CS 61A Lecture 9

Friday, September 16

The Sequence Abstraction

red, orange, yellow, green, blue, indigo, violet.

0 , 1 , 2 , 3 , 4 , 5 , 6 .

There isn't just one sequence type (in Python or in general)

This abstraction is a collection of behaviors:

Length. A sequence has a finite length.

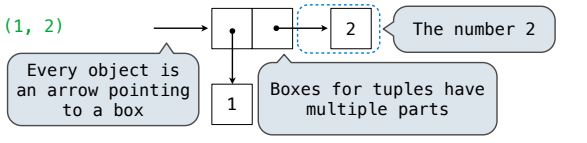
Element selection. A sequence has an element corresponding to any non-negative integer index less than its length, starting at 0 for the first element.

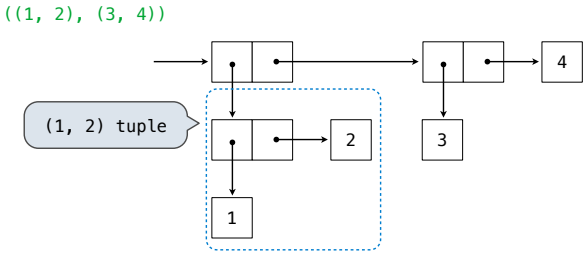
The sequence abstraction is shared among several types.

Tuples are Sequences

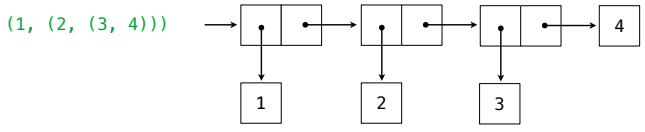
(Demo)

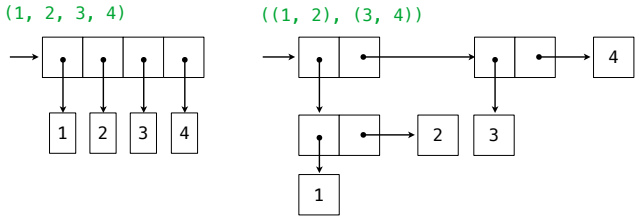
Box-and-Pointer Notation for Nested Pairs





Alternative Nested Structures





The Closure Property of Data Types

- A method for combining data values satisfies the *closure property* if:
- The result of combination can itself be combined using the same method.
- Closure is the key to power in any means of combination because it permits us to create hierarchical structures.
- Hierarchical structures are made up of parts, which themselves are made up of parts, and so on.

Tuples can contain tuples as elements

Recursive Lists

Constructor:

```
def make_rlist(first, rest):
    """Make a recursive list from its first element and the rest."""
```

Selectors:

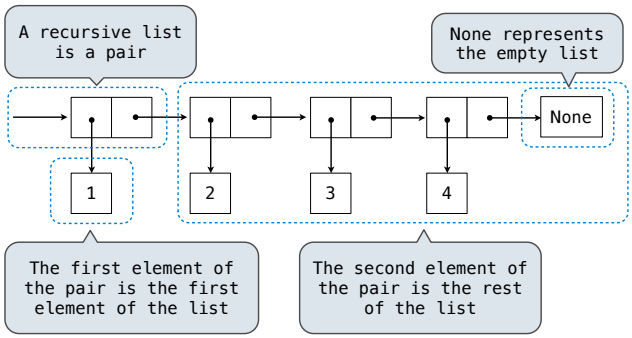
```
def first(s):
    """Return the first element of a recursive list s."""

def rest(s):
    """Return the rest of the elements of a recursive list s."""
```

Behavior condition(s):

If a recursive list s was constructed from first element f and recursive list r, then

- first(s) returns f, and
- rest(s) returns r, which is a recursive list.

Implementing Recursive Lists with Pairs



(Demo)

Implementing the Sequence Abstraction

```
def len_rlist(s):
    """Return the length of recursive list s."""
    length = 0
    while s != empty_rlist:
        s, length = rest(s), length + 1
    return length
```

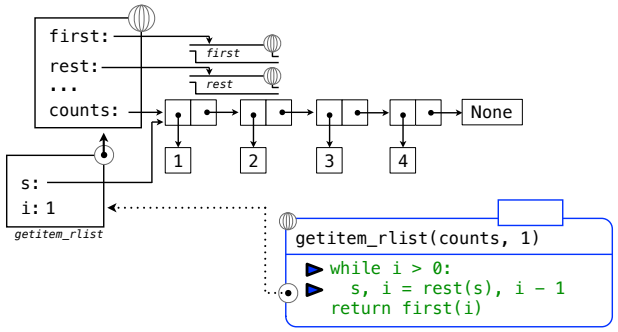
(Demo)

```
def getitem_rlist(s, i):
    """Return the element at index i of recursive list s."""
    while i > 0:
        s, i = rest(s), i - 1
    return first(s)
```

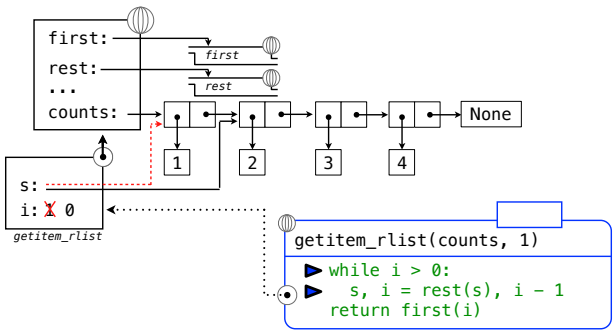
Length. A sequence has a finite length.

Element selection. A sequence has an element corresponding to any non-negative integer index less than its length, starting at 0 for the first element.

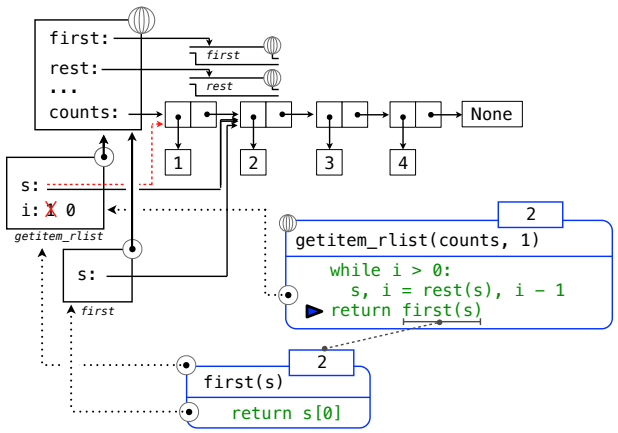
Environment Diagram for getitem_rlist



Environment Diagram for getitem_rlist



Environment Diagram for getitem_rlist



Sequence Iteration

(Demo)

```
def count(s, value):
    total = 0
    for elem in s:
        if elem == value:
            total = total + 1
    return total
```

Name bound in the first frame of the current environment

For Statement Execution Procedure

```
for <name> in <expression>:
    <suite>
```

1. Evaluate the header <expression>, which must yield an iterable value.

2. For each element value in that sequence, in order:

   A. Bind <name> to that value in the local environment.

   B. Execute the <suite>.