Last Name: _____ First Name: _____ Cornell NetID: _____

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CS 1110 Prelim 1 March 11th, 2014

This 90-minute exam has 7 questions worth a total of 55 points. When permitted to begin, scan the whole test before starting. Budget your time wisely. Use the back of the pages if you need more space. You may tear the pages apart; we have a stapler at the front of the room.
When asked to write Python code on this exam, you may use any Python feature that you have learned about in class (if-statements, for-statements, map, lists, and so on).

It is a violation of the Academic Integrity Code to look at any exam other than your own, to look at any other reference material, or to otherwise give or receive unauthorized help. We also ask that you not discuss this exam with students who are scheduled to take a later makeup.
Academic Integrity is expected of all students of Cornell University at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare I shall not give, use or receive unauthorized aid in this examination.

Signature: _____ Date _____

For reference:

`s[i:j]`	Returns: A new string `s[i] s[i+1] ... s[j-1]` under ordinary circumstances. Returns `''` if `i` $\geq$ `len(s)` or `i` $\geq$ `j`.
`s.find(s1)`	Returns: index of the first character of the first occurrence of `s1` in `s`, or -1 if `s1` does not occur in `s`.
`s.index(s1)`	Like find, but raises an error if `s1` is not found.
`s.lower()`	Returns: a copy of `s` with all letters in it converted to lowercase.
`s.split()`	Returns: a list of the words in string `s`, using whitespace as the delimiter.
`s.join(slist)`	Returns: a string that is the concatenation of the strings in list `slist` separated by string `s`.

`lt[i:j]`	Returns: A new list`[lt[i], lt[i+1], ..., lt[j-1]]` under ordinary circumstances. Returns `[]` if `i` $\geq$ `len(lt)` or `i` $\geq$ `j`.
`lt.index(item)`	Returns: index of first occurrence of `item` in list `lt`; raises an error if `item` is not found.
`range(n)`	Returns: the list `[0, 1, 2, ..., n-1]`
`x in lt`	Returns: `True` if `x` is in list `lt`, `False` otherwise.
`lt.append(x)`	Append object `x` to the end of list `lt`.
`lt.pop(i)`	Returns: item at position `i` in list `lt`, removing it from `lt`. If `i` is omitted, returns and removes the last item.
`lt.sort()`	Sort the items of `lt`, in place (the list is altered).
`sum(lt)`	Returns: the sum of the items in `lt`, which must all be numbers.

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Question	Points	Score
1	2	
2	12	
3	13	
4	13	
5	5	
6	5	
7	5	
Total:	55	

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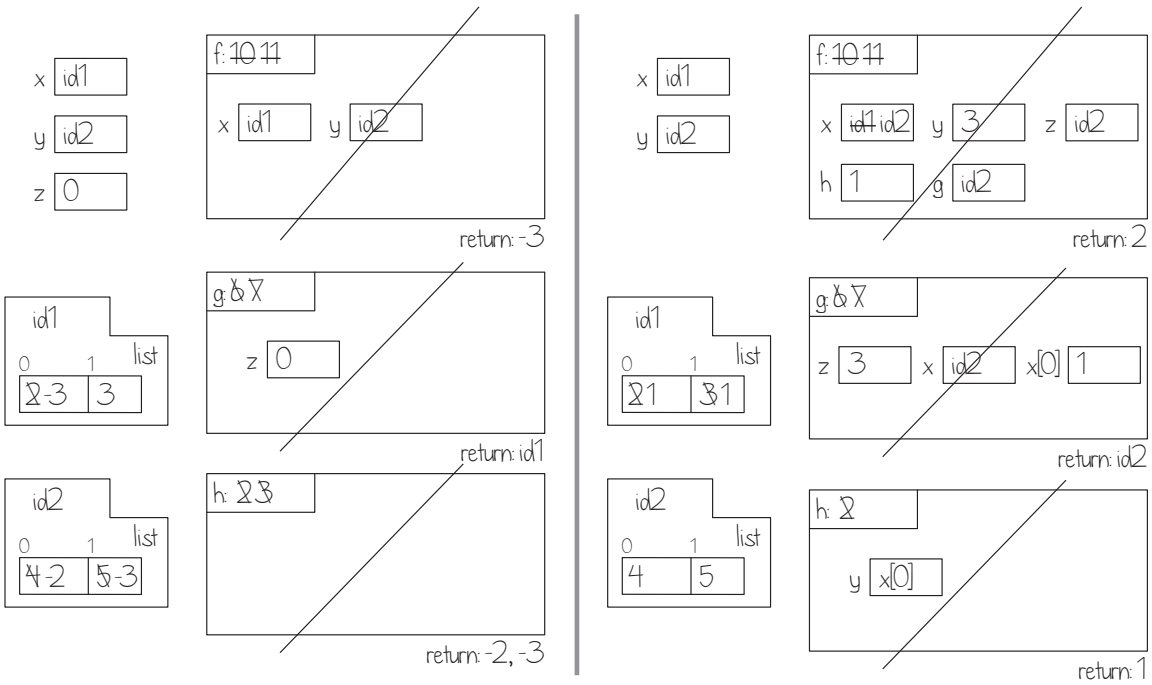
1. [2 points] When allowed to begin, write your last name, first name, and Cornell NetID at the top of *each* page, and circle your lab time on the top of the first page of the exam.

2. [12 points] Two students were assigned to diagram the execution of the following code.

```
1   def h(y):
2       y = x[1] - y
3       return y
4
5   def g(z, x):
6       x[0] = x[0] - z
7       return x
8
9   def f(x, y, z):
10      x = g(y, z)
11      return h(x[0])
12
13  x = [2,3]
14  y = [4,5]
15  x[1] = f(x, 3, y)
```

After executing the whole program they handed in the diagrams below. You are their grader; please mark up each student's solution as follows: (1) Draw an X through anything that is present that should not be; (2) circle anything that is present and should be, but has the wrong value or name; and (3) write in anything that is missing. You may wish to do this question by first drawing the relevant frames and objects yourself.



3. [13 points] Implement `reshmuplify` and `lower_one_char` so that they meet their specifications. Your solution can call the function `find_first_vowel` below; you may assume it's already been implemented according to its specification.

```
def find_first_vowel(s):
    """Return: the index of the first vowel in s, or -1 if s has no vowels."""
    # Assume this function has already been implemented correctly, so you can call it.

def reshmuplify(s):
    """Return: the string s followed by a ', ' and then the same string with the substring
    before the first vowel replaced by 'shm'.
    Precondition:
        s contains only letters
        s contains at least one vowel.
    Examples:
        'apple' -> 'apple, shmapple'
        'banana' -> 'banana, shmanana'
        'prelim' -> 'prelim, shmelim'
    """
```

```
def lower_one_char(s, n):
    """Return: the string s with the character at index n
    converted to lowercase.
    Precondition:
        s is a string containing only letters, and has at least one character in it.
        n is a valid index into s.
        n > 0 and n < len(s) - 1.
    Examples:
        lower_one_char('FOO', 1) -> 'FoO'
        lower_one_char('HELLo', 2) -> 'HElLo'
        lower_one_char('HELLo', 4) -> 'HELLo'
        lower_one_char('TEST', 0) violates the precondition
        lower_one_char('TEST', 3) violates the precondition
    """
```

4. [13 points] Assume that inside a module named `transcript2` is the definition of class `Titem2`, which is an extension of class `Titem` from Lab 3. Titem2s have the following attributes:

`name`	non-empty string of lowercase letters followed by numbers
`credits`	positive `int`
`gradeval`	positive `float`

and are created by calls like `transcript2.Titem2('CS1',4,'A+')` (if `transcript2` has been imported).

We define the *GPA contribution* of a Titem2 as its number of credits times its gradeval. For example, for the Titem2 created by the call above, the GPA contribution is $4 \times 4.3 = 17.2$.

Complete the function definition below so that it meets its specification. *Note that we already wrote a line of code for you.*

```
def separate(sourcelist, threshold, highlist, lowlist):
    """Appends to list highlist the Titem2s from sourcelist whose GPA
    contribution [see definition above] is greater than or equal to threshold,
    and appends to list lowlist the other items in sourcelist.
    Precondition:
      sourcelist is a (possibly empty) list of Titem2s
      threshold is a float or int
      highlist and lowlist are (possibly non-empty) lists."""
    # For an example, see text at the bottom of this page.

    # **MAKE SURE YOU SEE THIS LINE, AND INDENT RELATIVE TO IT**
    for item in sourcelist:
```

Illustrative example: let id1 be the ID of a Titem2 with GPA contribution 8, and id2 be the ID of a Titem2 with GPA contribution 16. Suppose x is a 2-item list holding id1 and id2, y is an empty list, and z is the list `[7]`. Then, the result of the call `separate(x, 10, y, z)` is that:

`x` remains the same;
The list that `y` refers to is modified to be a 1-item list containing id2;
The list that `z` refers to is modified to be a 2-item list containing the number 7 and id1.

5. [5 points] Assume that `separate` from the previous question is (correctly) defined in module `prelim1`. Now, suppose the following sequence of statements is executed.

```
import transcript2
import prelim1
nextlist = [transcript2.Titem2('class1', 12, "A+"),
            transcript2.Titem2('class2', 1, "B-"),
            transcript2.Titem2('class3', 1, "B")]
high = []
low = [transcript2.Titem2('engl9999', 2, "B-"),
       transcript2.Titem2('is666', 2, "B-")]
prelim1.separate(nextlist, 12, high, low)
high[0].name = 'FAKE'
print nextlist[0].name
```

Write down what the resulting printout(s) or error(s) are. Then explain your answer in one to three sentences.

6. [5 points] Complete this function definition according to its specification. One or two lines of code suffices.

```
def avg(inlist):
   """Returns: float value of the average of the values in list inlist.

   Pre: inlist a non-empty list, each item either an int or a float."""
   # The average of a list of numbers is the sum of the values in the list
   # divided by the length of the list.
```

7. [5 points] Consider the following function definition, which makes use of the `avg` function from the previous question.

```
def string_avg(nums_as_str):
    """Returns: float value of the average of the values represented
    by nums_as_str.

    Examples:  input ' 1.   3.5 6 ' -> output 3.5
              input '2 17.6' -> output 9.8

    Pre: nums_as_str is a string representing a non-empty sequence of numbers
    separated by whitespace.
    """
    return avg(nums_as_str.split())
```

Unfortunately, even if function `avg` is implemented correctly, `string_avg` is not correct, because `nums_as_str.split()` is a list of strings, which `avg` is not expecting as input.

Rewrite the last line of `string_avg`, using a call to `map`, to fix this error. One to three lines of code suffices.

Did you write your name & netID on each page, circle your lab on the front, and carefully re-read all instructions and specifications?