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COM 3355 Assignment #1.  [Revision 0]
Assigned:  Thursday, 2 January 2002
Due:       Thursday, 9 January 2002, by 6pm EST
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Implement the Qenv ADT as specified below. You are responsible for any testing that may be necessary. Late assignments may be discounted, and very late assignments may be discarded.

Specification of the Qenv ADT. Qenv is an immutable (functional) abstract data type. Its operations shall have no side effects. The Qenv ADT shall be implemented in portable R5RS Scheme, and must be interchangeable with any other correct implementation of this ADT. (This implies, for example, that you are not allowed to define any global variables or procedures beyond the operations of the ADT.)

Your implementation shall define the following top-level procedures, which are specified below by an algebraic specification. In this specification, the Symbol and ExactInteger predicate types are defined by the `symbol?` and

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(lambda (x) (and (number? x) (exact? x) (integer? x)))
```

procedures, respectively.

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empty:                                         -> Qenv
extend:       Qenv x Symbol x ExactInteger -> Qenv
lookupRib:    Qenv x Symbol                  -> ExactInteger
lookupOffset: Qenv x Symbol                  -> ExactInteger
lookupLabel:  Qenv x Symbol                  -> ExactInteger
beginScope:   Qenv                           -> Qenv
endScope:     Qenv                           -> Qenv
```

Algebraic specification:

$$\texttt{(lookupRib (empty) } s\texttt{)} = -1$$

$$\texttt{(lookupRib (extend } e\texttt{, } s_1\texttt{, } n\texttt{) } s_0\texttt{)}$$
$$= \begin{cases} 0 & \text{if } \texttt{(eq? } s_0\ s_1\texttt{)} \\ \texttt{(lookupRib } e\ s_0\texttt{)} & \text{otherwise} \end{cases}$$

$$\texttt{(lookupRib (beginScope } e\texttt{) } s_0\texttt{)}$$
$$= \begin{cases} -1 & \text{if } \texttt{(< (lookupRib } e\ s_0\texttt{) 0)} \\ \texttt{(+ 1 (lookupRib } e\ s_0\texttt{))} & \text{otherwise} \end{cases}$$

$$\texttt{(lookupOffset (empty) } s\texttt{)} = -1$$

$$\texttt{(lookupOffset (extend } e\ s_1\ n\texttt{) } s_0\texttt{)}$$
$$= \begin{cases} n & \text{if } \texttt{(eq? } s_0\ s_1\texttt{)} \\ \texttt{(lookupOffset } e\ s_0\texttt{)} & \text{otherwise} \end{cases}$$

$$\texttt{(lookupOffset (beginScope } e\texttt{) } s_0\texttt{)} = \texttt{(lookupOffset } e\ s_0\texttt{)}$$

$$\texttt{(lookupLabel } e\ s_0\texttt{)} = \texttt{(lookupOffset } e\ s_0\texttt{)}$$

$$\texttt{(endScope (empty))} = \texttt{(empty)}$$

$$\texttt{(endScope (extend } e\ s\ n\texttt{))} = \texttt{(endScope } e\texttt{)}$$

$$\texttt{(endScope (beginScope } e\texttt{))} = e$$