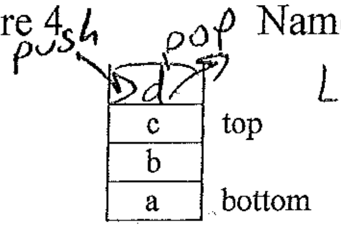
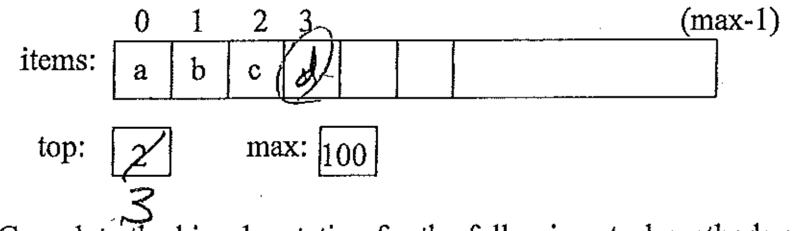
Data Structures (CS 1520) Lecture 4 Name:________________

1. An "abstract" view of the stack:



LIFO access
"Last In First Out"

Using an array implementation would look something like:



Complete the big-oh notation for the following stack methods assuming an array implementation: ("n" is the # items)

	push(item)	pop( )	peek( )	size( )	isEmpty( )	isFull( )	Constructor
Big-oh	O(1)	O(1)	O(1)	O(1)	O(1)	O(1)	O(1)

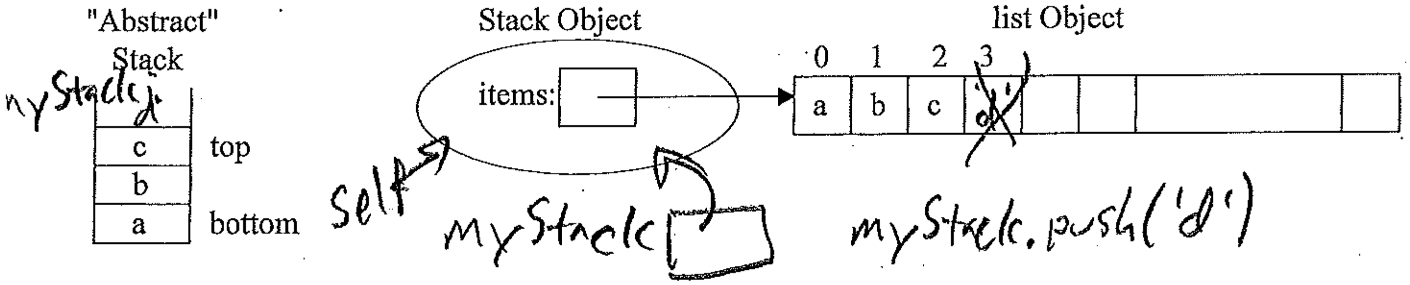
2. Since Python does not have a (directly accessable) built-in array, we can use a list.

```
class Stack:
    def __init__(self):
        self.items = []

    def isEmpty(self):
        return self.items == []

    def push(self, item):
        self.items.append(item)

    def pop(self):
        return self.items.pop()

    def peek(self):
        return self.items[len(self.items)-1]

    def size(self):
        return len(self.items)
```

myStack = Stack()

self.isEmpty()
if len(self.items)==0:
raise ValueError("Cannot pop from empty stack")
return self.items.pop()

Since Python uses an array of references (pointers) to list items in their implementation of a list.



a) Complete the big-oh notation for the stack methods assuming this Python list implementation: ("n" is the # items)

	push(item)	pop( )	peek( )	size( )	isEmpty( )	__init__
Big-oh	O(1)	O(1)	O(1)	O(1)	O(1)	O(1)

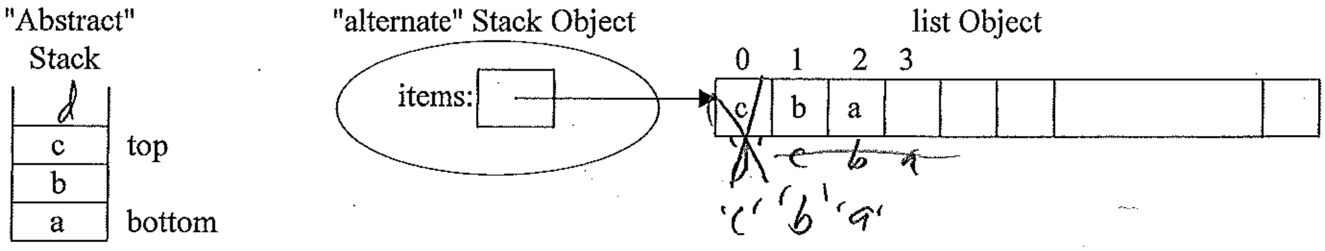
b) Which operations should have what preconditions?

pop - stack is not empty
peek -

3. The text's alternative stack implementation also using a Python list is:

```
class Stack:
    def __init__(self):
        self.items = []

    def isEmpty(self):
        return self.items == []

    def push(self, item):
        self.items.insert(0,item)

    def pop(self):
        return self.items.pop(0)

    def peek(self):
        return self.items[0]

    def size(self):
        return len(self.items)
```

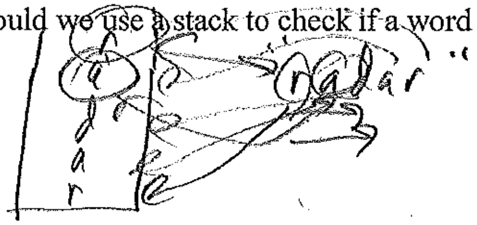
Since an array is used to implement a Python list, the alternate Stack implementation using a list:



a) Complete the big-oh notation for the "alternate" Stack methods: ("n" is the # items)

	push(item)	pop()	peek()	size()	isEmpty()	__init__
Big-oh	O(n)	O(n)	O(1)	O(1)	O(1)	O(1)

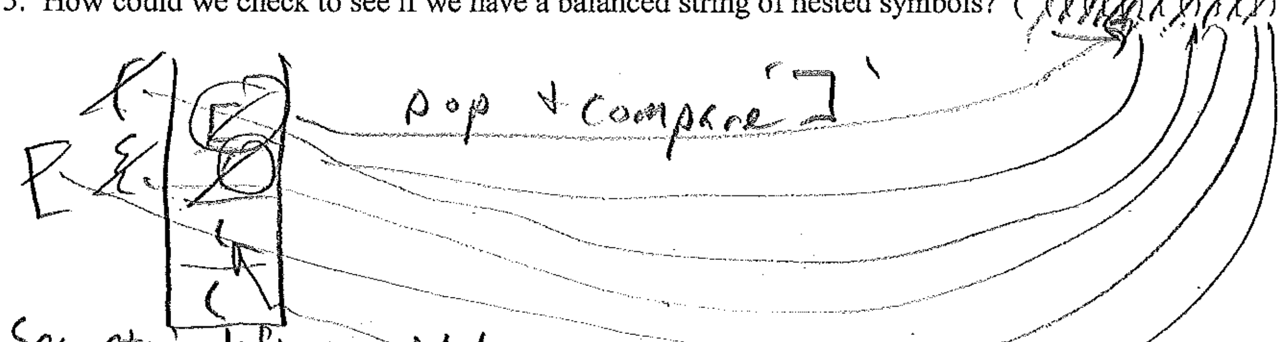
4. How could we use a stack to check if a word is a palindrome (e.g., radar, toot)?



radar

① push front half ② pops + compare for matches through back half of string

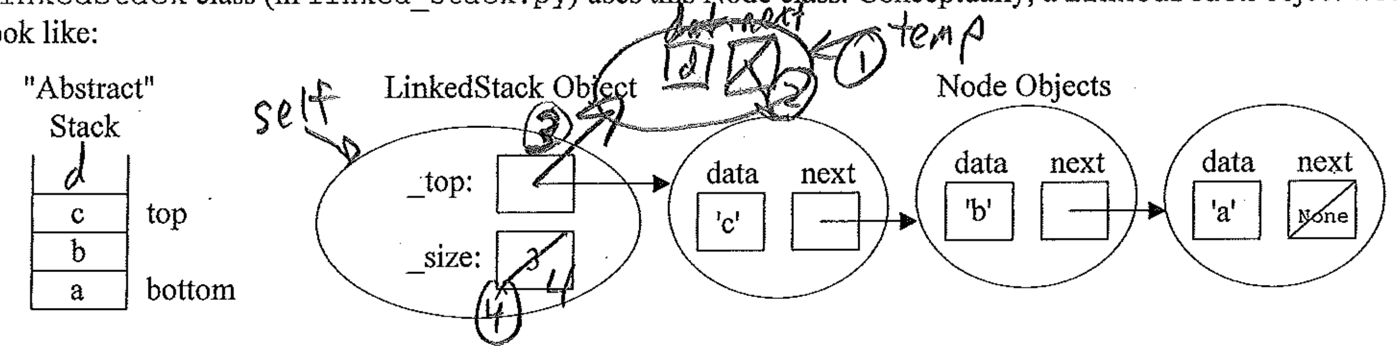
5. How could we check to see if we have a balanced string of nested symbols? ("(((())))")



Scan string left-to-right
Push any open brackets and when a closing bracket is encountered
pop stack and check for corresponding open bracket
At end of string stack should be empty.

Data Structures (CS 1520) Lecture 5 Name:________________

1. The `Node` class (in `node.py`) is used to dynamically create storage for a new item added to the stack. The `LinkedStack` class (in `linked_stack.py`) uses this Node class. Conceptually, a `LinkedStack` object would look like:



```
class Node:
    def __init__(self,initdata):
        self.data = initdata
        self.next = None

    def getData(self):
        return self.data

    def getNext(self):
        return self.next

    def setData(self,newdata):
        self.data = newdata

    def setNext(self,newnext):
        self.next = newnext
```

a) Complete the `push`, `pop`, and `__str__` methods.

b) Stack methods big-oh's?
(Assume "n" items in stack)

- constructor `__init__`:
- `push(item)`:
- `pop()`
- `peek()`
- `size()`
- `isEmpty()`
- `str()`

```
class LinkedStack(object):
    """ Link-based stack implementation."""

    def __init__(self):
        self._top = None
        self._size = 0

    def push(self, newItem):
        """Inserts newItem at top of stack."""
        temp = Node(newItem)
        temp.setNext(self._top)
        self._top = temp
        self._size += 1

    def pop(self):
        """Removes and returns the item at top of the stack.
        Precondition: the stack is not empty."""






    def peek(self):
        """Returns the item at top of the stack.
        Precondition: the stack is not empty."""
        return self._top.getData()

    def size(self):
        """Returns the number of items in the stack."""
        return self._size

    def isEmpty(self):
        return self._size == 0

    def __str__(self):
        """Items strung from top to bottom."""
```

Process for writing linked data structure method:

(1) Draw "normal" case picture (e.g. several items already)

(2) Modify picture to reflex changes of the method

(3) Number the steps to order the changes in step (2)

(4) Write normal case code