CS 61A Lecture 11

Friday, September 27

Announcements

- Midterm 1 has been graded...

  - Many of you did very well!

  - High scores on homework and projects balance out exam scores.

  - Typically, more than 75% of students receive A's & B's in 61A.

  - If you are falling behind, come to class (lecture, discussion, lab, & office hours)!

- Homework 3 due Tuesday 10/1 @ 11:59pm

- Optional Hog Contest due Thursday 10/3 @ 11:59pm

Sequences

The Sequence Abstraction

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

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

There isn't just one sequence class or abstract data type (in Python or in general).

The sequence abstraction is a collection of behaviors:

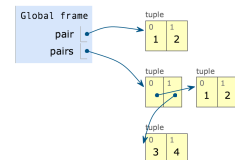> **Length.** A sequence has a finite length.
>
> **Element selection.** A sequence has an element corresponding to any non-negative integer index less than its length, starting at 0 for the first element.

There is built-in syntax associated with this behavior, or we can use functions.
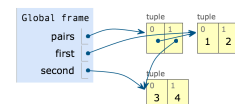
A tuple is a kind of built-in sequence (demo)

Box-and-Pointer Notation

Box-and-Pointer Notation

```
1  pair = (1, 2)
2  pairs = ((1, 2), (3, 4))
```

```
1  pairs = ((1, 2), (3, 4))
2  first, second = pairs
```

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

Recursive Lists

Constructor:

```python
def rlist(first, rest):
    """Return a recursive list from its first element and the rest."""
```

Selectors:

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

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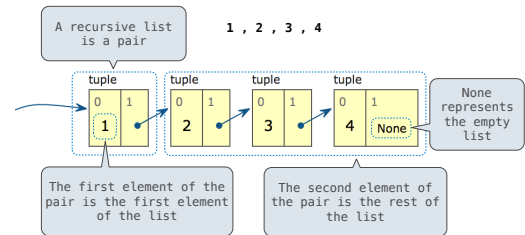
Behavior condition(s):

> If a recursive list s is constructed from a first element f and a recursive list r, then
>
> - first(s) returns f, and
>
> - rest(s) returns r, which is a recursive list.

Implementing Recursive Lists with Pairs

We can implement recursive lists as pairs. We'll use two-element tuples to encode pairs.

(Demo)

Sequence Abstraction Implementation

Implementing the Sequence Abstraction

```python
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)

```python
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.

Recursive implementations

(Demo)