CS 1110

Prelim 1 Review
Fall 2013

Exam Info

- Prelim 1: 7:30–9:00PM, Thursday, October 17th
  - Last name **A – G** in Olin 155
  - Last name **H – K** in Olin 165
  - Last name **L – R** in Olin 255
  - Last name **S – Z** in Upson B17
- 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 day, October 18th
  - **Goal**: Have everyone graded by noon of that day
  - 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 (A1, Lab 3, Lec. 10)
    - Lists and For-Loops (Lab 6)
    - 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 (A1, Lab 3, Lecture 10)
- Lists and For-Loops (Lab 6)
- 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'

Precondition: name is a string either with format '<first-name> <last-name>' or '<first-name> <middle-name> <last-name>'; names are separated by spaces. 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 (A1, Lab 3, Lecture 10)
- Lists and For-Loops (Lab 6)
- 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:]
```
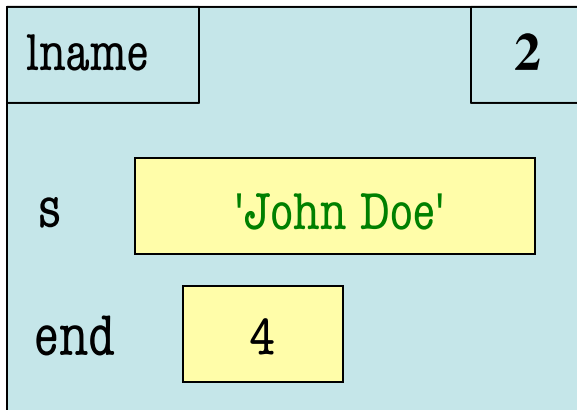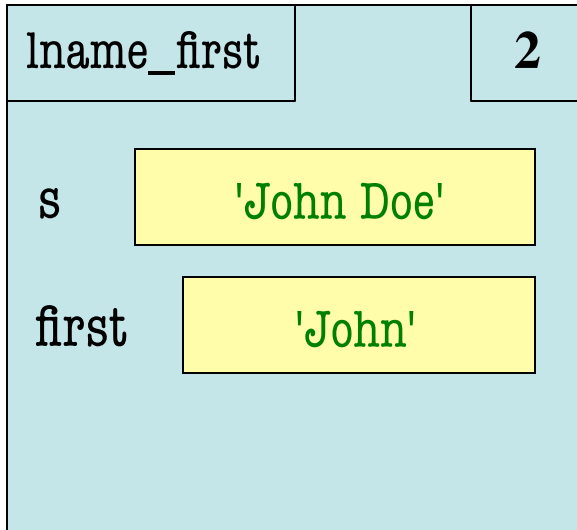
Call Stack Example: lname_first('John Doe')

lname_first | 2
---

s   'John Doe'

first   'John'

---

lname | 2
---

s   'John Doe'

end   4

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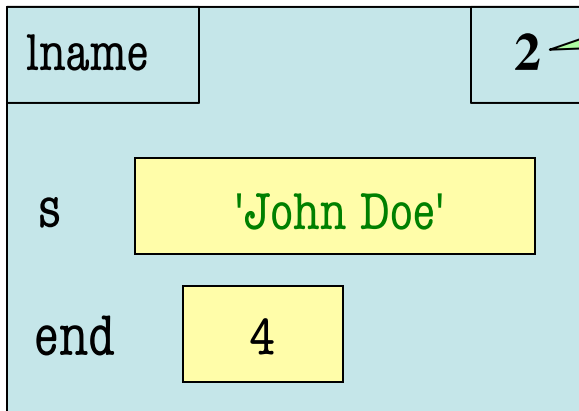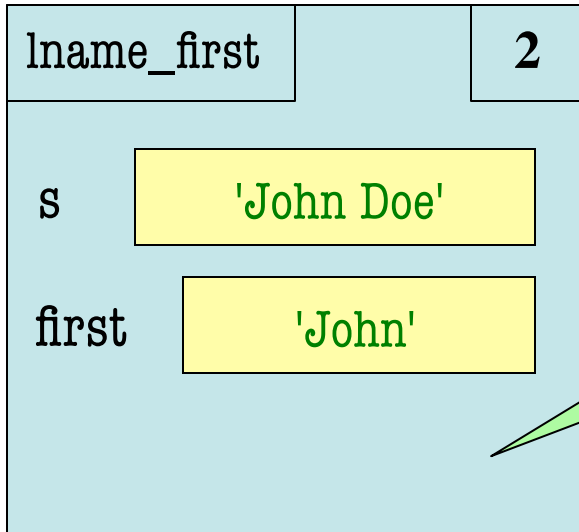
```
def lname(s):
    """Prec: see last_name_first"""
1   end = s.find(' ')
2   return s[end+1:]
```

Call Stack Example: lname_first('John Doe')

```
def lname_first(s):
    """...s in the form
    ...st-name>"""
    first = lname(s)
2   last = lname(s)
    ...last...first

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

lname_first   **2**

s   'John Doe'

first   'John'

No variable last.
Line 2 is not complete.

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

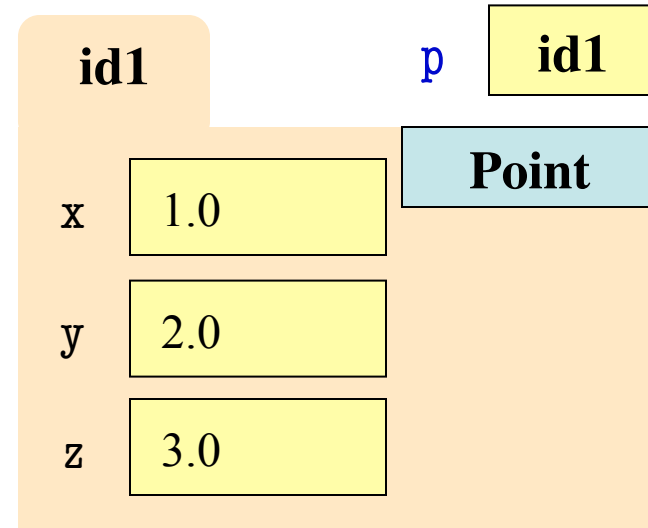**lname**   **2**

s   'John Doe'

end   4

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 = Point(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 = Point(1.0,2.0,3.0)
>>> shift(p)
```

Function Call

id1

p   id1

Point

x   1.0

y   2.0

z   3.0

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 = Point(1.0,2.0,3.0)
>>> shift(p)
```
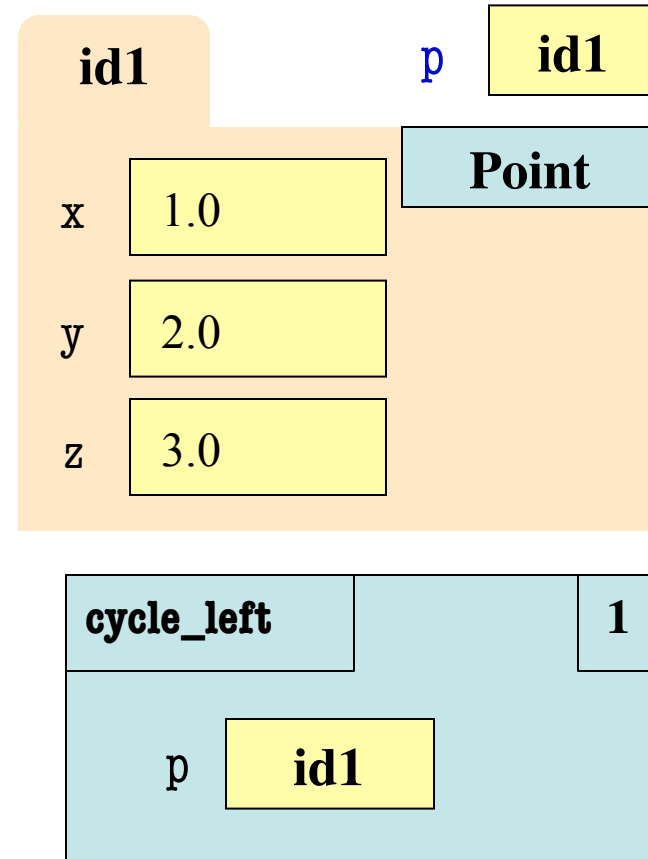
Function Call

id1   p   **id1**

Point

x   1.0

y   2.0

z   3.0

cycle_left   **1**

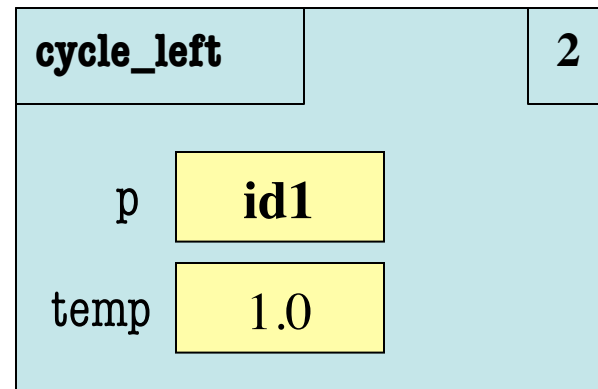p   **id1**

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 = Point(1.0,2.0,3.0)

>>> shift(p) Function Call

id1		p	**id1**
			Point
x	1.0		
y	2.0		
z	3.0		

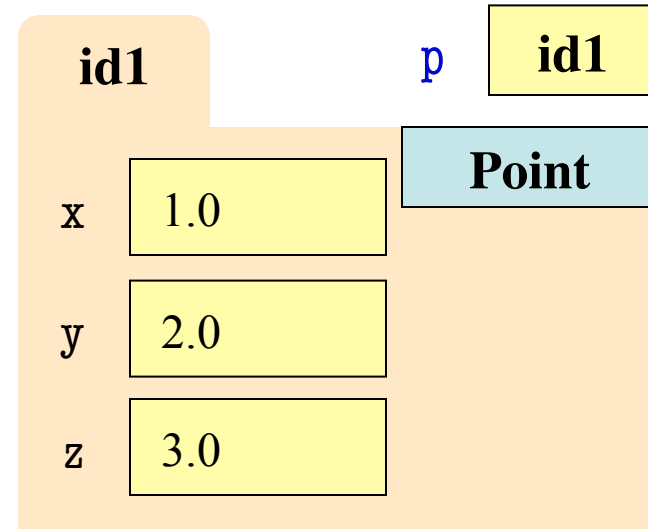| cycle_left		2
p	**id1**	
temp	1.0	

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 = Point(1.0,2.0,3.0)
>>> shift(p)
```

Function Call

p | **id1**

id1

Point

x | 1.0   2.0

y | 2.0

z | 3.0

cycle_left | **3**
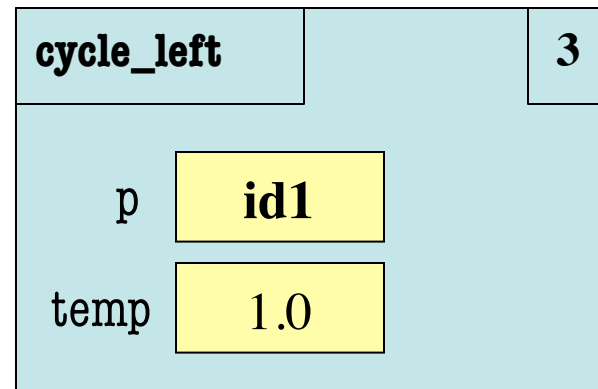
p | **id1**

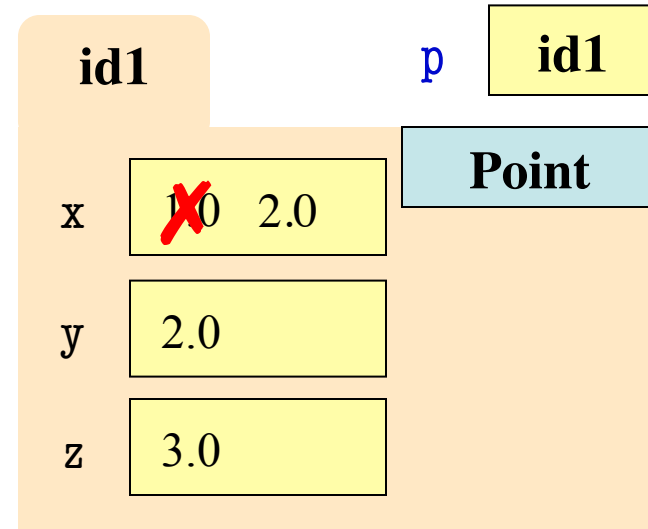temp | 1.0

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 = Point(1.0,2.0,3.0)

>>> shift(p)   Function Call

id1   p   id1

Point

x   1.0   2.0

y   2.0   3.0

z   3.0

cycle_left   4

p   id1

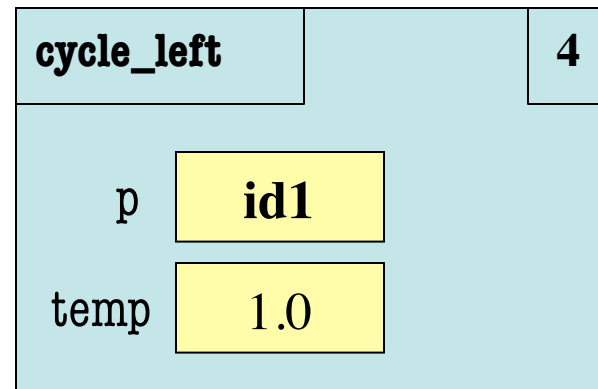temp   1.0

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 = Point(1.0,2.0,3.0)
>>> shift(p)
```

Function Call

p   id1

id1

Point

x   1.0 2.0

y   2.0 3.0

z   3.0 1.0

cycle_left

p   **id1**
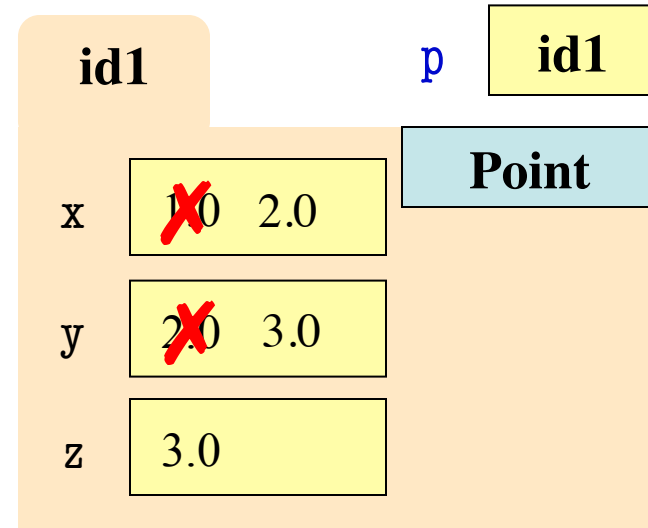
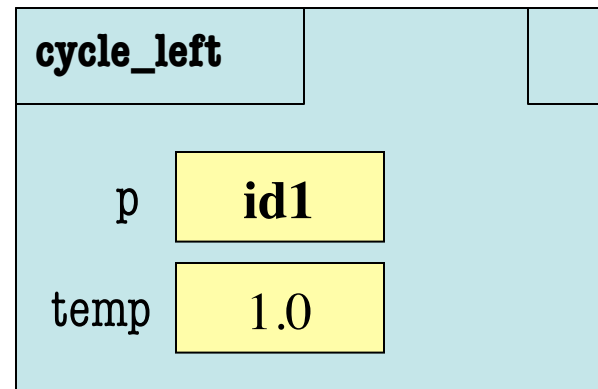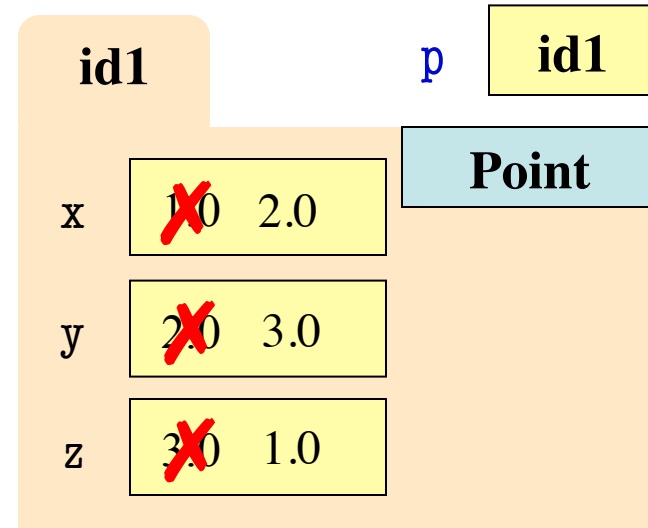temp   1.0

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 = Point(1.0,2.0,3.0)
>>> shift(p)   Function Call

id1   p   id1

                            Point
x   1.0   2.0

y   2.0   3.0

z   3.0   1.0

cycle_left

        p   id1

temp   1.0

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 (A1, Lab 3, Lecture 10)
- Lists and For-Loops (Lab 6)
- 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 ligher when they increase.
    Precondition: rgb an RGB object"""
    pass # implement me
```

Function that Modifies Object

Procedure: no return

```python
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

    Precondition: len1 and len2 are length objects
    len1 is longer than len2"""
    pass # implement me
```

Prelim 1 Review

Function that Does Not Modify Object

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

    Result is returned in inches

    Precondition: len1 and len2 are length objects
    len1 is longer than len2"""
    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 (A1, Lab 3, Lecture 10)
  - Coming up with test cases
  - Tracing program flow
  - Understanding assert statements
- Lists and For-Loops (Lab 6)
- 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'

    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)

Tracing Control Flow

```
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

```
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

What is printed during the call first(-1)?

Not guaranteed to have a try-except.

Might have an if or a for-loop instead.

But this example is the hardest type.

Tracing Control Flow

```python
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

Recovers;
no error msg

```python
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

No error

Error, but not inside try

What is printed during the call first(-1)?

'Starting first'

'Starting second'

'Done second try'

'In first except'

'Ending first'

Error messages do not show up if an `except` forces a recovery

Tracing Control Flow

```python
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

```python
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

What is printed during the call first(1)?

Tracing Control Flow

```python
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

```python
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

> Error

> Recovers; no error msg

What is printed during the call first(1)?

'Starting first'

'Starting second'

'In second except'

'Ending second'

'Done first try'

'Ending first'

> Error messages do not show up if an except forces a recovery

Tracing Control Flow

```
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

```
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

What is printed during the call first(0)?

Tracing Control Flow

```
def first(n):
    print 'Starting first'
    try:
        second(n)
        print 'Done first try'
    except:
        print 'In first except'
    print 'Ending first'
```

```
def second(n):
    print 'Starting second'
    try:
        assert n <= 0, 'is not <= 0'
        print 'Done second try'
    except:
        print 'In second except'
    assert n >= 0, 'not >= 0'
    print 'Ending second'
```

What is printed during the call first(0)?

'Starting first'

'Starting second'

'Done second try'

'Ending second'

'Done first try'

'Ending first'

Normal execution with no errors happening

What is on the Exam?

- String slicing functions (A1)
- Call frames and the call stack (A2)
- Functions on mutable objects (A3)
- Testing and debugging (A1, Lab 3, Lecture 10)
- Lists and For-Loops (Lab 6)
  - 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].

    Precondition: thelist is a list of ints; a and b are ints"""
    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].

    Precondition: thelist is a list of ints; a and b are ints"""
    result = [] # Accumulator
    for x in thelist:
        if x == a:
            result.append(a)
        else:
            result.append(x)
    return result
```

For-Loop in a Procedure

```python
def clamp(seq,vmin,vmax):
    """Clamp values in list seq (modifies seq, does not return copy).

    Values < vmin become vmin; values > vmax become vmax
    Example: if a = [2, -5, 7], then clamp(a,-4,4) modifies the list
    a so that it is now [2, -4, 4].

    Precondition: seq is a list of ints. vmax > vmin are ints."""
    pass # implement me
```

For-Loop in a Procedure

```
def clamp(seq,vmin,vmax):
    """Clamp values in list seq (modifies seq, does not return copy).

    Values < vmin become vmin; values > vmax become vmax
    Example: if a = [2, -5, 7], then clamp(a,-4,4) modifies the list
    a so that it is now [2, -4, 4].

    Precondition: seq is a list of ints. vmax > vmin are ints."""
    for k in range(len(seq)):
        if seq[k] > vmax:
            seq[k] = vmax
        if seq[k] < vmin:
            seq[k] = vmin
```

What is on the Exam?

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

Any More Questions?

Good Luck!

Prelim 1 Review