Reversal by accumulating parameters

(define revapp (xs ys)
  (if (null? xs)
      ys
      (revapp (cdr xs)
        (cons (car xs) ys))))

(define reverse (xs) (revapp xs '()))
A-list example

-> (find 'Building
    '((Course 105) (Building Barnum)
      (Instructor Ramsey)))

Barnum
-> (val nr (bind 'Office 'Halligan-222
                  (bind 'Courses '(105 150TW)
                    (bind 'Email 'comp105-grades '()))))

((Email comp105-grades)
  (Courses (105 150TW))
  (Office Halligan-222))

-> (find 'Office nr)
Halligan-222

-> (find 'Favorite-food nr)
()
Laws of association lists

\[(\text{find } k \ (\text{bind } k \ v \ l)) = v\]
\[(\text{find } k \ (\text{bind } k' \ v \ l)) = (\text{find } k \ l), \text{ provided } k \neq k'\]
\[(\text{find } k \ '()') = '() --- bogus!\]
\( \mu \text{Scheme vs Impcore} \)

New abstract syntax:
- LET (keyword, names, expressions, body)
- LAMBDA (formals, body)
- APPLY (exp, actuals)
Introduce local names into environment

(let ([x1 e1]
       ...
       [xn en])
    e)

Square brackets mean the same as round, but are easier to see
What McCarthy might have done

(let ([val x1 e1]
  ...  
  [val xn en])
  e)

(But semantics of let, let*, letrec is much simpler)
Function escapes!

-> (define to-the-n-minus-k (n k)
   (let
     ([x-to-the-n-minus-k (lambda (x)
                       (- (exp x n) k))]
    x-to-the-n-minus-k))
-> (val x-cubed-minus-27 (to-the-n-minus-k 3 27))
-> (x-cubed-minus-27 2)
-19
No need to name the escaping function

-> (define to-the-n-minus-k (n k)
    (lambda (x) (- (exp x n) k)))

-> (val x-cubed-minus-27 (to-the-n-minus-k 3 27))
-> (x-cubed-minus-27 2)
-19
(define findzero-between (f lo hi)
  ; binary search
  (if (>= (+ lo 1) hi)
      hi
      (let ([mid (/ (+ lo hi) 2)])
        (if (< (f mid) 0)
          (findzero-between f mid hi)
          (findzero-between f lo mid)))))

(define findzero (f) (findzero-between f 0 100))
Cube root of 27 and square root of 16

\[
\text{-> } (\text{findzero } (\text{to-the-n-minus-k} 3 27))
\]

3

\[
\text{-> } (\text{findzero } (\text{to-the-n-minus-k} 2 16))
\]

4
Lambda questions

(define combine (p? q?)
  (lambda (x) (if (p? x) (q? x) #f)))

(define divvy (p? q?)
  (lambda (x) (if (p? x) #t (q? x)))))

(val c-p-e (combine prime? even?))
(val d-p-o (divvy prime? odd?))

(c-p-e 9) == ?          (d-p-o 9) == ?
(c-p-e 8) == ?          (d-p-o 8) == ?
(c-p-e 7) == ?          (d-p-o 7) == ?
Lambda answers

(define combine (p? q?))
  (lambda (x) (if (p? x) (q? x) #f)))

(define divvy (p? q?))
  (lambda (x) (if (p? x) #t (q? x))))

(val c-p-e (combine prime? even?))
(val d-p-o (divvy prime? odd?))

(c-p-e 9) == #f                   (d-p-o 9) == #t
(c-p-e 8) == #f                   (d-p-o 8) == #f
(c-p-e 7) == #f                   (d-p-o 7) == #t