CS 1110 Regular Prelim 1 March 2022

This 90-minute closed-book, closed-notes exam has 6 questions worth a total of roughly 77 points (some point-total adjustment may occur during grading).
You may separate the pages while working on the exam; we have a stapler available.

It is a violation of the Academic Integrity Code to look at any exam other than your own, to look at any reference material besides the 1 page reference provided, 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 __________

First Name: ______________________________

Last Name: ______________________________

Cornell NetID, all caps:

1. [8 points] **Strings.** Implement the following function.

```
def peel(markers, text):
    """Returns a new string where the `markers` have been removed from the
       beginning and end of `text`

    Examples:
      peel( "()",   "(abc)" )    -->  "abc"

      peel( "()",   "(1(+)1)" )  -->  "1(+)1"

      peel( "<()>", "<(>.<)>" )  -->  ">.<"

      peel( "ab",   "ab" )       -->  ""

      Preconditions:
        markers: string of even length (0 is allowed)
        text: any-length string that starts w/ 1st half of `markers`, ends w/ 2nd half.
     """
    # REMINDER: in a slice expression like s[n:m], n and m must be ints, not floats
```

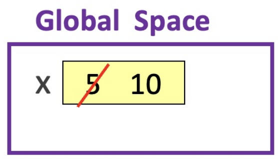
2. [8 points] **Lists.** Implement the following function.

```
def swap2(a_list, j, k):
    """Modifies a_list by swapping the two elements of a_list starting
    at index j with the 2 entries of a_list starting at index k.

    Examples:
      swap2([100, 101, 102, 103, 104, 105, 106, 107, 108, 109], 1, 6)
         changes a_list to
            [100, 106, 107, 103, 104, 105, 101, 102, 108, 109]
                  --------                 --------

      swap2([100, 101, 102, 103, 104, 105, 106, 107, 108, 109], 0, 4)
         changes a_list to
            [104, 105, 102, 103, 100, 101, 106, 107, 108, 109]
             --------            --------

      swap2(['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j'], 0, 4)
         changes a_list to
            ['e', 'f', 'c', 'd', 'a', 'b', 'g', 'h', 'i', 'j']
             --------            --------

    Preconditions:
       j and k are valid indices (positive, < len(a_list))
       j + 2 <= k  (the elements you're swapping don't overlap in a_list)
       k + 2 <= len(a_list)                                           """
    # STUDENTS: loops are NOT ALLOWED (or needed)
```

3. **Some truths are self evident. Some are learned in CS 1110.**

(a) [2 points] **True or False?** The drawing below accurately depicts the value of variable x in Global Memory after the code below is executed in Python:

```python
def double_x(input):
    return input * 2

x = 5
x = double_x(x)
```

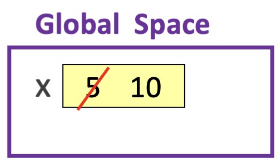


Circle One:

True False

(b) [2 points] **True or False?** The drawing below accurately depicts the value of variable x in Global Memory after the code below is executed in Python:

```python
def double_x(input):
    x = input * 2

x = 5
double_x(x)
```

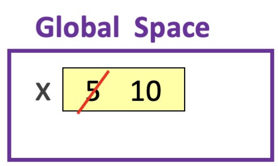


Circle One:

True False

(c) [2 points] **True or False?** The drawing below accurately depicts the value of variable x in Global Memory after the code below is executed in Python:

```python
def double_x(input):
    x = input * 2
    print(str(x))

x = 5
double_x(x)
```

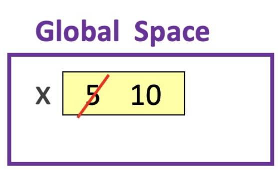


Circle One:

True False

(d) [2 points] **True or False?** The drawing below accurately depicts the value of variable x in Global Memory after the code below is executed in Python:

```python
def double_x(input):
    x = input * 2
    print(str(x))

x = 5
x = double_x(x)
```



Circle One:

True False

4. [24 points] **Time for dinner!** `Place` is an object with 3 attributes: `spoon`, `fork`, and `knife`. A call of the form `Place(s,f,k)` creates a new `Place` object with attribute `spoon` set to `s`, `fork` set to `f`, and `knife` set to `k`. Assume that class `Place` is accessible within the given code. Simulate running all 27 lines of code and draw the memory diagram as seen in class and Assignment 2.

```
1  def soup(p):
2    p.spoon = p.spoon + 1
3    drawer.spoon = drawer.spoon - 1

4  def salad(p):
5    p.fork = p.fork + 1
6    drawer.fork = drawer.fork - 1
7    p2.knife = p2.knife + 2
8    drawer.knife = drawer.knife - 1

9  def dinner (p, with_soup, with_salad):
10   if with_soup:
11     soup(p)
12   if with_salad:
13     salad(p)

14 def dessert(p, name):
15   if name == "ice cream":
16     n_spoons = 2
17   else:
18     n_spoons = 0
19     p.fork = p.fork + 1
20   p.spoon = p.spoon + n_spoons
21   return n_spoons

22 p1 = Place(1, 2, 0)
23 p2 = Place(1, 2, 0)
24 drawer = Place(6, 4, 8)
25 dinner(p1, False, True)
26 n_spoons = dessert(p2, "ice cream")
27 drawer.spoon = drawer.spoon - n_spoons
```

Global Space	**Heap**	**Call Stack**

5. [8 points] **Testing, Testing, 1, 2, 3, Testing!**

Consider the following function specification, which you might use if you want to distribute the cost of dinner amongst you and your friends.

```python
def batch_withdraw(balance_list, withdraw_amount):
    """balance_list is a list of floats representing the balances of
    multiple bank accounts

    Pre-condition:
       withdraw_amount is a float with value >= 0.

    Return a new list of the same length as balance_list, where every
    value is the corresponding value in balance_list minus
    withdraw_amount. If any value in balance_list is less than
    withdraw_amount (i.e., there is not enough in the account to withdraw),
    return the empty list.  """
```

Here is an example of one set of sample inputs and an expected output:

	Inputs		Expected Output
Test Case	`balance_list`	`withdraw_amount`	`return value`
1	[20.0, 30.0, 40.0, 50.0]	10.0	[10.0, 20.0, 30.0, 40.0]

Provide **two** more conceptually distinct test cases, using the same format. Include a short statement (1-2 sentences) explaining what situation each of your test cases represents.

Test Case	`balance_list`	`withdraw_amount`	`return value`
2			

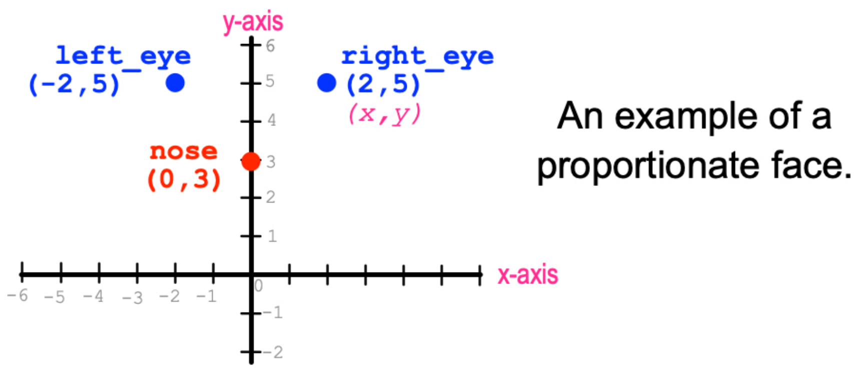
Test Case 2 covers the following situation:

Test Case	`balance_list`	`withdraw_amount`	`return value`
3			

Test Case 3 covers the following situation:

6. **The eyes have it.** Assume objects of class `Point` have two attributes: `x` and `y`; both are `int`s. Assume objects of new class `Face` have three `Point` attributes: `left_eye`, and `right_eye`, and `nose`. `Face` attributes should have the following relationships to be considered **proportionate**:

- `left_eye` and `right_eye` have the same `y` attribute values (they are the same height)
- `left_eye` and `right_eye` are centered across the y-axis (`left_eye`'s `x` attribute is negative and `right_eye`'s `x` attribute is positive)
- `nose` always sits on the y-axis (`x`=0)
- `nose` is always lower than the eyes by the distance that the eyes are from the y-axis. Example: if the eyes are 2 units from the y-axis, the nose will be 2 units below the eyes.



(a) [6 points] Implement the following function.

```
def set_face(f, right_x, right_y):
    """Given ints right_x and right_y (which are the desired values for the
    x and y coordinates of the right eye of Face f), sets the left_eye,
    right_eye and nose attributes of Face f, so that Face f is proportionate.

    Precondition: right_x and right_y are non-negative ints.          """
    # Reminder: to negate the variable n in Python, you simply write -n.
```

(b) [9 points] Implement the following function.

```
def is_proportionate(f):
    """Return True if the locations of the eyes and nose of Face f make the face
    `proportionate`, based on the definition at the beginning of this question.
    If any of the x,y attributes of the elements of Face f are not in proportion,
    return False.
    """
```

(c) [6 points] Implement the following function.

```
def eyes_wider(first, second):
    """ Return True if the eyes of Face `first` are wider apart than
    the eyes of Face `second`. Otherwise return False.
    Also return False if either face is not proportionate.
    """
```