

CS 1110

Prelim 2 Review
Fall 2024

Exam Info

- **Prelim 2:** Thursday, December 5th at 7:30 pm
 - Last name **A – C** in Ives 305
 - Last name **D – E** in Ives 105
 - Last name **F – Q** in Statler Aud.
 - Last name **R – Z** in Uris G01
 - SDS Students will get an e-mail
- Exceptions **ONLY** if you filed a conflict
 - We expect you at time and room assigned

Studying for the Exam

- Read study guides, review slides online
 - Solution to review posted after review
- Review all labs and assignments
 - Solutions to Assignment 5 are in CMS
 - No solutions to code, but talk to TAs
- Look at exams from past years
 - Exams with solutions on course web page
 - Only look at fall exams; spring is **VERY** different

What is on the Exam?

- **Four or Five** questions on these topics :
 - Recursion (Labs 15 and 16; A4)
 - Iteration (Labs 13, 17, and 22; A4; A6)
 - Defining classes (Labs 18, 19, 20, & 21; A6)
 - Drawing folders (Lecture; A5)
 - Short Answer (Terminology, Potpourri)
- + 2 pts for writing your name and net-id
- Exact number depends on question length

What is on the Exam?

- Recursion (Labs 15 and 16; A4)
 - Will be given a function specification
 - Implement it using recursion
 - May have an associated call stack question
- Iteration (Labs 13, 17, and 22; A4; A6)
- Defining classes (Labs 18, 19, 20, and 21; A6)
- Drawing folders (Lecture; A5)
- Short Answer (Terminology, Potpourri)

Recursive Function (Fall 2017)

```
def filter(nlist):
```

```
    """Return: a copy of nlist (in order) with negatives removed.
```

```
    The order of the original list is preserved
```

```
    Example: filter([1,-1,2,-3,-4,0]) returns [1,2,0]
```

```
    Precondition: nlist is a (possibly empty) list of numbers."""
```

Recursive Function (Fall 2017)

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    Example: filter([1,-1,2,-3,-4,0]) returns [1,2,0]
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```
    Precondition: nlist is a (possibly empty) list of numbers."""
```

Hint:

- Use divide-and-conquer to break up the list
- Filter each half and put back together

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?)
 - Stop 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 (Labs 15 and 16; A4)
- Iteration (Labs 13, 17, and 22; A4; A6)
 - Again, given a function specification
 - Implement it using a for-loop
 - May involve 2-dimensional lists
- Defining classes (Labs 18, 19, 20, and 21; A6)
- Drawing folders (Lecture; A5)
- 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"""
```

While-Loop Example

```
def dupevens(nums):
```

```
    """MODIFIES nums so that all even numbers are duplicated
```

```
    The duplicate value should appear immediately after the original.
```

```
    Example: If a = [1,2,3,4], dupevens(a) modifies a to [1,2,2,3,4,4]
```

```
    Precondition: nums is a list of integers"""
```

What is on the Exam?

- Recursion (Labs 15 and 16; A4)
- Iteration (Labs 13, 17 and 22; A4, A6)
- Defining Classes (Labs 18, 19, 20, and 21; A6)
 - Given a specification for a class
 - Also given a specification for a subclass
 - Will “fill in blanks” for both
- Drawing folders (Lecture; A5)
- Short Answer (Terminology, Potpourri)

```
class Customer(object):
```

```
    """Instance is a customer for our company"""
```

```
    # MUTABLE ATTRIBUTES:
```

```
    # _name: string or None if unknown
```

```
    # _email: string or None if unknown
```

```
    # IMMUTABLE ATTRIBUTES:
```

```
    # _born: 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: 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 (Labs 15 and 16; A4)
- Iteration (Labs 13, 17, and 22; A4, A6)
- Defining classes (Labs 18, 19, 20, and 21; A6)
- Drawing class folders (Lecture; A5)
 - Given a skeleton for a class
 - Also given several assignment statements
 - Draw all folders and variables created
- Short Answer (Terminology, Potpourri)

Two Example Classes

```
class Congressman(object):
    """Instance is legislator in congress"""
    # INSTANCE ATTRIBUTES:
    # _name: a string

    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 (additional):
    # _state: a string

    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 (Labs 15 and 16; A4)
 - Iteration (Labs 13, 17, and 22; A4; A6)
 - Defining classes (Labs 18, 19, 20, and 21; A6)
 - Drawing class folders (Lecture; A5)
 - **Short Answer (Terminology, Potpourri)**
 - See the study guide
 - Look at the lecture slides
 - Look at the lecture demo code
- In that order

Any More Questions?

