MASSACHVSETTS INSTITVTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science
6.001—Structure and Interpretation of Computer Programs
Spring Semester, 1999
Recitation – Wednesday, February 17

1. Review of Lists

Let's look at simple operations on lists. Say I define a list as follows:

    (define primes (list 2 3 5 7))

How could I make the following lists using `primes`?

`non-composites`	$(1\ 2\ 3\ 5\ 7)$	`(define non-composites`	`)`
`odd-primes`	$(3\ 5\ 7)$	`(define odd-primes`	`)`
`more-primes`	$(2\ 3\ 5\ 7\ 11)$	`(define more-primes`	`)`
`less-primes`	$(2\ 3\ 5)$	`(define less-primes`	`)`

2. Simple Functions on Lists

We saw that we have the primitive function `pair?` to see if an object is a pair. What if we wanted to write the function `list?` to see if an object is a list?

What is the contract for `list?` $\forall x_1, x_2, \ldots, x_n$ `(list?  (list `x_1` `x_2` ... `x_n`)) == #t`

What's another way to write it?   `(list? nil) == #t`
                                    `(list? (cons `x` `l`)) == #t   ==>   (list? `l`)`

Now, how can we write `list?` in scheme?

    (define (list? x)

)

What is the Order of Growth of `pair?` and `list?` ?

$\Rightarrow$ `pair?` is $\Theta(\ )$ and `list?` is $\Theta(\ )$

3. More Functions on Lists

What if we wanted to reference the nth element of a list? Write the function `list-ref` that takes a list x and an integer n and returns the nth element of the list x.

    (define (list-ref x n)

)

Write the function `length` that takes a list x and returns the length of the list. Is your function iterative or recursive? Write the other one too!

    (define (length x)   (define (length x)

)

)

4. Recursive Append

Consider the procedure `append` that takes two lists and returns a list that results from appending the second to the first.

```
(define (append a b)
  (if (null? a)
      b
      (cons (car a) (append (cdr a) b))))
```

Draw the box and pointer diagrams for `(append (list 1 2) (list 3 4 5))`. Notice that the second list is never looked at!

5. Copy

Consider the procedure `copy` which takes a list and returns a copy of the list. How do each of the following differ?

```
(define (copy-ident x) x)

(define (copy-recurse x)
  (if (null? x)
      nil
      (cons (car x) (copy-recurse (cdr x)))))
```

Notice that `copy-recurse` is a recursive process. Let's write an iterative copy:

```
(define (*copy-iter* x)




)
```

6. Iterative Append

Given what we learned about iterative vs. recursive processes operating on lists, write an iterative version of append.

```
(define (append a b)




)
```

7. One More Function for Lists

Write the function `lrange` that takes a list `x` and two integers `a` and `b`, and returns a list of the `a`'th though the `b`'th elements of `x`. e.g. `(lrange (list 0 1 2 3 4) 1 3)` ⇒ `(1 2 3)`.
I know we're not going to get to this in class... Try it, and the answer will be on the web.

```
(define (lrange x a b)



    )
```