Given two lists, write a program to find the minimum number of item insertions, item deletions, and item replacements to change one list into the other.

After trying the question, scroll down to the solution.
Here is the standard solution, which uses for-loops (Subsection 5.2.3), but for-loops are never necessary. We will change list $A$ into list $B$. Let $D: ([#A+1] \times ([#B+1] \times \text{nat})$ be an array-valued variable whose final value will be such that $D'_{ij} = \text{(the edit distance from } A[0;\ldots,i] \text{ to } B[0;\ldots,j])$. So the final answer will be $D' (\#A) (\#B)$.

\begin{verbatim}
(0) for $i := 0;\ldots;\#A+1$ do $D_{i0} := i$ od.
(1) for $j := 1;\ldots;\#B+1$ do $D_{0j} := j$ od.
(2) for $i := 1;\ldots;\#A+1$ do
    (3) for $j := 1;\ldots;\#B+1$ do
        (4) $D_{ij} := (D_{i-1}(j-1) + \text{if } A_i = B_j \text{ then } 0 \text{ else } 1 \text{ fi})$
            \uparrow (D_{i-1}j + 1)
        (5) \uparrow (D_{i}j-1) + 1)
    od od
\end{verbatim}

Line 0 says $A[0;\ldots,i]$ can be changed to $[\text{nil}]$ by $i$ deletions.
Line 1 says $[\text{nil}]$ can be changed to $B[0;\ldots,j]$ by $j$ insertions.
Lines 2 and 3 fill in the interior of $D$.
On line 4, if we can transform $A[0;\ldots,i-1]$ to $B[0;\ldots,j-1]$ in $D (i-1) (j-1)$ steps, and if $A_i=B_j$, we have transformed $A[0;\ldots,i]$ to $B[0;\ldots,j]$. But if $A_i \neq B_j$ then we need to replace $A_i$ by $B_j$ which takes 1 step.
On line 5, if we can transform $A[0;\ldots,i-1]$ to $B[0;\ldots,j]$ in $D (i-1) j$ steps, then we can transform $A[0;\ldots,i]$ to $B[0;\ldots,j]$ by deleting $A_i$.
On line 6, if we can transform $A[0;\ldots,i]$ to $B[0;\ldots,j-1]$ in $D i (j-1)$ steps, then we can transform $A[0;\ldots,i]$ to $B[0;\ldots,j]$ by appending $B_j$.
The shortest way to transform $A[0;\ldots,i]$ to $B[0;\ldots,j]$ is the minimum of the three ways from lines 4, 5, and 6.

To prove the correctness of this solution, find invariants for the for-loops. Or eliminate the for-loops and write specifications as in Chapter 4.