CS 1110

Prelim 2 Review
Fall 2014

Exam Info

- Prelim 2: 7:30–9:00PM, Thursday, Nov. 13th
  - Last name **A–Sh** in Statler Auditorium
  - Last name **Si–X** in Statler 196
  - Last name **Y–Z** in Statler 198
  - SDS Students will get an e-mail
- To help you study:
  - Study guides, review slides are online
  - Review solution to prelim 1 (esp. call stack!)
- Grades will be released before next class

What is on the Exam?

- Five questions from the following topics:
  - Recursion (Lab 8, A4)
  - Iteration and Lists (Lab 7, A4, A6)
  - Defining classes (Lab 9, Lab 10, A6)
  - Drawing folders (Lecture, A5)
  - Exceptions (Lectures 10 and 20)
  - Short Answer (Terminology, Potpourri)
- +2 points for name, netid **AND SECTION**

If You Study the Past Prelims

- Not all part prelims are good example
- Fall 2012 has all the right questions but…
  - We will not have properties on this exam
  - Folders are drawn **completely different**
  - The recursion is too easy (look at **Final** for 2012FA)
- Spring 2013 has better recursion, for-loops but…
  - It includes loop invariants (those will be on final)
  - It is one question too short (no very easy questions)

If You Study the Past Prelims

- Not all part prelims are good example
- Fall 2012 has all the right questions but…
  - We will not have properties on th…
  - Folders a…
  - Th… final for 2012FA)
- Sprin… has better recursion, for-loops but…
  - It includes loop invariants (those will be on final)
  - It is one question too short (no very easy questions)

Fall 2013 is the closest match

What is on the Exam?

- Recursion (Lab 8, A4)
  - Will be given a function specification
  - Implement it using recursion
  - May have an associated call stack question
- Iteration and Lists (Lab 7, A4, A6)
- Defining classes (Lab 9, Lab 10, A6)
- Drawing folders (Lecture, A5)
- Exceptions (Lectures 10 and 20)
- Short Answer (Terminology, Potpourri)

Recursive Function

```
def merge(s1,s2):
    """Returns: characters of s1 and s2, in alphabetical order.

    Examples: merge('ab', '') = 'ab'
    merge('abbce', 'cdg') = 'abbccdeg'

    Precondition: s1 a string with characters in alphabetical order
    s2 a string with characters in alphabetical order"""
```

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    s2 a string with characters in alphabetical order"""
```

Hint:

- Make input "smaller" by pulling off first letter
- Only make **one** of two strings smaller each call
- Which one should you make smaller each call?

Call Stack Question

```
def skip(s):
    """Returns: copy of s
    Odd letters dropped"""
1   result = ''
2   if (len(s) % 2 = 1):
3       result = skip(s[1:])
4   elif  len(s) > 0:
5       result = s[0]+skip(s[1:])
6   return result
```

- **Call**: skip('abc')
- Recursive call results in four frames (why?)
  - Consider when 4th frame completes line 6
  - Draw the entire call stack at that time
- Do not draw more than four frames!

What is on the Exam?

- Recursion (Lab 8, A4)
- Iteration (Lab 7, A4, A6)
  - Again, given a function specification
  - Implement it using a for-loop
  - May involve 2-dimensional lists
- Defining classes (Lab 9, Lab 10, A6)
- Drawing folders (Lecture, A5)
- Exceptions (Lectures 10 and 20)
- Short Answer (Terminology, Potpourri)

Implement Using Iteration

```
def evaluate(p, x):
    """Returns: The evaluated polynomial p(x)
    We represent polynomials as a list of floats.  In other words

        [1.5, –2.2, 3.1, 0, –1.0] is 1.5 – 2.2x + 3.1x**2 + 0x**3 – x**4

    We evaluate by substituting in for the value x.  For example

      evaluate([1.5,–2.2,3.1,0,–1.0], 2) is 1.5–2.2(2)+3.1(4)–1(16) = –6.5
      evaluate([2], 4) is 2

    Precondition: p is a list (len > 0) of floats, x is a float"""
```

Example with 2D Lists (Like A6)

```
def max_cols(table):
    """Returns: Row with max value of each column

    We assume that table is a 2D list of floats (so it is a list of rows and
    each row has the same number of columns.  This function returns
    a new list that stores the maximum value of each column.

    Examples:
        max_cols([ [1,2,3], [2,0,4], [0,5,2] ]) is [2,5,4]
        max_cols([ [1,2,3] ]) is [1,2,3]

    Precondition: table is a NONEMPTY 2D list of floats"""
```

What is on the Exam?

- Recursion (Lab 8, A4)
- Iteration (Lab 7, A4, A6)
- Defining Classes (Lab 9, Lab 10, A6)
  - Given a specification for a class
  - Also given a specification for a subclass
  - Will "fill in blanks" for both
- Drawing folders (Lecture, A5)
- Exceptions (Lectures 10 and 20)
- Short Answer (Terminology, Potpourri)

```
class Customer(object):
    """Instance is a customer for our company
    Mutable attributes:
        _name: last name [string or None if unknown]
        _email: e-mail address [string or None if unknown]
    Immutable attributes:
        _born: birth year [int > 1900; -1 if unknown]"""

    # DEFINE GETTERS/SETTERS HERE
    # Enforce all invariants and enforce immutable/mutable restrictions

    # DEFINE INITIALIZER HERE
    # Initializer: Make a Customer with last name n, birth year y, e-mail address e.
    # E-mail is None by default
    # Precondition: parameters n, b, e satisfy the appropriate invariants

    # OVERLOAD STR() OPERATOR HERE
    # Return: String representation of customer
    # If e-mail is a string, format is 'name (email)'
    # If e-mail is not a string, just returns name
```

```
class PrefCustomer(Customer):
    """An instance is a 'preferred' customer
    Mutable attributes (in addition to Customer):
        _level: level of preference [One of 'bronze', 'silver', 'gold'] """

    # DEFINE GETTERS/SETTERS HERE
    # Enforce all invariants and enforce immutable/mutable restrictions

    # DEFINE INITIALIZER HERE
    # Initializer: Make a new Customer with last name n, birth year y,
    # e-mail address e, and level l
    # E-mail is None by default
    # Level is 'bronze' by default
    # Precondition: parameters n, b, e, l satisfy the appropriate invariants

    # OVERLOAD STR() OPERATOR HERE
    # Return: String representation of customer
    # Format is customer string (from parent class) +', level'
    # Use __str__ from Customer in your definition
```

What is on the Exam?

- Recursion (Lab 7, A4)
- Iteration and Lists (Lab 6, A4, A5)
- Defining classes (Lab 8, Lab 9, A5)
- Drawing class folders (Lecture, **A5**)
  - Given a skeleton for a class
  - Also given several assignment statements
  - Draw all folders and variables created
- Exceptions (Lectures 10 and 20)
- Short Answer (Terminology, Potpourri)

Two Example Classes

```
class CongressMember(object):
    """Instance is legislator in congress
    Instance attributes:
        _name: Member's name [str]"""

    def getName(self):
        return self._name

    def setName(self,value):
        assert type(value) == str
        self._name = value

    def __init__(self,n):
        self.setName(n)  # Use the setter

    def __str__(self):
        return 'Honorable '+self.name
```

```
class Senator(CongressMember):
    """Instance is legislator in congress
    Instance attributes (plus inherited):
        _state: Senator's state [str]"""

    def getState(self):
        return self._state

    def setName(self,value):
        assert type(value) == str
        self._name = 'Senator '+value

    def __init__(self,n,s):
        assert type(s) == str and len(s) == 2
        CongressMember.__init__(self,n)
        self._state = s

    def __str__(self):
        return (CongressMember.__str__(self)+
                ' of '+self.state)
```

'Execute' the Following Code

```
>>> b = CongressMember('Jack')
>>> c = Senator('John', 'NY')
>>> d = c
>>> d.setName('Clint')
```

Remember:
Commands outside of a function definition happen in global space

- Draw two columns:
  - **Global space**
  - **Heap space**
- Draw both the
  - Variables created
  - Object folders created
  - Class folders created
- If an attribute changes
  - Mark out the old value
  - Write in the new value

What is on the Exam?

- Recursion (Lab 8, A4)
- Iteration and Lists (Lab 7, A4, A6)
- Defining classes (Lab 9, Lab 10, A6)
- Drawing class folders (Lecture, A5)
- Exceptions (Lectures 10 and 20)
  - Try-except tracing (skipped on Prelim 1)
  - But now with dispatch on type
  - Will give you exception hierarchy
- Short Answer (Terminology, Potpourri)

Exceptions and Dispatch-On-Type

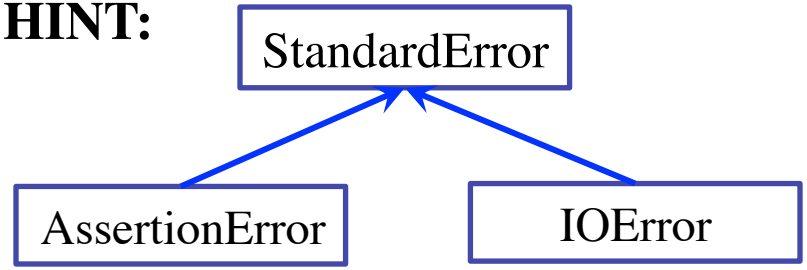
```
def first(x):
    print 'Starting first.'
    try:
        second(x)
    except IOError:
        print 'Caught at first'
    print 'Ending first'

def second(x):
    print 'Starting second.'
    try:
        third(x)
    except AssertionError:
        print 'Caught at second'
    print 'Ending second'
```

```
def third(x):
    print 'Starting third.'
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print 'Ending third.'
```

What is the output of first(-1)?

HINT:



Exceptions and Dispatch-On-Type

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    print 'Starting first.'
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        second(x)
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    print 'Ending first'

def second(x):
    print 'Starting second.'
    try:
        third(x)
    except AssertionError:
        print 'Caught at second'
    print 'Ending second'
```

```
def third(x):
    print 'Starting third.'
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print 'Ending third.'
```

What is the output of first(1)?

What is on the Exam?

- Recursion (Lab 7, A4)
- Iteration and Lists (Lab 6, A4, A5)
- Defining classes (Lab 8, Lab 9, A5)
- Drawing class folders (Lecture, Study Guide)
- Exceptions (Lectures 10 and 20)
- Short Answer (Terminology, Potpourri)
  - See the study guide
  - Look at the lecture slides
  - Read relevant book chapters

In that order

Any More Questions?