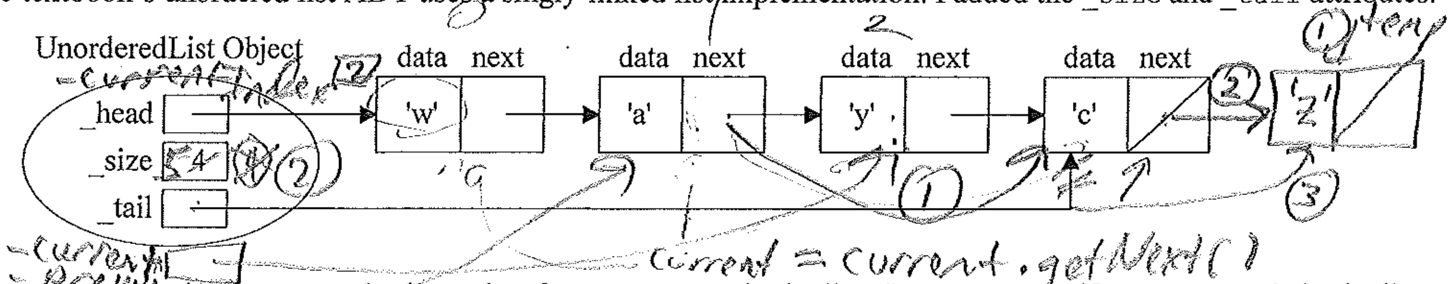
Data Structures (CS 1520) Lecture 8 Name:______________

1. The textbook's unordered list ADT uses a singly-linked list implementation. I added the `_size` and `_tail` attributes:



a) The `search(targetItem)` method searches for `targetItem` in the list. It returns `True` if `targetItem` is in the list; otherwise it returns `False`. Complete the `search(targetItem)` method code:

```
class UnorderedList:

   def search(self, targetItem):
  self.currentIndex = 0
  self._previous = None
 self._current = self._head.
    while self._current != None:
        if targetItem == self._current.getData():
            return True
        else:
            self._previous = self._current
        self._current = self._current.getNext()
        self._currentIndex += 1
    return False

if self._current != None and
   self._current.getData() == targetItem
return True
```

b) The textbook's unordered list ADT **does not** allow duplicate items, so operations `add(item)`, `append(item)`, and `insert(pos, item)` would have what precondition?

Precondition: item not already in list

c) Complete the `append(item)` method including a check of it's precondition(s)?

```
   def append(self, item):
      if self.search(item):
          raise ValueError("Cannot append duplicate item")
      temp = Node()
      if self._size == 0:
          self._head = temp
      else:
          self._tail.setNext(temp)
      self._size += 1
```

d) Why do you suppose I added a `_tail` attribute? to make append fast

e) The textbook's `remove(item)` and `index(item)` operations "Assume the item is present in the list." Thus, they would have a precondition like "Item is in the list." When writing a program using an UnorderedList object (say `myGroceryList = UnorderedList()`), how would the programmer check if the precondition is satisfied?

```
itemToRemove = input("Enter the item to remove from the Grocery list: ")
if myGroceryList.search(itemToRemove):
   myGroceryList.remove(itemToRemove)
```

f) The `remove(item)` and `index(item)` methods both need to look for the `item`. What is inefficient in this whole process?

(1) remove & index both start by doing a search again to check precondition.

(2) remove inch-worm down the list a third time to find item to remove (or count its index)

g) Modify the `search(targetItem)` method code in (a) to set additional data attributes to aid the implementation of the `remove(item)` and `index(item)` methods.

h) Write the `index(item)` method including a check of its precondition(s).

```
def index(self, item):
    if self.search(item) == False:
        raise ValueError("Cannot find index of item not in list")
    return self._currentIndex
```

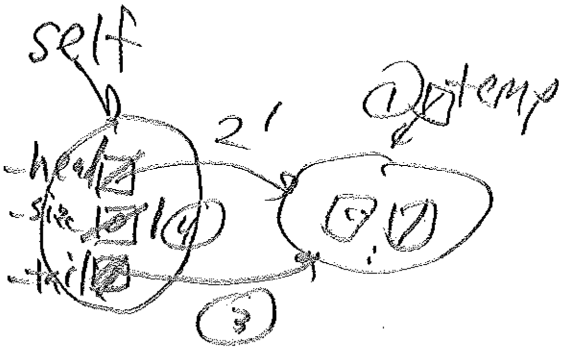
i) Write the `remove(item)` method including a check of its precondition(s). See next page(s)

```
def remove(self, item):
    if

        raise
```

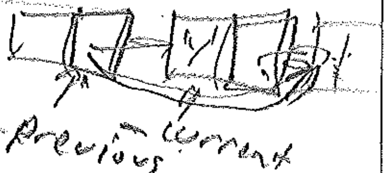
Append normal case

Empty List



```
① temp = Node(item)
  if self._size == 0:
     self._head = temp
  else:
     self._tail.setNext(temp)
3) self._tail = temp
  self._size += 1
```

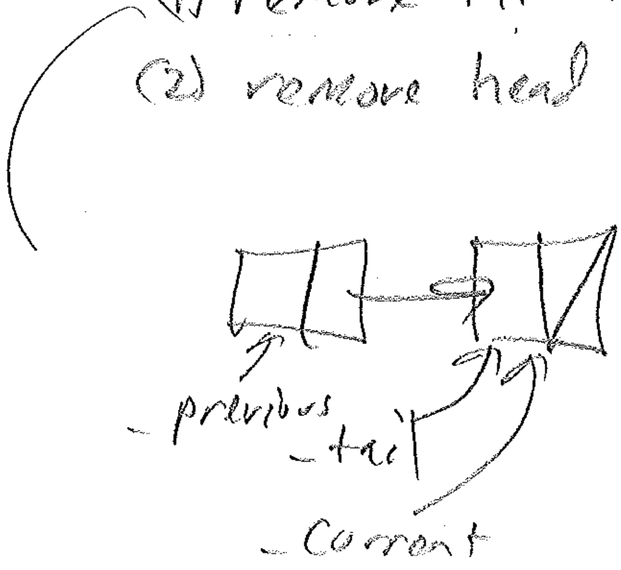
Remove special cases normal case



```
self._previous setNext(
        self._current.getNext())
```

(1) remove tail item

(2) remove head item



```
""" File:  unordered_linked_list.py
    Description:  Unordered List ADT implemented using singly-linked list.
"""

from node import Node

class UnorderedList(object):

    def __init__(self):
        """ Constructs an empty unsorted list.
            Precondition:  none
            Postcondition:  Reference to empty unsorted list returned.
        """
        self._head = None
        self._tail = None
        self._size = 0
        self._current = None
        self._previous = None
        self._currentIndex = -1

    def search(self, targetItem):
        """ Searches for the targetItem in the list.
            Precondition: none.
            Postcondition:  Returns True and makes it the current item if targ
etItem is in the list;
                            otherwise False is returned.
        """
        if self._current != None and self._current.getData() == targetItem:
            return True

        self._previous = None
        self._current = self._head
        self._currentIndex = 0
        while self._current != None:
            if self._current.getData() == targetItem:
                return True
            else: #inch-worm down list
                self._previous = self._current
                self._current = self._current.getNext()
                self._currentIndex += 1
        return False

    def add(self, newItem):
        """ Adds the newItem to the list.
            Precondition: newItem is not in the list.
            Postcondition:  newItem is added to the list.
        """
        if self.search(newItem):
            raise ValueError("Cannot not add since item is already in the list
!")

        temp = Node(newItem)
        if self._size == 0:
            self._tail = temp
        else:
            temp.setNext(self._head)
        self._head = temp
        self._size += 1
    def remove(self, item):
        """ Removes item from the list.
            Precondition:  item is in the list.
            Postcondition:  Item is removed from the list.
        """
        if not self.search(item):
            raise ValueError("Cannot remove item since it is not in the list!"
)

        if self._current == self._tail:
            self._tail = self._previous

        if self._current == self._head:
            self._head = self._head.getNext()
        else:
            self._previous.setNext(self._current.getNext())
        self._current = None
        self._size -= 1

    def isEmpty(self):
        """ Checks to see if the list is empty.
            Precondition:  none.
            Postcondition:  Returns True if the list is empty; otherwise retur
ns False.
        """
        return self._size == 0

    def length(self):
        """ Returns the number of items in the list.
            Precondition:  none.
            Postcondition:  Returns the number of items in the list.
        """
        return self._size

    def append(self, newItem):
        """ Adds the newItem to the tail of list.
            Precondition: newItem is not in the list.
            Postcondition:  newItem is added to the tail of list.
        """
        if self.search(newItem):
            raise ValueError("Cannot not append since item is already in the l
ist!")

        temp = Node(newItem)
        if self._size == 0:
            self._head = temp
        else:
            self._tail.setNext(temp)
        self._tail = temp
        self._size += 1

    def index(self, item):
        """ Returns the position of item in the list.
            Precondition:  item is in the list.
            Postcondition:  Returns the position of item from the head of list
.
        """
        if not self.search(item):
            raise ValueError("Cannot determine index since item is not in the
list!")

        return self._currentIndex

    def insert(self, pos, newItem):
        """ Inserts newItem at position pos of the list.
            Precondition:  position pos exists in the list, and newItem is not
 in the list
            Postcondition:  The item has newItem inserted at position pos of t
he list.
        """
        if not isinstance(pos, int):
            raise TypeError("Position must be an integer!")

        if pos < 0 or pos >= self._size:
            raise IndexError("Cannot insert because index", pos, "is invalid!"
)

        if self.search(newItem):
            raise ValueError("Cannot insert because item is already in the lis
t!")

        temp = Node(newItem)

        self._current = self._head
        self._previous = None
        for count in range(pos):
            self._previous = self._current
            self._current = self._current.getNext()

        temp.setNext(self._current)
        if self._current == self._head:
            self._head = temp
        else:
            self._previous.setNext(temp)
        self._current = None
        self._size += 1


    def pop(self, pos = None):
        """ Removes and returns the item at position pos of the list.
            Precondition:  position pos exists in the list.
            Postcondition:  Removes and returns the item at position pos of th
e list.
        """
        if pos == None:
            pos = self._size - 1

        if not isinstance(pos, int):
            raise TypeError("Position must be an integer!")

        if pos >= self._size or pos < 0:
            raise IndexError("Cannot pop from index", pos, "-- invalid index!"
)

        self._current = self._head
        self._previous = None
        for count in range(pos):
            self._previous = self._current
            self._current = self._current.getNext()

        if self._current == self._tail:
            self._tail = self._previous

        if self._current == self._head:
            self._head = self._head.getNext()
        else:
            self._previous.setNext(self._current.getNext())
        returnValue = self._current.getData()
        self._current = None
        self._size -= 1
        return returnValue

    def __str__(self):
        """ Removes and returns the item at position pos of the list.
            Precondition:  position pos exists in the list.
            Postcondition:  Removes and returns the item at position pos of th
e list.
        """
        resultStr = "(head)"
        current = self._head
        while current != None:
            resultStr += " " + str(current.getData())
            current = current.getNext()
        return resultStr + " (tail)"
```