Extra Topics, Week 7

Notes by HF. Thanks HF!

Stuff on Quiz:

- Recursion
- Preconditions

Recursion

- solve problem by solving a simpler version of the problem and extending that solution (recursive case)
  - Lists: smaller version of the problem: one fewer element
- At some point, it’s simple enough we can solve it directly (base case)
  - base case test: is it simple?
  - For lists, the base case test is Empty? One element?

Example: counting all #'s < 50 in a list

Input: list of real numbers

Output: integer

If the list is empty (base case test)
  - there are no number <50 (0) (base case computation)
Otherwise
  - count how many number < 50 appear in rest if first element <50 add 1 to number < 50

(define count-small
  (lambda (lst)
    (if (null? lst)
        0
        (if (< (car lst) 50)
            (+ 1 (count-small (cdr lst)))
            (count-small (cdr lst))))))

(count-small '(1 60 3 4 75 2))

extract all #'s < 50 in a list

Input: list of real numbers

Output: list of real #'s
Example: add all #'s < 50 in a list

Input: list of real numbers
Output: integer
If the list is empty (base case test)
    there are no number <50 (0) (base case computation)
Otherwise
    add number < 50 appear in rest if first element <50 add first element to number < 50

(define add-small
  (lambda (lst)
    (if (null? lst)
        0
        (if (< (car lst) 50)
            (+ (car lst) (add-small (cdr lst)))
            (add-small (cdr lst))))))

Example: Multiply #'s < 50

If the list is empty
    the product is 1
Otherwise
    compute product of remainder of list
    if first is small, multiply first by remainder of list
    o/w just use the product of the remainder of list

Multiply example with running product

(3 4 110 15 6 83)
update and remove to compute running product

Tail Recursion:

(define f
  (lambda (prod remaining)
    (if (null? remaining)
        prod
        (if (< (car remaining) 50)
            (f (* prod (car remaining))
                (cdr remaining))
            (f prod
                (cdr remaining))))))

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