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;;; The 6.001 Meta-Circular Evaluator, Lazy Version
;;; The Core Evaluator
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(define (l-eval exp env)
  (cond ((self-evaluating? exp) exp)
        ((variable? exp) (lookup-variable-value exp env))
        ((quoted? exp) (text-of-quotation exp))
        ((assignment? exp) (eval-assignment exp env))
        ((definition? exp) (eval-definition exp env))
        ((if? exp) (eval-if exp env))
        ((lambda? exp)
         (make-procedure (lambda-parameters exp) (lambda-body exp) env))
        ((begin? exp) (eval-sequence (begin-actions exp) env))
        ((application? exp)
         (l-apply (actual-value (operator exp) env) (operands exp) env))
        (else (error "Unknown expression type -- L-EVAL" exp))))

(define (l-apply procedure arguments env)
  (cond ((primitive-procedure? procedure)
         (apply-primitive-procedure procedure (list-of-arg-values arguments env)))
        ((compound-procedure? procedure)
         (eval-sequence (procedure-body procedure)
                         (extend-environment (procedure-parameters procedure)
                                             (list-of-delayed-args arguments env)
                                             (procedure-environment procedure))))
        (else (error "Unknown procedure type -- L-APPLY" procedure))))

(define (actual-value exp env) (force-it (l-eval exp env)))

(define (list-of-arg-values exps env)
  (if (no-operands? exps) '()
      (cons (actual-value (first-operand exps) env) (list-of-arg-values (rest-operands exps) env))))

(define (list-of-delayed-args exps env)
  (if (no-operands? exps) '()
      (cons (delay-it (first-operand exps) env) (list-of-delayed-args (rest-operands exps) env))))

(define (eval-if exp env)
  (if (actual-value (if-predicate exp) env)
      (l-eval (if-consequent exp) env)
      (l-eval (if-alternative exp) env)))

(define (eval-sequence exps env)
  (cond ((last-exp? exps) (l-eval (first-exp exps) env))
        (else (l-eval (first-exp exps) env) (eval-sequence (rest-exps exps) env))))

(define (eval-assignment exp env)
  (set-variable-value! (assignment-variable exp) (l-eval (assignment-value exp) env) env))

(define (eval-definition exp env)
  (define-variable! (definition-variable exp) (l-eval (definition-value exp) env) env))

;;; Representing Expressions, procedures, environments: removed to save trees

;;; Representing Thunks

(define (delay-it exp env) (list 'thunk exp env))

(define (thunk? obj) (tagged-list? obj 'thunk))
(define (thunk-exp thunk) (cadr thunk))
(define (thunk-env thunk) (caddr thunk))

(define (force-it obj)
  (cond ((thunk? obj)
         (let ((result (actual-value (thunk-exp obj) (thunk-env obj))))
           (set-car! obj 'evaluated-thunk) (set-car! (cdr obj) result) (set-cdr! (cdr obj) '())
           result))
        ((evaluated-thunk? obj) (thunk-value obj))
        (else obj)))

(define (actual-value exp env) (force-it (l-eval exp env)))
(define (evaluated-thunk? obj) (tagged-list? obj 'evaluated-thunk))
(define (thunk-value evaluated-thunk) (cadr evaluated-thunk))
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