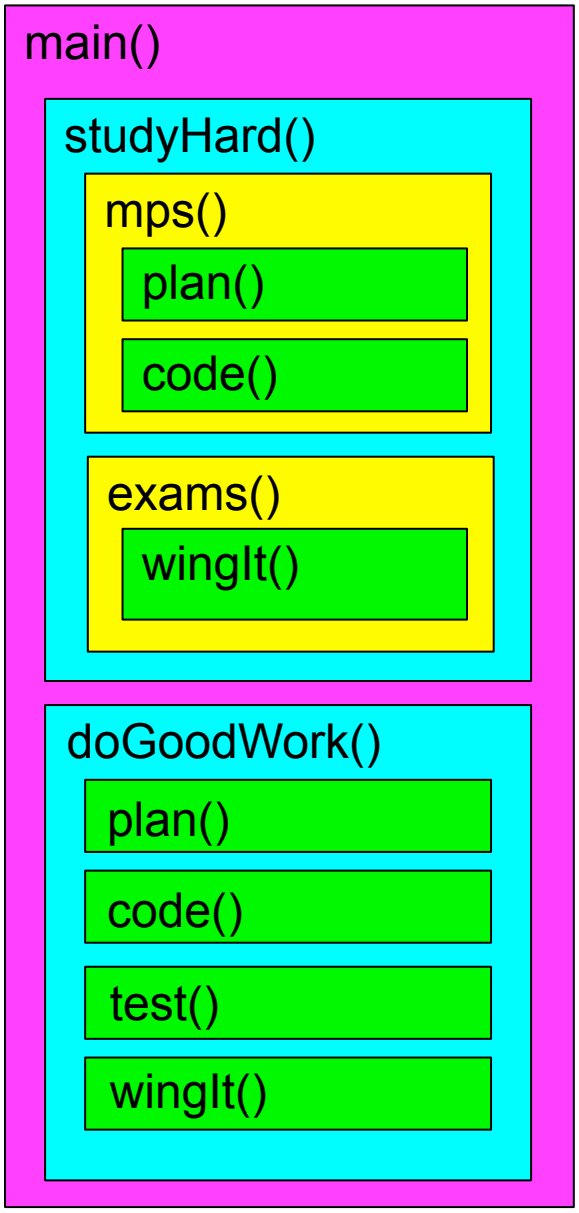
```
void List<LIT>::removeCurrent(listNode * curr) {

}
```

Summary – running times for List functions:

	SLL	Array
Insert/Remove at front:	O(1)	O(1)
Insert at given location: (given == known)	O(1)	O(1)
Remove at given location: (given == known)	O(1) hack	O(n) shift
Insert at arbitrary location: (arb == parameterized)	O(1)	O(n) shift
Remove at arbitrary location: (arb == parameterized)	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()

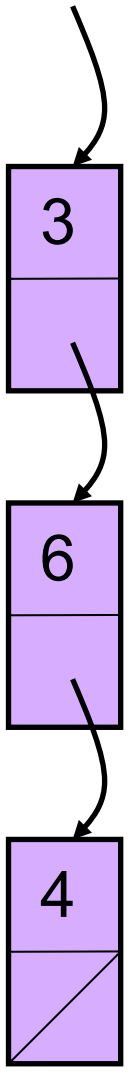
push(2)

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;
};
```

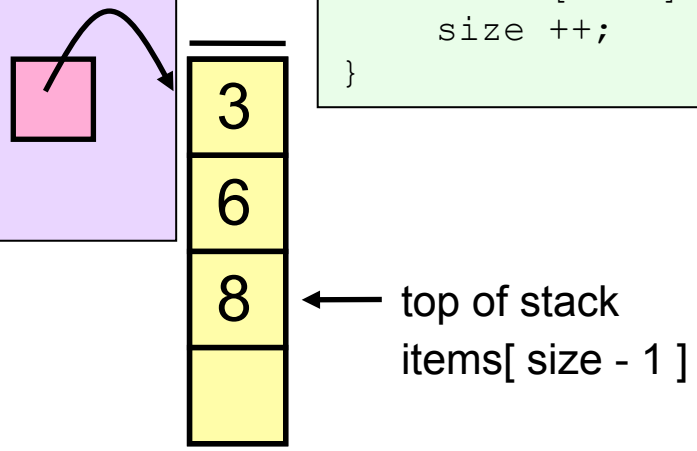
```
template<class SIT>
Stack<SIT>::Stack(){
    capacity = 4;
    size = 0;
    items = new SIT[capacity];
}
```

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;
};
```

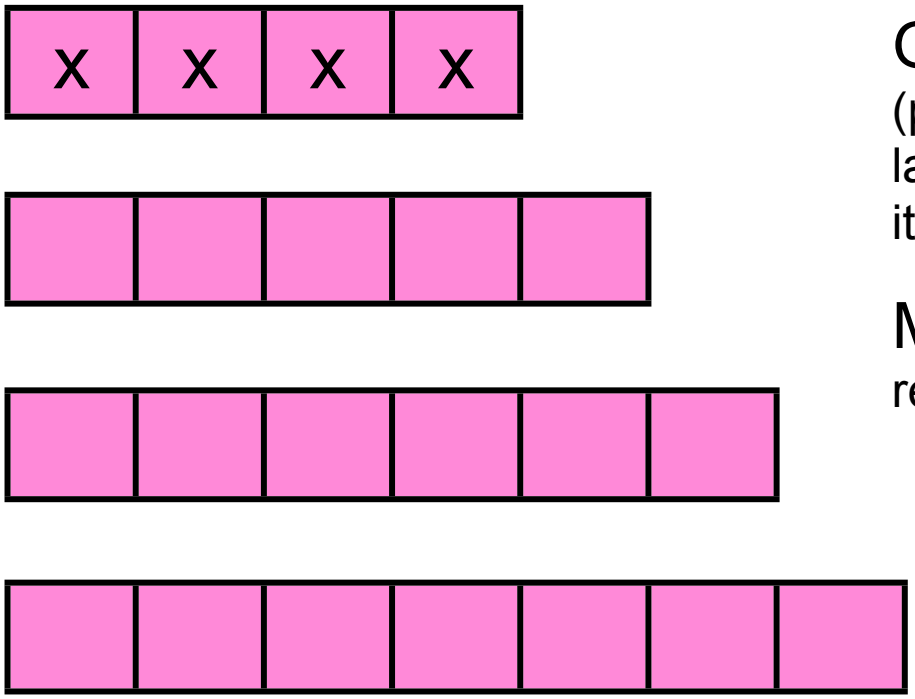
```
template<class SIT>
Stack<SIT>::Stack(){
     capacity = 4;
     size = 0;
     items = new SIT[capacity];
}
```

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



Stack array based implementation: (what if array fills?)

Analysis holds for array based implementations of Lists, Stacks, Queues, Heaps…



General Idea: upon an insert (push), if the array is full, create a larger space and copy the data into it.

Main question: What's the resizing scheme? We examine 3.