Lazy Evaluation

Announcements

Promises

Implementing Streams with Delay and Force

A promise is an expression, along with an environment in which to evaluate it

Delaying an expression creates a promise to evaluate it later in the current environment

Forcing a promise returns its value in the environment in which it was defined

```
scm> (define promise (let ((x 2)) (delay     (list (+ x 1)) ) ))
     (define promise (let ((x 2)) (lambda () (list (+ x 1)) ) ))
scm> (define x 5)
scm> (force promise)
(3)
```

```
(define-macro (delay expr)   `(lambda () ,expr))
(define       (force promise) (promise))
```

A stream is a list, but the rest of the list is computed only when **forced:**

```
scm> (define ones (cons-stream 1 ones))
(1 . #[promise (not forced)])
(1 . (lambda () ones))
```

```
(define-macro (cons-stream a b) `(cons ,a (delay ,b)))
(define       (cdr-stream s)     (force (cdr s)))
```

Lazy Evaluator

Lazy Evaluation

When a procedure is applied:

- **Built-in:** The arguments are evaluated and the primitive procedure is applied to them
- **User-Defined:** All arguments are delayed

When an if expression is evaluated:

- **Predicate:** Must be fully evaluated to determine which sub-expression to evaluate next
- **Consequent/Alternative:** Is evaluated, but call expressions within it are eval'd lazily

(Demo)