THE METACIRCULAR EVALUATOR: EVALUATION

At the core of Scheme is a recursive cycle of expression evaluation and procedure application.

**Question 1.** Per the diagram above, an expression is evaluated in the context of an environment. Why is this necessary?

Write some concrete examples of expressions, which when evaluated, require objects to be looked up in an environment.

What sorts of objects need to be looked up inside an environment? Name as many as you can.
Here is the definition of \texttt{mc-eval}, which evaluates an expression, from the metacircular evaluator in SICP (we’ll look at procedure application later):

\begin{verbatim}
(define (mc-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))
        ((and? exp) (eval-and exp env))
        ((lambda? exp) (make-procedure (lambda-parameters exp) (lambda-body exp) env))
        ((begin? exp) (eval-sequence (begin-actions exp) env))
        ((cond? exp) (eval-if (cond->if exp) env))
        ((let? exp) (mc-eval (let->combination exp) env))
        ((application? exp) (mc-apply (mc-eval (operator exp) env)
                                     (list-of-values (operands exp) env)))
        (else (error "Unknown expression type -- MC-EVAL")))
\end{verbatim}

\textbf{Question 2.} What are the parameters to \texttt{mc-eval}? What do you think they represent?

\textbf{Question 3.} Notice that the implementation of \texttt{mc-eval} is a big \texttt{cond} statement. Expressions are evaluated by determining what sort of expression is presently encountered and then handling it.

Starting with the first predicate, give some examples of expressions that are self-evaluating. Hint: notice that they don’t require use of the environment for evaluation.

List as many different examples as you can. You should find at least two sorts of things.

\textbf{Question 4.} Assuming that an expression is a list, write an implementation for the predicate \texttt{self-evaluating}?.

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