

CS3L: Introduction to Symbolic Programming

Lecture 25:
Trees and Generalized Lists

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Colleen Lewis
colleenL@berkeley.edu



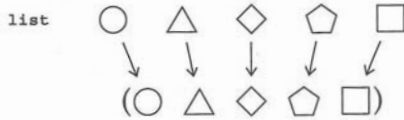
Today

- Review of List stuff
- Generalized Lists
- Deep-add



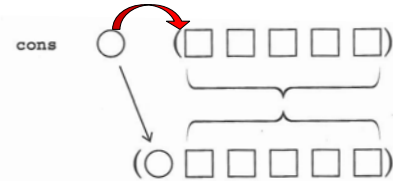
list

- Takes any number of arguments and puts them in a list



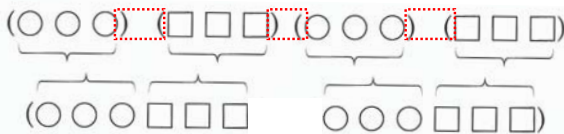
cons

- Takes two arguments
- Makes the first arg the car of the new list
- Makes the second arg the cdr of the new list
- The second argument MUST be a list



append

- Takes one or many lists and turns them into one
- all arguments MUST be lists



car and cdr

(car (cdr (car (car L))))
(caddr L)

(cddaadr L)

(cdr (cdr (car (car (cdr L)))))



Generalized Lists

```
(this (is a (list)) ((with only two) (elements)))  
(this (is a (list))  
      ((with only two) (elements)))
```

deep-add

```
(define (deep-add L)  
  (cond  
    ((null? L) 0)  
    ((number? (car L))  
     (+ (car L) (deep-add (cdr L))))  
    (else  
     (+ (deep-add (car L))  
        (deep-add (cdr L))))))
```

```
(deep-add '(1 (2 3) ((4) 5)))  
(+ 1 (deep-add '((2 3) ((4) 5)))  
(+ 1 (+ (deep-add '(2 3)) (deep-add '((4) 5)))  
(+ 1 (+ (+ 2 (deep-add '(3))) (deep-add '((4) 5)))  
(+ 1 (+ (+ 2 (+ 3 (deep-add '())) (deep-add '((4) 5)))  
(+ 1 (+ (+ 2 (+ 3 0)) (deep-add '((4) 5)))  
      ((null? L) 0)  
      ((number? (car L))  
       (+ (car L) (deep-add (cdr L))))  
      (else  
       (+ (deep-add (car L))  
          (deep-add (cdr L))))))
```

```
(+ 1 (+ (+ 2 (+ 3 0)) (deep-add '((4) 5)))  
(+ 1 (+ (+ 2 (+ 3 0)) (deep-add '((4) 5)))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (deep-add '(4)) (deep-add '(5))))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 (deep-add '())) (deep-add '(5))))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (deep-add '(5))))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (deep-add '(5))))  
      ((null? L) 0)  
      ((number? (car L))  
       (+ (car L) (deep-add (cdr L))))  
      (else  
       (+ (deep-add (car L))  
          (deep-add (cdr L))))))
```

```
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (deep-add '(5))))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (+ 5 (deep-add '()))))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (+ 5 0)))  
(+ 1 (+ (+ 2 (+ 3 0)) (+ (+ 4 0)) (+ 5 0)))  
(deep-add '(1 (2 3) ((4) 5)))  
      ((null? L) 0)  
      ((number? (car L))  
       (+ (car L) (deep-add (cdr L))))  
      (else  
       (+ (deep-add (car L))  
          (deep-add (cdr L))))))
```