CS 1110

Prelim 1 Review
Fall 2015

Exam Info

- Prelim 1: 7:30–9:00PM, Thursday, October 15th
  - Last name **A – J** in Uris G01
  - Last name **K – Z** in Statler Auditorium
  - SDS Students will get an e-mail
- To help you study:
  - Study guides, review slides are online
  - Solutions to Assignment 2 are in CMS
- Arrive early! Helps reducing stress

Grading

- We will announce *approximate* letter grades
  - We adjust letter grades based on all exams
  - But no hard guidelines (e.g. mean = grade X)
  - May adjust borderline grades again at final grades
- Use this to determine whether you want to drop
  - **Drop deadline** is next week, October 20th
  - **Goal**: Have everyone graded by end of Saturday
  - Will definitely notify you if you made less than C

What is on the Exam?

- **Five** Questions out of Six Topics:
  - String slicing functions (A1)
  - Call frames and the call stack (A2)
  - Functions on mutable objects (A3)
  - Testing and debugging (Lab 3 & 6, Lec. 11)
  - Lists and For-Loops (Lab 7)
  - Short Answer (Terminology)
- + 2 pts for writing your name and net-id

What is on the Exam?

- String slicing functions (A1)
  - Will be given a function specification
  - Implement it using string methods, slicing
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
- Testing and debugging (Lab 3 & 6, Lecture 11)
- Lists and For-Loops (Lab 7)
- Short Answer (Terminology)

String Slicing

```
def make_netid(name,n):
    """Returns: a netid for name with suffix n

    Netid is either two letters and a number (if the student has no
    middle name) or three letters and a number (if the student has
    a middle name).  Letters in netid are lowercase.

    Example: make_netid('Walker McMillan White',2) is 'wmw2'
    Example: make_netid('Walker White',4) is 'ww4'

    Parameter name: the student name
    Precondition: name is a string either with format '<first-name>
    <last-name>' or '<first-name> <middle-name> <last-name>'

    Parameter n: the netid suffix
    Precondition: n > 0 is an int."""
```

Useful String Methods

Method	Result
s.find(s1)	Returns first position of s1 in s; -1 if not there.
s.rfind(s1)	Returns LAST position of s1 in s; -1 if not there.
s.lower()	Returns copy of s with all letters lower case
s.upper()	Returns copy of s with all letters upper case

- We will give you any methods you need
- But you must know how to slice strings!

String Slicing

```
def make_netid(name,n):
    """Returns: a netid for name with suffix n."""
    name = name.lower() # switch to lower case
    fpos = name.find(' ')   # find first space
    first = name[:fpos]
    last = name[fpos+1:]
    mpos = last.find(' ')   # see if there is another space
    if mpos == -1:
        return first[0]+last[0]+str(n)   # remember, n is not a string
    else:
        middle = last[:mpos]
        last = last[mpos+1:]
        return first[0]+middle[0]+last[0]+str(n)
```

What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
  - **Very** similar to A2 (see solution in CMS)
  - May have to draw a full call stack
  - See lectures 4 and 9 (slide typos corrected)
- Functions on mutable objects (A3)
- Testing and debugging (Lab 3 & 6, Lecture 11)
- Lists and For-Loops (Lab 7)
- Short Answer (Terminology)

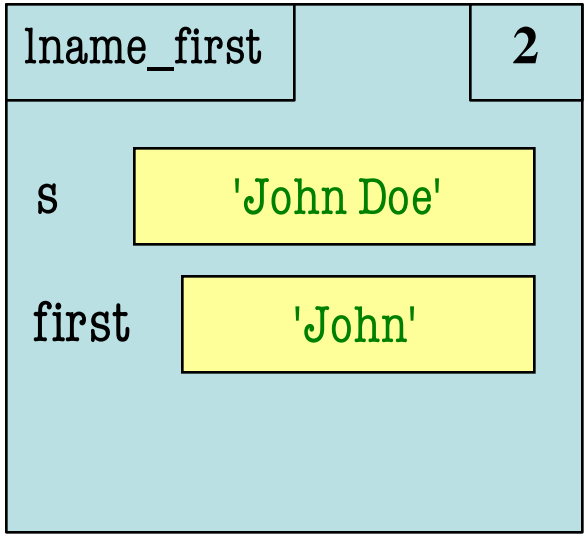
Call Stack Example

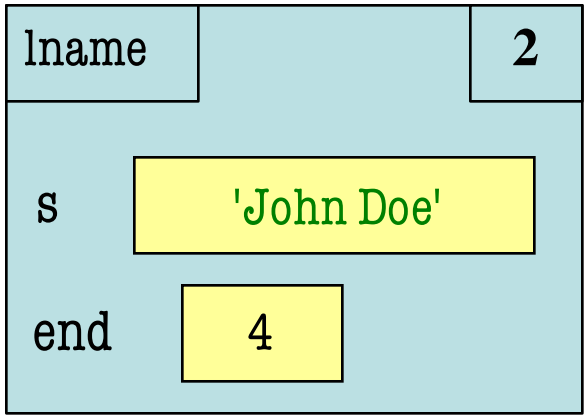
- Given functions to right
  - Function fname() is not important for problem
  - Use the numbers given
- Execute the call: lname_first('John Doe')
- Draw **entire** call stack when helper function lname completes line 1
  - Draw nothing else

```
def lname_first(s):
    """Precondition: s in the form
    <first-name> <last-name>"""
1   first = fname(s)
2   last = lname(s)
3   return last + ',' + first
```

```
def lname(s):
    """Prec: see last_name_first"""
1   end = s.find(' ')
2   return s[end+1:]
```

Call Stack Example: lname_first('John Doe')

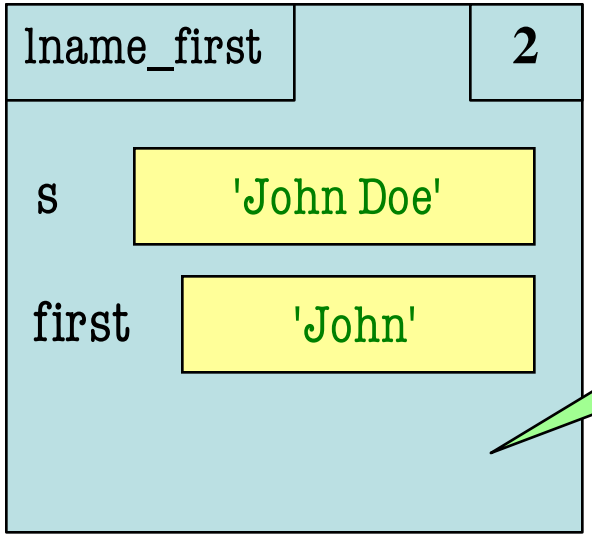


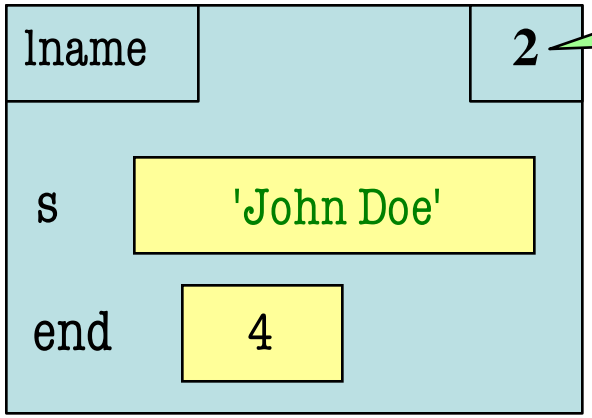



```
def lname_first(s):
    """Precondition: s in the form
    <first-name> <last-name>"""
1   first = fname(s)
2   last = lname(s)
3   return last + ',' + first
```

```
def lname(s):
    """Prec: see last_name_first"""
1   end = s.find(' ')
2   return s[end+1:]
```

Call Stack Example: lname_first('John Doe')





No variable last.
Line 2 is not complete.

Line 1 is **complete**.
Counter is next line.

```
def lname_first(s):
    """s in the form <first-name> <last-name>"""
    last = lname(s)
    return first(s, last)

def lname(s):
    """Prec: see last_name_first"""
    end = s.find(' ')
    return s[end+1:]
```

Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```

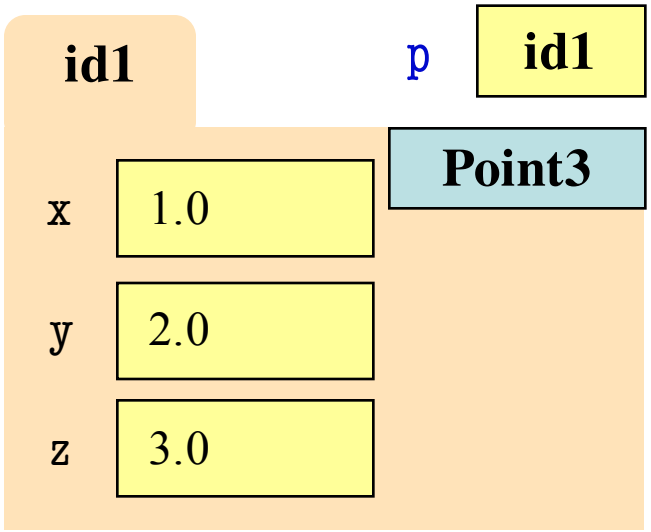
- May get a function on a mutable object

  ```
  >>> p = Point3(1.0,2.0,3.0)
  >>> cycle_left(p)
  ```

- You are not expected to come up w/ the "folder"
  - Will provide it for you
  - You just track changes
- **Diagram all steps**

Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```




```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call

Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
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3   p.y = p.z
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>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```
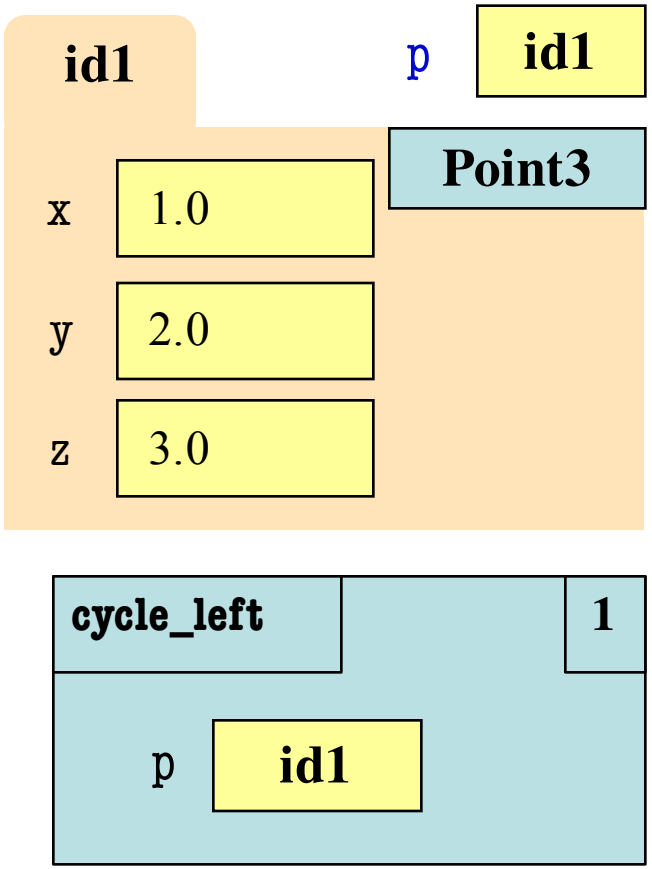

Function Call



Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
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```
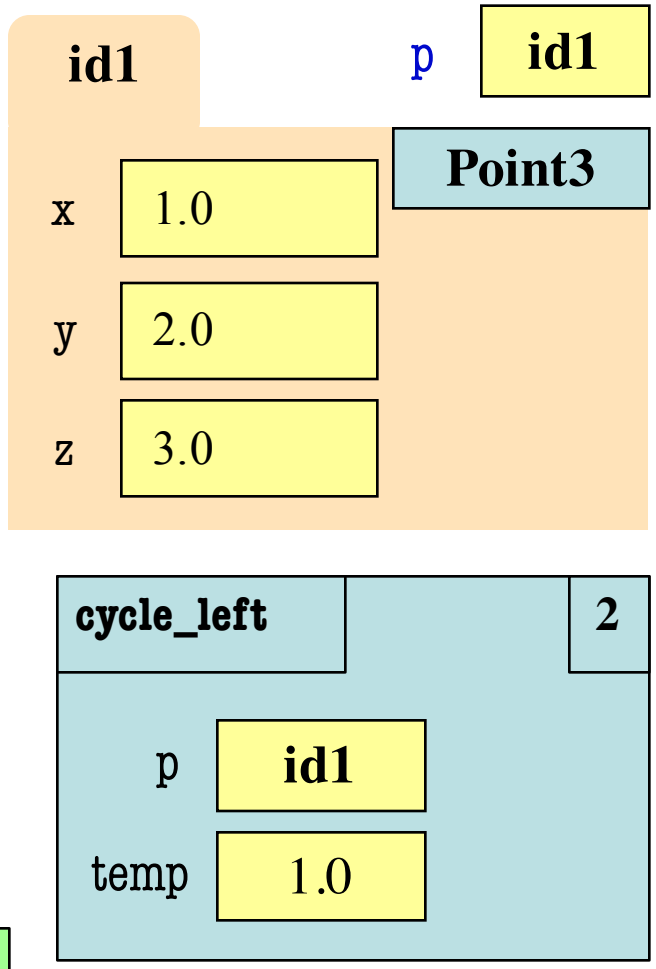

```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call

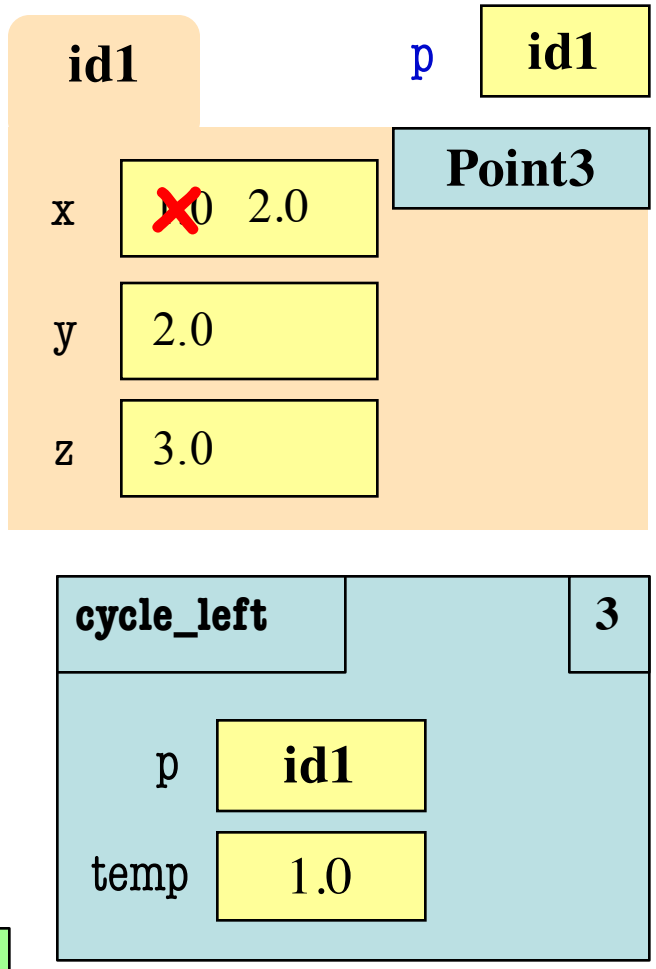


Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```

```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call

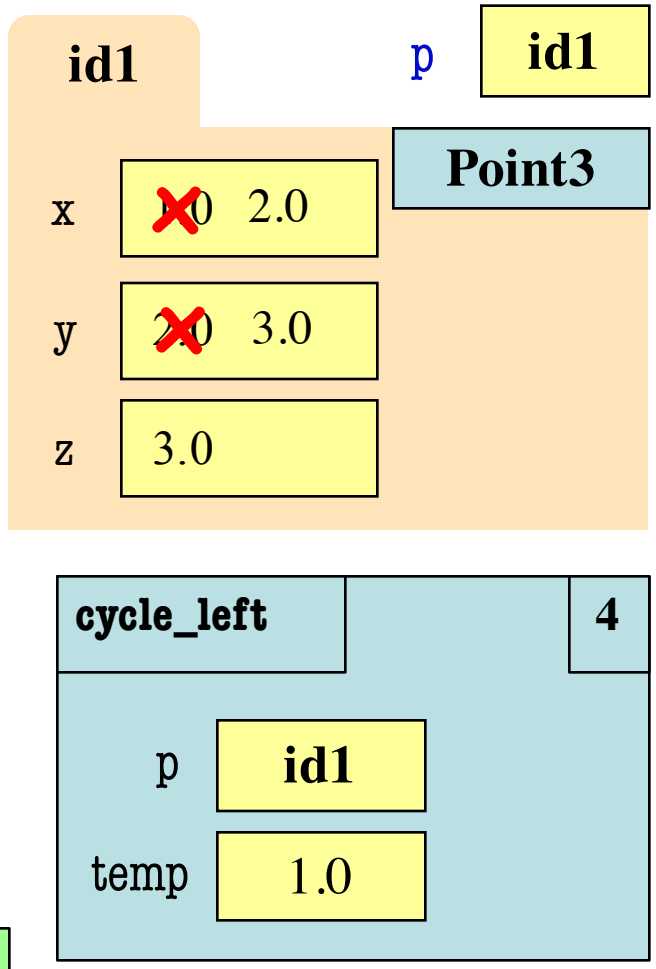


Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```

```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call

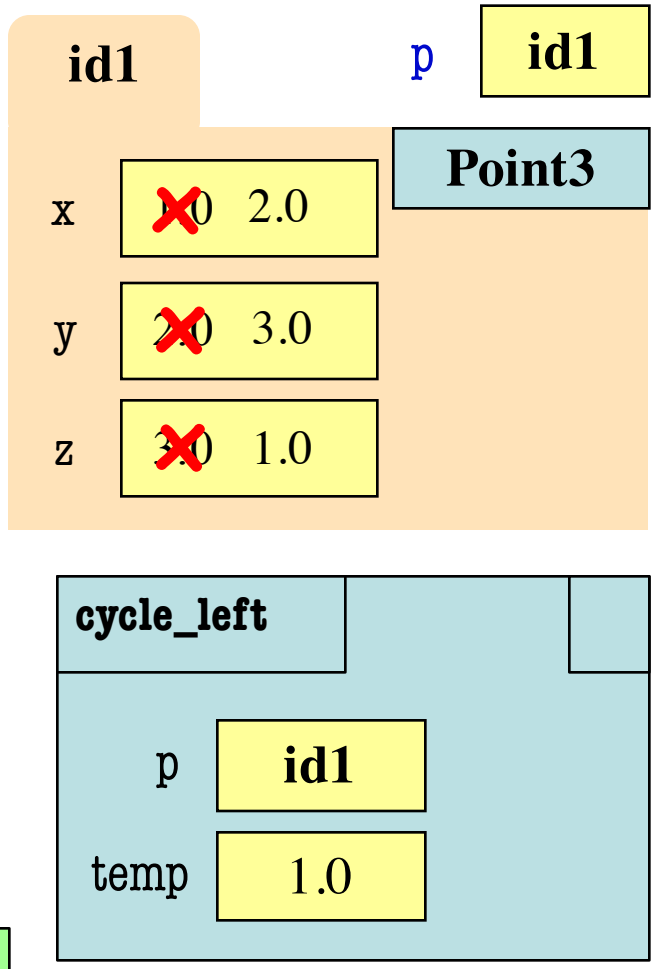


Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```

```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call

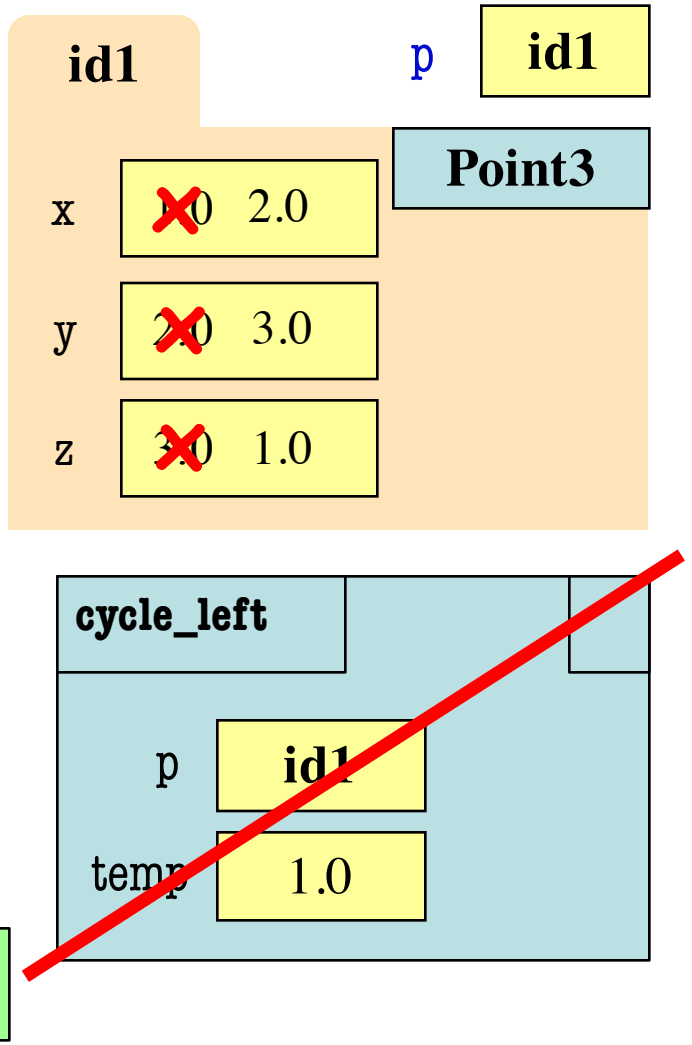


Example with a Mutable Object

```
def cycle_left(p):
    """Cycle coords left
    Precondition: p a point"""
1   temp = p.x
2   p.x = p.y
3   p.y = p.z
4   p.z = temp
```

```
>>> p = Point3(1.0,2.0,3.0)
>>> cycle_left(p)
```

Function Call



What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
  - Given an object type (e.g. class)
  - Attributes will have invariants
  - Write a function respecting invariants
- Testing and debugging (Lab 3 & 6, Lecture 11)
- Lists and For-Loops (Lab 7)
- Short Answer (Terminology)

Example from Assignment 3

- Class: RGB
  - Constructor function: RGB(r,g,b)
  - Remember constructor is just a function that gives us back a mutable object of that type
  - Attributes:

Attribute	Invariant
red	int, within range 0..255
green	int, within range 0..255
blue	int, within range 0..255

Function that Modifies Object

```
def lighten(rgb):
    """Lighten each attribute by 10%

    Attributes get lighter when they increase.

    Parameter rgb: the color to lighten
    Precondition: rgb an RGB object"""

    pass # implement me
```

Function that Modifies Object

Procedure:
no return

```
def lighten(rgb):
    """Lighten each attribute by 10%"""
    red = rgb.red  # puts red attribute in local var
    red = 1.1*red # increase by 10%
    red = int(round(red,0))  # convert to closest int
    rgb.red = min(255,red)  # cannot go over 255
    # Do the others in one line
    rgb.green = min(255,int(round(1.1*rgb.green,0)))
    rgb.blue = min(255,int(round(1.1*rgb.blue,0)))
```

Another Example

- Class: Length
  - Constructor function: Length(ft,in)
  - Remember constructor is just a function that gives us back a mutable object of that type
  - Attributes:

Attribute	Invariant
feet	int, non-negative, = 12 in
inches	int, within range 0..11

Function that Does Not Modify Object

```
def difference(len1,len2):
    """Returns: Difference between len1 and len2

    Result is returned in inches

    Parameter len1: the first length
    Precondition: len1 is a length object longer than len2

    Parameter len2: the second length
    Precondition: len2 is a length object shorter than len1"""

    pass # implement me
```

Function that Does Not Modify Object

```
def difference(len1,len2):
    """Returns: Difference between len1 and len2
    Result is returned in inches
    Parameter len1: the first length
    Parameter len2: the second length
    Precondition: len2 is a length object shorter than len1"""
    feetdif = (len1.feet-len2.feet)*12
    inchdif = len1.inches-len2.inches # may be negative
    return feetdif+inchdif
```

What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
- Testing and debugging (Lab 3 & 6, Lecture 11)
  - Coming up with test cases
  - Tracing program flow
  - Understanding assert statements
- Lists and For-Loops (Lab 7)
- Short Answer (Terminology)

Picking Test Cases

```
def pigify(w):
    """Returns: copy of w converted to Pig Latin

    'y' is a vowel if it is not the first letter

    If word begins with a vowel, append 'hay'

    If word starts with 'q', assume followed by 'u';
    move 'qu' to the end, and append 'ay'

    If word begins with a consonant, move all
    consonants up to first vowel to end and add 'ay'

    Parameter w: the word to translate
    Precondition: w contains only (lowercase) letters"""
```

Picking Test Cases

```
def pigify(w):
    """Returns: copy of w converted to Pig Latin"""
    ...
```

- Test Cases (Determined by the rules):
  - are => arehay (Starts with vowel)
  - quiet => ietquay (Starts with qu)
  - ship => ipshay (Starts with consonant(s))
  - bzzz => bzzzay (All consonants)
  - yield => ieldyay (y as consonant)
  - byline => ylinebay (y as vowel)

Debugging Example

```
def replace_first(word,a,b):
    """Returns: a copy with FIRST instance of a replaced by b

    Example: replace_first('crane','a','o') returns 'crone'
    Example: replace_first('poll','l','o') returns 'pool'

    Parameter word: The string to copy and replace
    Precondition: word is a string

    Parameter a: The substring to find in word
    Precondition: a is a valid substring of word

    Parameter b: The substring to use in place of a
    Precondition: b is a string"""
```

Debugging Example

```
def replace_first(word,a,b):
    """Returns: a copy with
    FIRST a replaced by b"""

    pos = word.rfind(a)
    print pos
    before = word[:pos]
    print before
    after  = word[pos+1:]
    print after
    result = before+b+after
    print result
    return result
```

```
>>> replace_first('poll', 'l', 'o')
3
pol

polo
'polo'
>>> replace_first('askew', 'sk', 'ch')
1
a
kew
achkew
'achkew'
```

Identify the bug(s) in this function.

Debugging Example

```
def replace_first(word,a,b):
    """Returns: a copy with
    FIRST a replaced by b"""
    pos = word.rfind(a)
    print pos
    before = word[:pos]
    print before
    after  = word[pos+1:]
    print after
    result = before+b+after
    print result
    return result
```

```
>>> replace_first('poll', 'l', 'o')
3
pol

polo
'polo'
>>> replace_first('askew', 'sk', 'ch')
1
a
kew
achkew
'achkew'
```

Unexpected!

Debugging Example

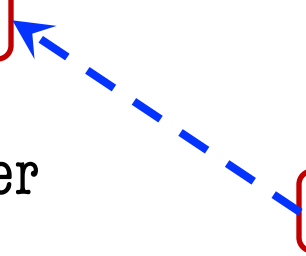
```
def replace_first(word,a,b):
    """Returns: a copy with
    FIRST a replaced by b"""

    pos = word.find(a)
    print pos
    before = word[:pos]
    print before
    after  = word[pos+1:]
    print after
    result = before+b+after
    print result
    return result
```

```
>>> replace_first('poll', 'l', 'o')
3
pol


polo
'polo'
>>> replace_first('askew', 'sk', 'ch')
1
a
kew
achkew
'achkew'
```

Debugging Example

```
def replace_first(word,a,b):
    """Returns: a copy with
    FIRST a replaced by b"""

    pos = word.find(a)
    print pos
    before = word[:pos]
    print before
    after  = word[pos+1:]
    print after
    result = before+b+after
    print result
    return result
```

```
>>> replace_first('poll', 'l', 'o')
3
pol

polo
'polo'
>>> replace_first('askew', 'sk', 'ch')
1
a
kew      Unexpected!
achkew
'achkew'
```



Debugging Example

```
def replace_first(word,a,b):
    """Returns: a copy with
    FIRST a replaced by b"""

    pos = word.find(a)
    print pos
    before = word[:pos]
    print before
    after  = word[pos+len(a):]
    print after
    result = before+b+after
    print result
    return result
```

```
>>> replace_first('poll', 'l', 'o')
3
pol


polo
'polo'
>>> replace_first('askew', 'sk', 'ch')
1
a
kew
achkew
'achkew'
```

What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
- Testing and debugging (Lab 3 & 6, Lecture 11)
- Lists and For-Loops (Lab 7)
  - Given a function specification
  - Implement it using a for-loop
  - Challenge is how to use accumulators
- Short Answer (Terminology)

Useful List Methods

Method	Result
x.index(a)	Returns first position of a in x; error if not there
x.append(a)	Modify x to add element a to the end
x.insert(a,k)	Modify x to put a at position k (and move rest to right)
x.remove(a)	Modify x to remove first occurrence of a
x.sort()	Modify x so that elements are in sorted order

- We will give you any methods you need
- But you must know how to slice lists!

For-Loop in a Fruitful Function

```
def replace(thelist,a,b):
    """Returns: COPY of thelist with all occurrences of a replaced by b

    Example: replace([1,2,3,1], 1, 4) = [4,2,3,4].

    Parameter thelist: list to copy
    Precondition: thelist is a list of ints

    Parameter a: the value to remove
    Precondition: a is an int

    Parameter b: the value to insert
    Precondition: b is an int """
    return [] # Stub return.  IMPLEMENT ME
```

For-Loop in a Fruitful Function

```
def replace(thelist,a,b):
    """Returns: COPY of thelist with all occurrences of a replaced by b
    Example: replace([1,2,3,1], 1, 4) = [4,2,3,4]."""
    result = [] # Accumulator
    for x in thelist:
        if x == a:
            result.append(b)
        else:
            result.append(x)
    return result
```

For-Loop in a Procedure

```
def pairswap(seq):
    """MODIFIES thelist, swapping each two elements with each other
     Example: if a = [0,2,4,5], pairswap(a) makes a into [2,0,5,4]
                    if a = [1,2], pairswap(a) turns a into [2,1]
    Parameter thelist: list to modify
    Precondition: thelist is a list with an even number of elements."""
    pass # implement me
```

For-Loop in a Procedure

```
def pairswap(thelist):
    """MODIFIES thelist, swapping each two elements with each other
     Example: if a = [0,2,4,5], pairswap(a) makes a into [2,0,5,4]
                    if a = [1,2], pairswap(a) turns a into [2,1]
    Precondition: thelist is a list with an even number of elements."""
    for k in range(len(thelist)):
        if k % 2 == 0:
            tmp = thelist[k]            # Store old value
            thelist[k] = thelist[k+1] # Get next value
        else:
            thelist[k] = tmp            # Value stored in previous step
```

What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
- Testing and debugging (Lab 3 & 6, Lecture 10)
- Lists and For-Loops (Lab 7)
- Short Answer (Terminology)
  - See the study guide
  - Look at the lecture slides
  - Read relevant book chapters

In that order

Any More Questions?

Good Luck!