CS 1110

Prelim 2 Review
Fall 2017

Exam Info

- Prelim 2: 7:30–9:00PM, Thursday, Nov. 9th
  - 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
  - Review solution to prelim 1 (esp. call stack!)
  - Review solution to Assignment 5 (posted soon)

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 11 and 21)
  - Short Answer (Terminology, Potpourri)
- +2 points for name, netid **AND SECTION**

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 11 and 21)
- Short Answer (Terminology, Potpourri)

Recursive Function (Fall 2014)

```
def histogram(s):
```
   """Return: a histogram (dictionary) of the # of letters in string s.

   The letters in s are keys, and the count of each letter is the value. If the letter is not in s, then there is NO KEY for it in the histogram.

   Example: histogram('') returns { },
            histogram('abracadabra') returns {'a':5,'b':2,'c':1,'d':1,'r':2}

   Precondition: s is a string (possibly empty) of just letters."""

Recursive Function (Fall 2014)

```
def histogram(s):
    """Return: a histogram (dictionary) of the # of letters in string s.

    The letters in s are keys, and the count of each letter is the value. If
    the letter is not in s, then there is NO KEY for it in the histogram.

    Precondition: s is a string (possibly empty) of just letters."""
```

Hint:

- Use divide-and-conquer to break up the string
- Get two dictionaries back when you do
- Pick one and insert the results of the other

Call Stack Question

```
def skip(s):
    """Returns: copy of s
    Odd (from end) skipped"""
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 11 and 21)
- 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)

```python
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 11 and 21)
- Short Answer (Terminology, Potpourri)

```python
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
```

```python
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 11 and 21)
- Short Answer (Terminology, Potpourri)

Two Example Classes

```python
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
```

```python
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
        super().__init__(n)
        self._state = s

    def __str__(self):
        return (super().__str__()+
                ' 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 11 and 21)
  - Try-except tracing (skipped on Prelim 1)
  - But now with dispatch on type
  - Will give you exception hierarchy
- Short Answer (Terminology, Potpourri)
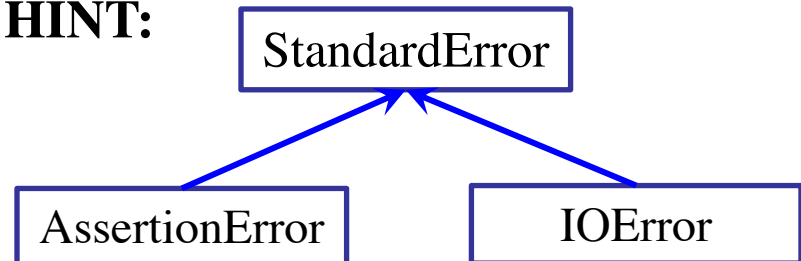
Processing Exceptions By Type

```python
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'
```

```python
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:

StandardError

AssertionError ← StandardError → IOError

Processing Exceptions By Type

```python
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'
```

```python
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 11 and 21)
- Short Answer (Terminology, Potpourri)
  - See the study guide
  - Look at the lecture slides   } In that order
  - Read relevant book chapters