EECS 12: Lecture 9
Linked Lists and Stacks

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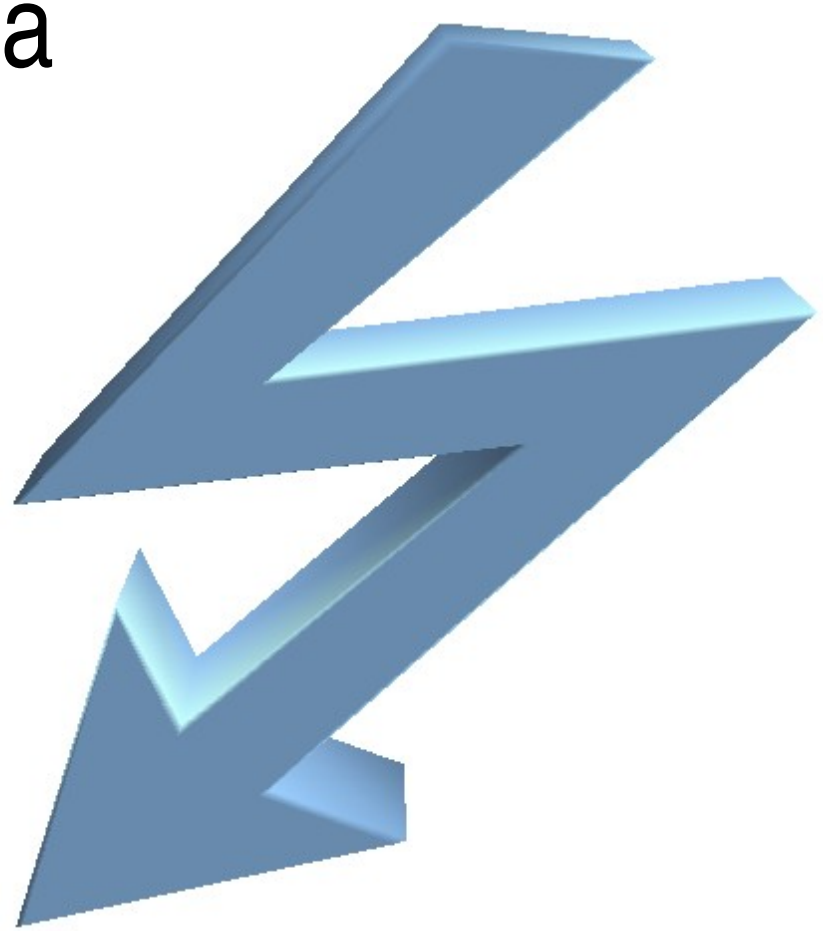
Agenda

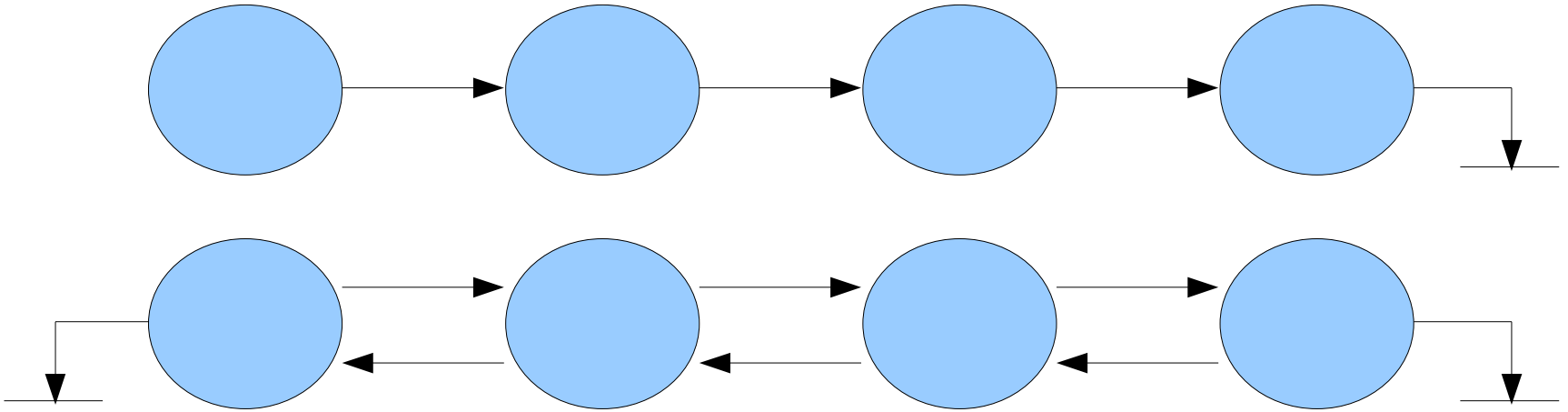
- Linked Lists
- `break` and `continue`
- Stacks versus queues
- Postfix calculators
- Very basic regex
- Python factoid of the day



She turned me into a stack!
A stack?
I got better...

Linked Lists are boring trees

- Tress have data and multiple children
- Linked lists have data and a *next*
- *Doubly linked lists* also have a *previous*



Singly Linked List Node Implementation

```
class LLNode:
    def __init__(self, data, next):
        self.data = data
        self.next = next
    def __str__(self):
        return str(self.data)
```

Doubly Linked List Node Implementation

```
class LLNode:
    def __init__(self,data,prev,next):
        self.data = data
        self.prev = prev
        self.next = next
    def __str__(self):
        return str(self.data)
```

Find a Node in a LL using *tail recursion*

(doesn't work currently in python and Guido said that it won't...)

```
def find(item, lst):
    if lst.data == item:
        return lst
    elif lst.next == None:
        return None
    else:
        return find(item, lst.next)
```

Find a Node in a LL using iteration

```
def find(item, lst):
    node = lst
    while node != None:
        if node.data == item:
            return node
        node = node.next
    return None
```

Insert After

```
def insertAfter(toInsert, item, lst):
    node = find(item, lst)
    if node == None:
        return False
    else:
        toInsert.next = node.next
        node.next = toInsert
        return True
```

Let's think...

- Can we use `insertAfter` to insert at the beginning of a list?
- How would we have to change `insertAfter` if we were working with a doubly-linked list instead?

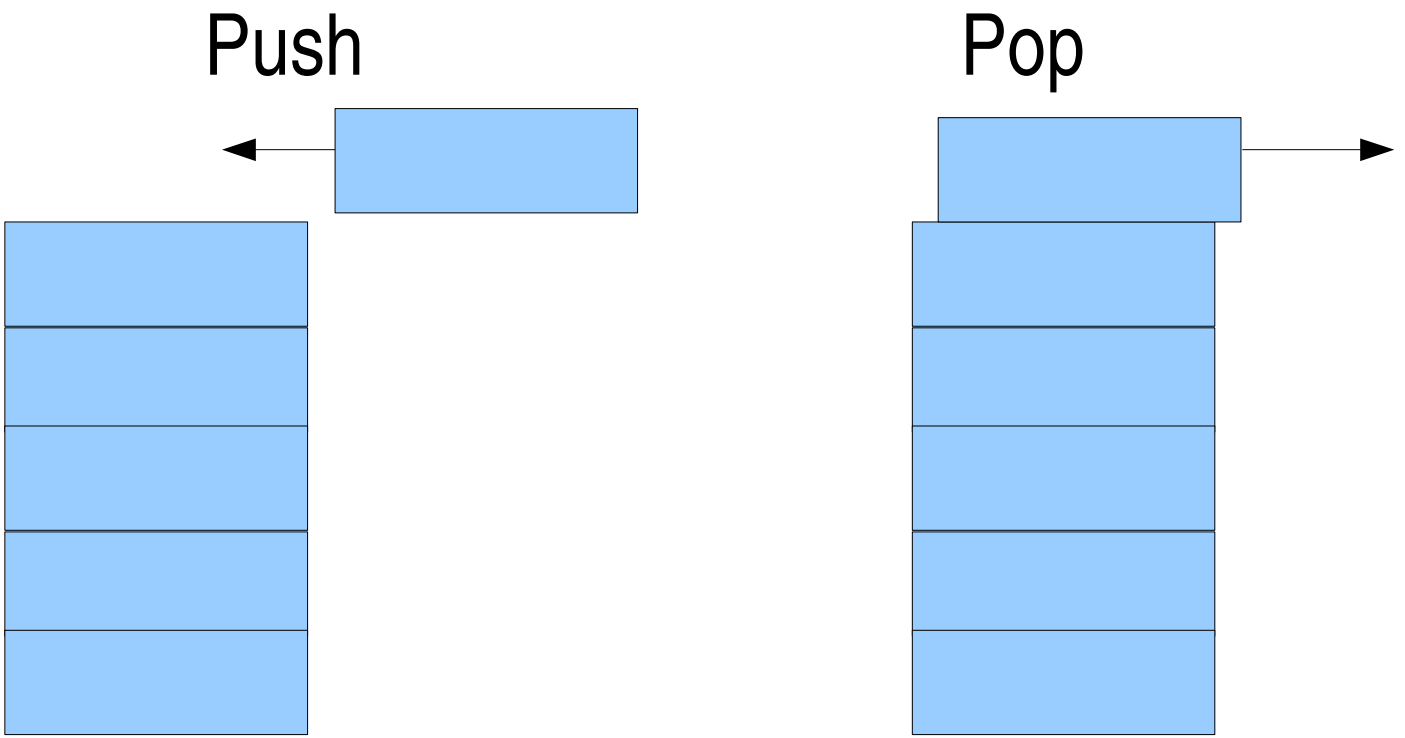
Aside: `break` and `continue`

```
>>> for ltr in ['a','b','c','d','e']:
    if ltr == 'b':
        continue # go on to next
    elif ltr == 'd':
        break    # stop looping
    print ltr,

a c
```

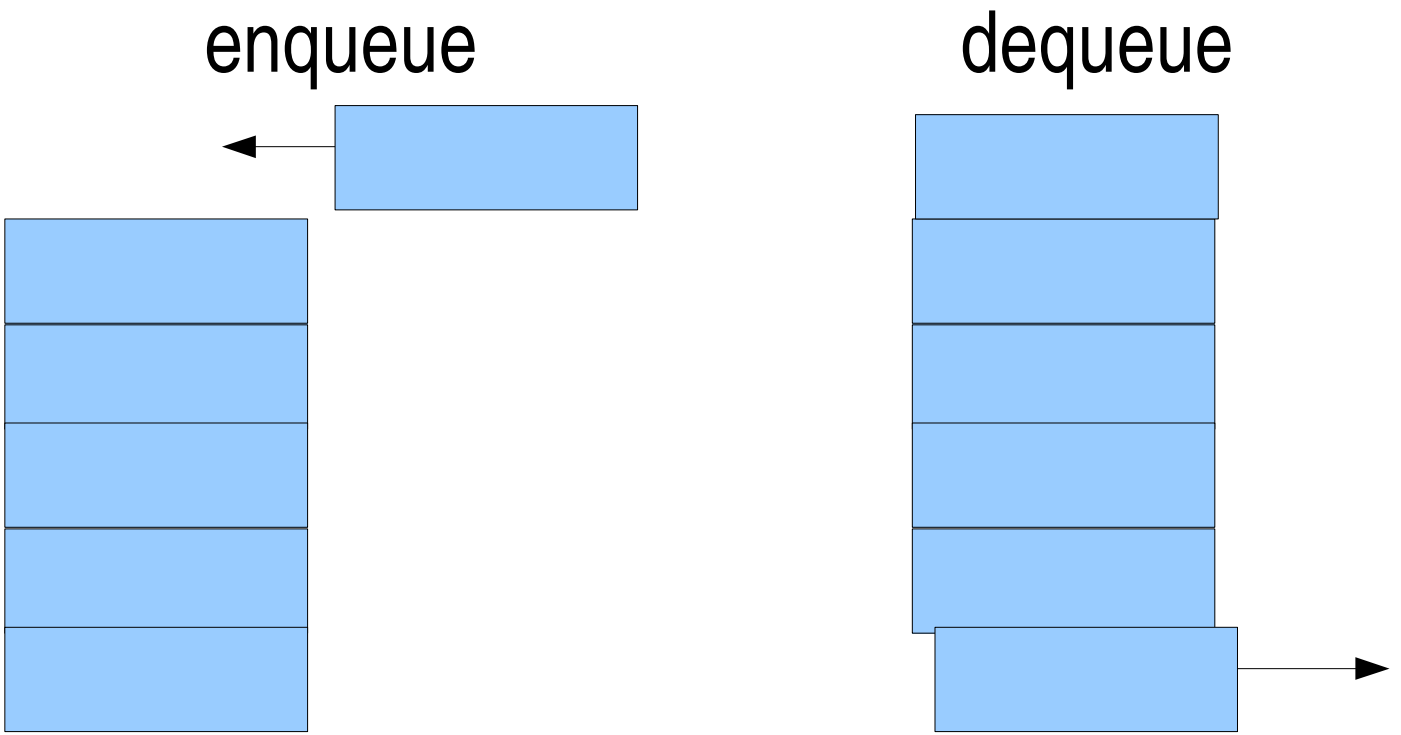
Stacks

First In Last Out (FILO) or *Last In First Out* (LIFO)



Queues

First In First Out (FIFO)



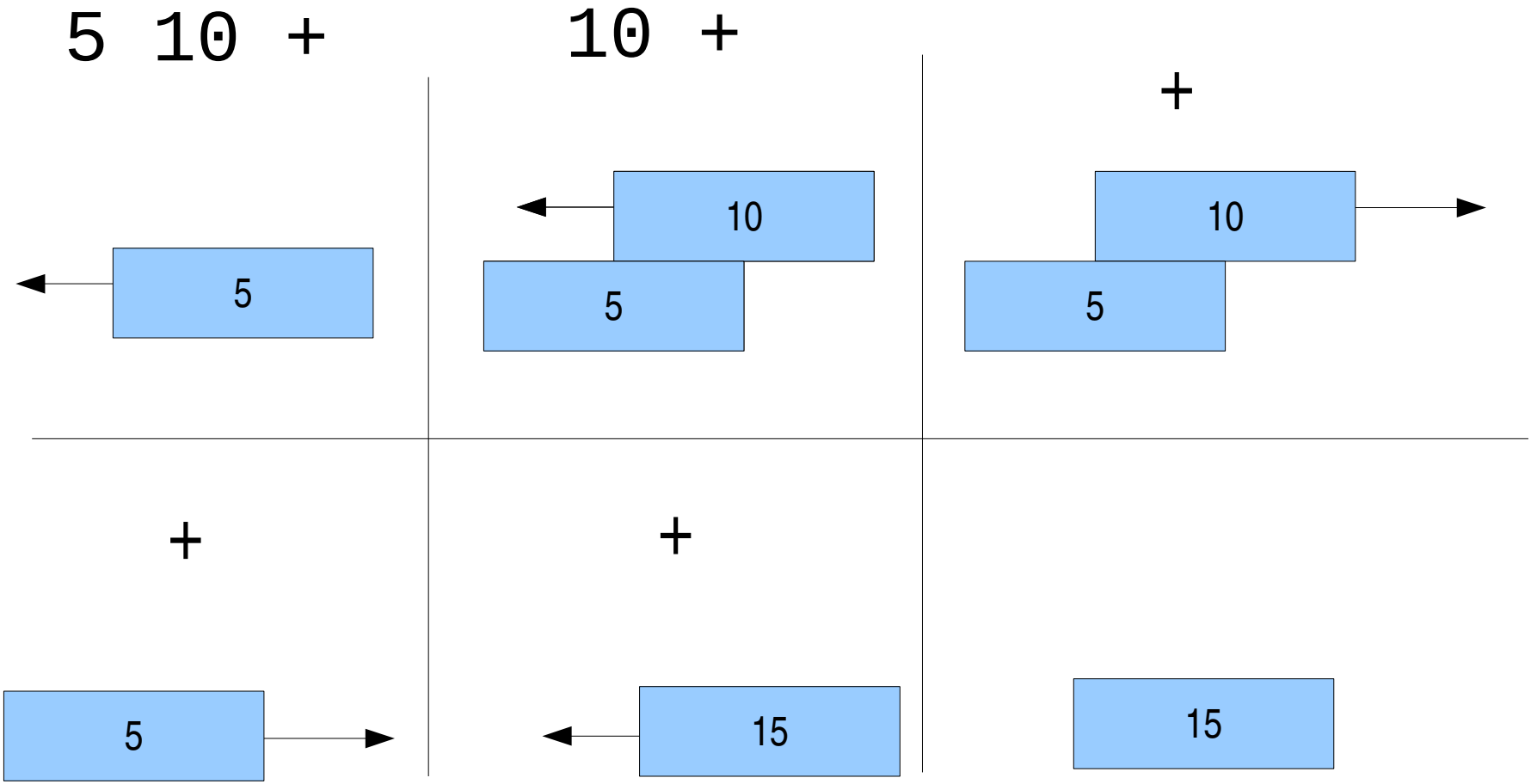
Stack: list-based implementation

```
class Stack(list):
    def push(self, item):
        self.append(item)
    # pop is already part of list
    def __str__(self):
        return 'Stack('\
               + str(list(self)) \
               + ')'
```

Postfix calculators

- Called “Reverse Polish Notation”
  - Prefix notation was developed by Polish mathematician Jan Lukasiewicz
  - Charles L. Hamblin devised postfix notation
- Operators come after operands
- Easy to parse with a stack

Postfix add



Let's work it out...

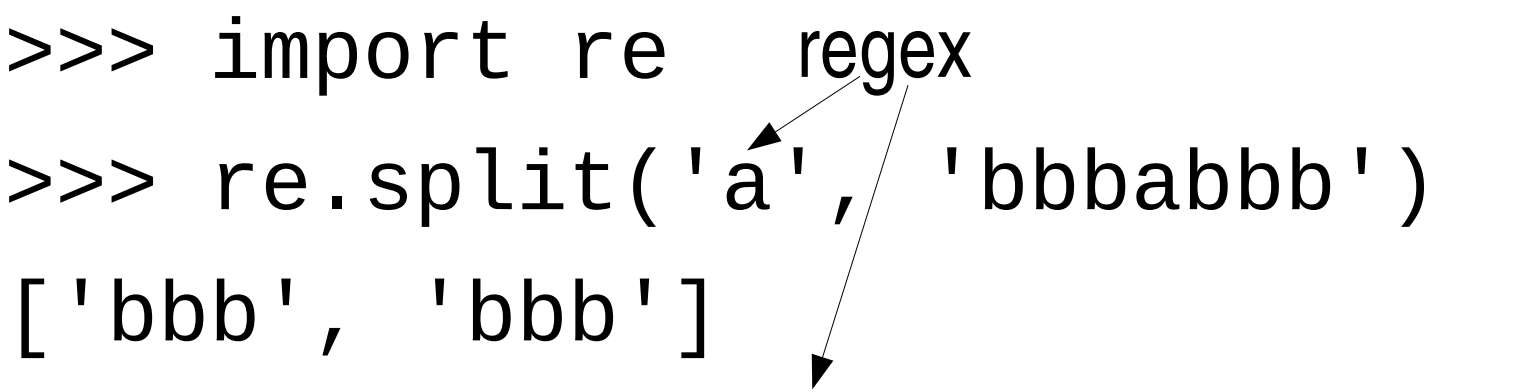
Compute the value of the following postfix expressions

(hint: postfix `a b -` : infix `a - b`)

- `2 4 + 7 *`
- `47 5 – 47 +`
- `27 3 / 13 + 3 *`

Simple Regular Expressions

A regular expression (regex) is a *pattern* that can be matched in a string. We can use it to split strings




```
>>> import re
>>> re.split('a', 'bbbabbb')
['bbb', 'bbb']
>>> re.split('(a)', 'bbbabbb')
['bbb', 'a', 'bbb']
```

Simple Regular Expressions (continued)

The “one of these” construct `[ ]`

```
>>> re.split('[ac]', 'bbbabcbb')
['bbb', 'b', 'bb']
>>> re.split('([ac])', 'bbbabcbb')
['bbb', 'a', 'b', 'c', 'bb']
```

Simple Regular Expressions (continued)

The “none of these” construct `[^ ]`

```
>>> re.split("[^ac]", 'babcb')
['', 'a', 'c', '']
>>> re.split('([^ac])', 'babcb')
['', 'b', 'a', 'b', 'c', 'b', '']
```

Simple Regular Expressions (continued)

All letters and all numbers `[A-z] [0-9]`

```
>>> re.split('[A-z]', 'a1b2c3')
['', '1', '2', '3']
>>> re.split('[0-9]', 'a1b2c3')
['a', 'b', 'c', '']
```

Simple Regular Expressions (continued)

`findall` matches instead of splits

```
>>> re.findall('[A-z]', 'a1b2c3')
['a', 'b', 'c']
>>> re.findall('[0-9]', 'a1b2c3')
['1', '2', '3']
```

Let's explore...

- Develop a single regex that matches both letters and numbers
- Develop a single regex that matches anything that is neither a letter nor a number

Python Factoid of the day: `import this` and the Zen of Python

```
>>> import this
[...]
>>> this.s
[...]
>>> this.d
```