CS 1110 Prelim 1 Solutions, March 2023

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

```
def before_first_inclusive(text, marker):
    """
    Returns: substring of `text` up to and including the first
    occurrence of `marker`.

    If `marker` is the empty string then return all of `text`

    Examples:
       before_first_inclusive( "abc", "c" )        -->  "abc"
       before_first_inclusive( "abc", "abc" )      -->  "abc"
       before_first_inclusive( "abcabc", "abc" )   -->  "abc"
       before_first_inclusive( "abc", "a" )        -->  "a"
       before_first_inclusive( "a", "a" )          -->  "a"
       before_first_inclusive( "abba", "b" )       -->  "ab"
       before_first_inclusive( "abba", "" )        -->  "abba"

    Preconditions:
       text: non-empty string containing at least one instance of `marker`
       marker: string found in `text`
    """

    if marker == "":
       return text

    marker_len = len(marker)
    marker_ind = text.index(marker)

    return text[:marker_ind + marker_len]
```

2. [12 points] **Lists.** Implement the following function. *Hint:* see `reverse` on the reference sheet.

```
def mirror_me(mylist, i):
    """
    Given an input list `mylist` and an index `i`, returns a new list which
    is a copy of `mylist` except all elements after index `i` are reversed.

    `mylist` should not be modified

    Examples:
        mirror_me([1,2,3,4,5,6], 2) returns [1,2,3,6,5,4]
        mirror_me([9,2,1,8,4], 4) returns [9,2,1,8,4]
        mirror_me([5,8], 1) returns [5,8]
        mirror_me([5], 0) returns [5]
        mirror_me([], 0) returns []

    Preconditions: 0 <= i < len(mylist)
                   mylist is not None but could be empty

    """
    # STUDENTS: loops are NOT ALLOWED (or needed)
    # STUDENTS: conditionals (if-else) are NOT ALLOWED (or needed)

    begin = mylist[:i+1]
    end = mylist[i+1:]
    end.reverse()
    return begin + end
```

3. [10 points] **Test cases.** Consider the following function specification, which one might use if to transmit messages one character at a time.

```
def is_valid_message(m):
    """  Returns True if `m` is a valid message and False otherwise.

    A valid message is a list whose elements consist of only characters
    (strings of length one). Additionally, a message must contain
    at least two elements in order to be valid.

    Pre-condition: m is a list
    """
```

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

Test Case	Input `m`	Expected Output / `return value`
1	`["n","o","","d","i","c","e"]`	`False`

Test Case 1 covers the following situation:

m is not valid because it has an element that is a string whose length is not 1.

Complete the table for **three** more conceptually distinct test cases, using the same format. (Your cases should be distinct from each other and from Test Case 1.)

Test Case	Input `m`	Expected Output / `return value`
2		`True`
3		`False`
4		`False`

Include a short statement (1-2 sentences) explaining what situation **Test Cases 3 and 4** cover.

Test Case 3 covers the following situation:

Test Case 4 covers the following situation:

Test Case 2 needs to be a valid message. For example `m: ["d","i","c","e"]`

Test Cases 3 & 4 need to be invalid messages covering cases distinct from each other and Test Case 1. Some possibilities:

(1) `m: [] or ["g"]` tests the case where the message has fewer than 2 elements

(2) `m: ["a", "b", 6]` tests the case where the message has an element that is not a string

An example of an unacceptable Test Case would be `m: "hello"` because the precondition that `m` is a list is not met.

4. [12 points] **Understanding Python.** For each snippet of code below, at most 3 lines will be printed. What are these three lines? **Put a single letter (A-E) in each box.**

CHOICES:

(A) `python`

(B) `CS1110`

(C) `None`

(D) `Error`

(E) Nothing printed due to an Error in a previous box.

```
1 def funclass(s):
2     print(s)
3     s = 'CS1110'
4     print(s)
5
6 s = "python"
7 funclass(s)
8 print(s)
```

Your Answer:

line 1:

line 2:

line 3:

Correct Answer: **ABA**

```
1 def funclass(s):
2     print(s)
3     s = 'CS1110'
4     return s
5
6 s = "python"
7 s = funclass(print(s))
8 print(s)
```

Your Answer:

line 1:

line 2:

line 3:

Correct Answer: **ACB**

```
1 def funclass():
2     s = 'CS1110'
3     print(s)
4     return s
5
6 s = "python"
7 print(funclass())
8 print(s)
```

Your Answer:

line 1:

line 2:

line 3:

Correct Answer: **BBA**

```
1 def funclass():
2     s = 'CS1110'
3     print(s)
4
5 s = "python"
6 print(s)
7 s = funclass()
8 print(s)
```

Your Answer:

line 1:

line 2:

line 3:

Correct Answer: **ABC**

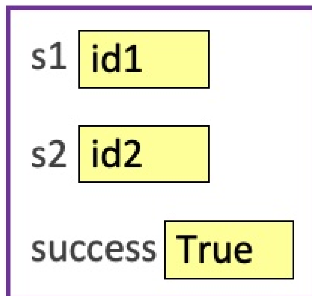
5. [28 points] **More widgets, Edna!** `Store` is an object with 3 attributes: `name`, `widgets`, and `sister`. A call of the form `Store(n,w,s)` creates a new `Store` object with attribute `name` set to `n`, `widgets` set to `w`, and `sister` set to `s`. Assume the class `Store` is accessible within the given code. Simulate running all the code. Draw the memory diagram as seen in class and Assignment 2. (As usual, do not draw the objects/folders for imported modules or for function definitions.) Pay attention to what goes in the **Global Space** / **Call Stack** / **Heap**.

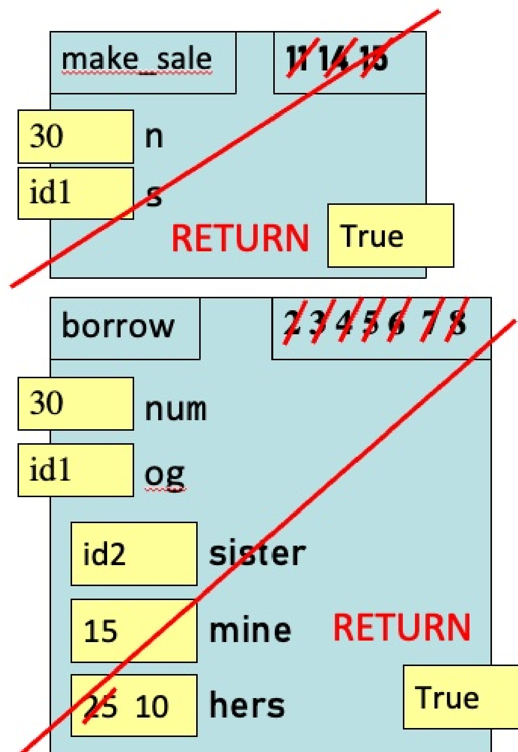
```
1  def borrow(num, og):
2      sister = og.sister
3      mine  = og.widgets
4      hers = sister.widgets
5      if mine + hers >= num:
6          hers -= num - mine
7          og.widgets = 0
8          return True
9      return False
```

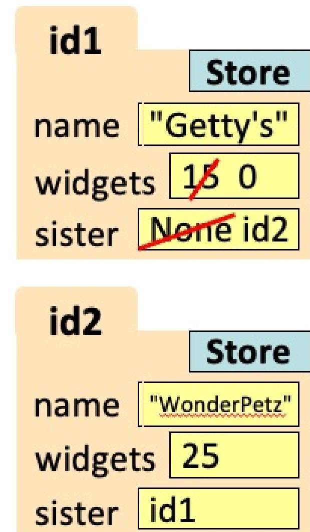
```
10 def make_sale(n, s):
11     if s.widgets >= n:
12         s.widgets -= n
13         return True
14     elif s.sister is not None:
15         return borrow(n, s)
16     else:
17         return False

18 s1 = Store("Getty's", 15, None)
19 s2 = Store("WonderPetz", 25, s1)
20 s1.sister = s2
21 success = make_sale(30, s1)
```

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







6. **Object-**ively speaking. Objects of class `Warehouse` have 4 attributes:
   - `pending` [`int` list]: unique `ids` of packages **not yet** delivered to the warehouse
   - `delivered` [`int` list]: unique `ids` of packages that **have** been delivered to the warehouse
   - `goal` [`int`]: the number of deliveries this warehouse will try to complete
   - `met_goal` [`boolean`]: whether warehouse has delivered at least `goal` # of packages

   (a) [8 points] Implement the following function according to its specification:

```
def prep_warehouse(w, g, n_ids, packages):
    """
    Initializes Warehouse `w` attributes:
      - pending: set as a list of the last `n_ids` in the `packages` list
      - delivered: set as the empty list
      - goal: set to `g`
      - met_goal: set to False

    `packages` should not be modified

    Examples:
    prep_warehouse(w, 2, 3, [3,5,8,13,5,4]) --> w should have the attributes:
          pending is the list [13,5,4]
          delivered is the empty list
          goal is 2
          met_goal is False

    prep_warehouse(w, 7, 1, [1,9,4,3]) --> w should have the attributes:
          pending is the list [3]
          delivered is the empty list
          goal is 7
          met_goal is False

    Preconditions: n_ids:    a positive integer
                   packages: an int list with >= n_ids elements

    """
    # STUDENTS: loops are NOT ALLOWED (or needed)
    w.pending = packages[len(packages)-n_ids:] # or  [-n_ids: ]
    w.delivered = []
    w.goal = g
    w.met_goal = False
```

(b) [12 points] Implement the following function (which simulates the delivery of a package to the warehouse) according to its specification:

```
def deliver_package(w, id):
    """
    Given a warehouse `w` and integer `id`, a successful delivery:
        Moves `id` from w's pending list to the end of w's delivered list
        Sets met_goal to True only if `w` has had at least as many
            deliveries as its goal
        returns True (to indicate the delivery was successful)

    Two situations would prevent a successful delivery:
    (1) `id` might _not_ be on w's pending list.
        In this case, return False. (delivery failed)
    (2) `id` might _already_ be on w's delivered list.
        In this case, return False (deliver failed)
    If a delivery fails, none of w's attributes should be modified.

    Preconditions:
      w:  a warehouse with attributes pending, delivered, goal, met_goal
      id: a positive integer
    """

    if id in w.pending and id not in w.delivered:
        w.pending.remove(id)
        w.delivered.append(id)
        w.met_goal = (len(w.delivered) >= w.goal)
        return True
    return False

    # Alternate Solution #1:
    # ----------------------
    if id not in w.pending:
        return False
    if id in w.delivered:
        return False
    w.pending.remove(id)
    w.delivered.append(id)
    if (len(w.delivered) >= w.goal):
        w.met_goal = True
    return True

    # Alternate Solution #2:
    # ----------------------
    pending_i = w.pending.find(id)
    if (pending_i == -1):
        return False
    if (w.delivered.count(id) > 0):
```

```
    return False

# list slicing!
w.pending = w.pending[:pending_i]+w.pending[pending_i + 1:]
w.delivered.append(id)
if (len(w.delivered) >= w.goal):
    w.met_goal = True
else:   # you didn't have to set False, but fine to have done this
    w.met_goal = False
return True
```