LABORATORY 5 : Python Lists

OBJECTIVES

- to understand Python Lists
- to understand what "reference" means in Python

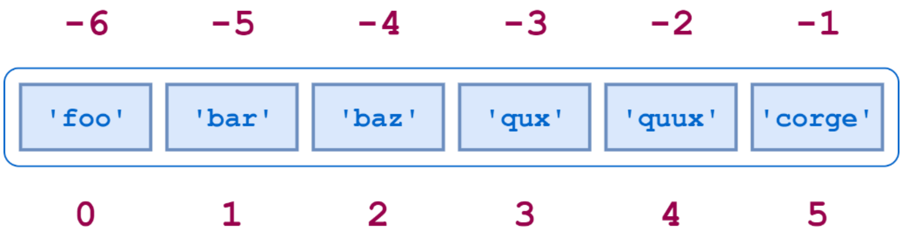
BACKGROUND

❖ Lists

- Basics

A Python list is a collection of arbitrary objects, somewhat similar to an array in many other programming languages but more flexible.

A list can be viewed as comma-separated items between square brackets. Each item occupies one slot in the list. Each slot has a number associated to it. This number is called index. Index is used to refer to item in the slot. List index is an integer starting from 0 to list size – 1. Python allows negative index where index -1 refers to the right most item. List indexing is shown in the figure below. (Indices are shown in red)



Note that items in a list need not be of the same type.

Examples :

```
list1 = ['January', 'December', 1997, 2018];
list2 = [1, 2, 3, 4, 5 ];
list3 = ["a", "b", "c", "d"]

# accessing item in a list
print "list1[0]: ", list1[0]
# output
# list1[0]:  January

print "list2[1:5]: ", list2[1:5]
# output
# list2[1:4]:  [2, 3, 4]

# update item in a list
list = ['January', 'December', 1997, 2018];
print "Value available at index 2 : "
print list[2]
# output
# Value available at index 2 :
# 1997

list[2] = 2001;
print "New value available at index 2 : "
print list[2]
# output
# New value available at index 2 :
# 2001

# delete item from a list
del list[2];
print "After deleting value at index 2 : "
print list
# output
# After deleting value at index 2 :
# ['January', 'December', 2018]
```

- Operations

`+`	concatenation (same as in string)
`*`	repetition (same as in string)
`len(a_list)`	number of items in list `a_list`
`x in a_list`	membership –check whether `x` is in list `a_list`
`for x in a_list :`	iteration through every item in list `a_list`

- Indexing and Slicing

`a_list[2]`	item in `a_list` at index 2
`a_list[-2]`	2nd item from the right (item next to last item in `a_list`)
`a_list[a:]`	slice items from index `a` to end of list
`a_list[:a]`	slice items from beginning of list to index `a - 1`
`a_list[a:b]`	slice items from index `a` to index `b - 1`
`a_list[a:b:c]`	slice items from index `a` to index `b - 1` with step `c`

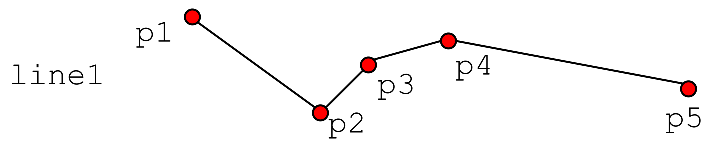
- Functions
  Common functions include

1	`list.append(obj)` Appends object obj to list
2	`list.count(obj)`

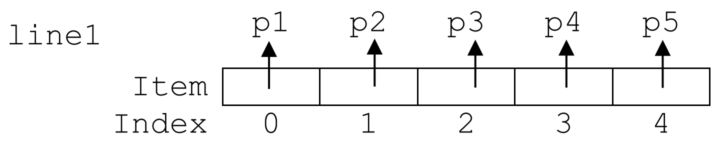
	Returns count of how many times obj occurs in list
3	`list.extend(seq)` Appends the contents of seq to list
4	`list.index(obj)` Returns the lowest index in list that obj appears
5	`list.insert(index, obj)` Inserts object obj into list at offset index
6	`list.pop(obj=list[-1])` Removes and returns last object or obj from list
7	`list.remove(obj)` Removes object obj from list
8	`list.reverse()` Reverses objects of list in place
9	`list.sort([func])` Sorts objects of list, use compare function, if given

❖ Line

A line is a series of points (two points, minimum). For example, the line below, named `line1`, is a series of five points.



A line can be viewed as a list of points.



LABORATORY 5: Pre-lab

1. Read about Python List from your favorite Python book.
2. Read Python documentation on List and pseudorandom number generator (`random.Random`). Make yourself familiar with them.

LABORATORY 5: In-lab, Post-lab

1. Use class `Point` from Lab 4. Write a new class, `Line,` representing a line. You may add more function to `Point` as you see fit.

   Hint: a line can be represented by a sequence of points

2. In class `Line,` write the following functions (also, you can write more functions)

   2.1. `__str__()` :

   Returns string representation of a line.

   2.2. `join(Line)` :

   `line1.join(line2)` connects `line2` to the end of `line1`. All points in `line2` are moved to `line1`. `line2` will be empty after successful operation.

   2.3. `zigzag1(Line):`

   `line3 = line1.zigzag1(line2)` shuffles points in `line1` and `line2` to `line3` in a way that one point removed from `line1` is added to `line3` and then one point removed from `line2` is added to `line3`; and so forth (please see Figure 3 below). After `zigzag1` operation finishes, `line3` will contain all points from `line1` and `line2`. `Line1` and `line2` are empty after a successful operation. `line3` is returned.

   2.4. `zigzag2(Line):`

   `line1.zigzag2(line2)` shuffles points in `line1` and `line2` to `line1` in a way that points are removed from `line2,` one by one, then inserted into `line1` at zigzag positions (please see Figure 4 below). All points in `line2` are shuffled into `line1`. `line2` will be empty after a successful operation.

   Figures below illustrate initial lines and lines after successful `join`, `zigzag1` and `zigzag2` operations.

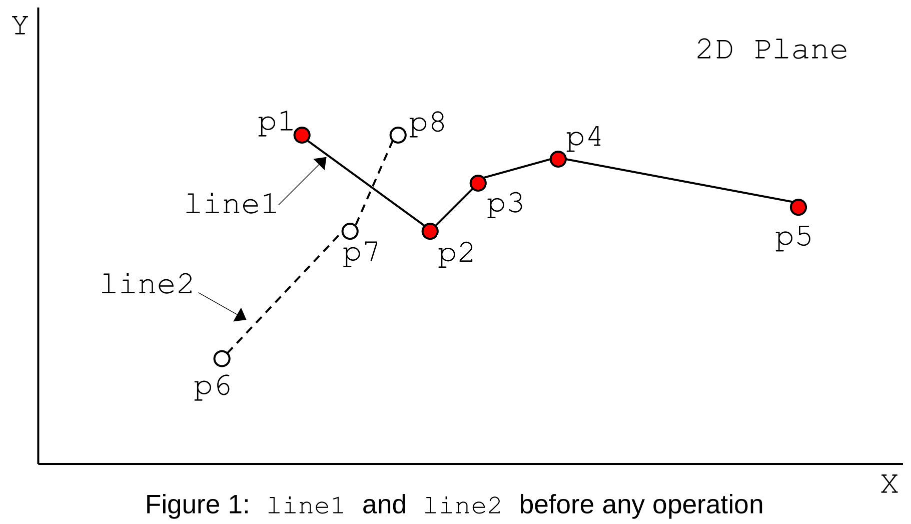


Figure 1: `line1` and `line2` before any operation

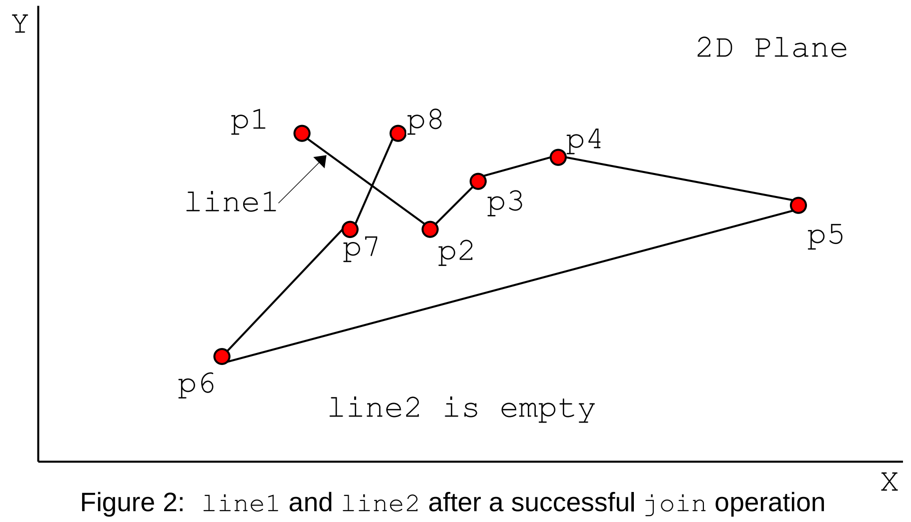


Figure 2: `line1` and `line2` after a successful `join` operation

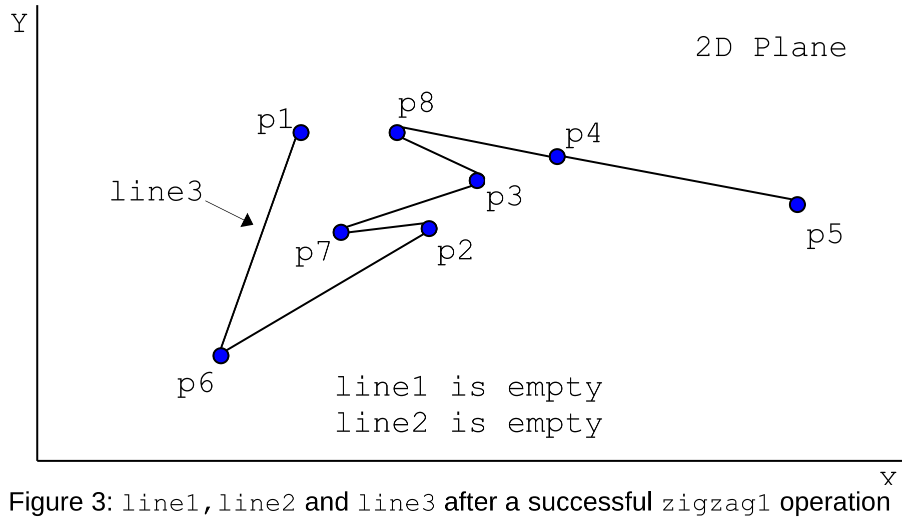


Figure 3: `line1`,`line2` and `line3` after a successful `zigzag1` operation

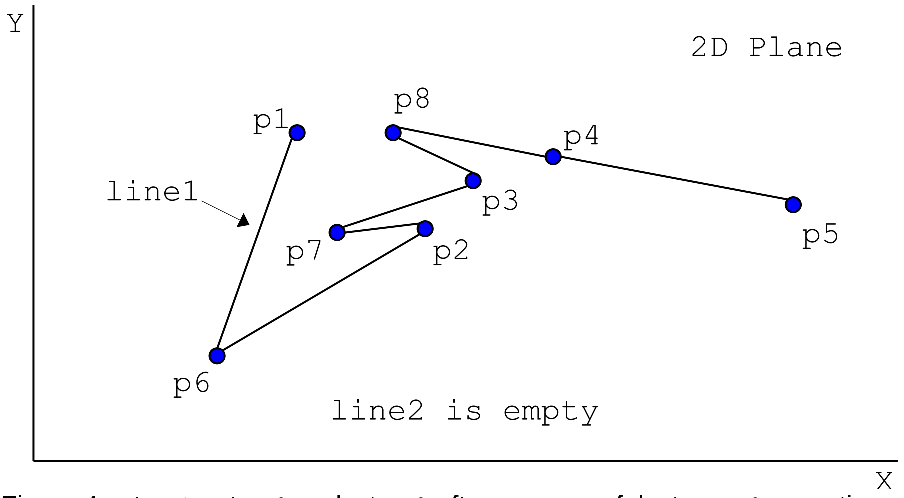


Figure 4: `line1`,`line2` and `line3` after a successful `zigzag2` operation

Please note that in this example `line1` contains more number of points; however, `line2` can contain more points or number of points in both lines can be equal.

3. Draw your lines with `Turtle`. (Turtle's odometer should relate to length of line)
4. Write a test plan. Write a class `LineTester` to test your `Line` class.

Submission:

Due date: in-lab, post-lab : Tuesday. Sep 15, 2:30pm.

You are to demonstrate your test plan and program. Prepare to answer some questions individually.