511 (*T*-strings) Let us call a string S: *(“a”, “b”, “c”) a *T*-string if no two adjacent nonempty segments are identical:

$$\neg\exists i, j, k\cdot\ 0\le i<j<k\le \leftrightarrow S\ \wedge\ S_{i;..j} = S_{j;..k}$$

Write a program to output all *T*-strings in alphabetical order. (The mathematician Axel Thue proved that there are infinitely many *T*-strings.)

After trying the question, scroll down to the solution.

§ Define $R =$ (print all T-strings in alphabetical order) .
Define $Z =$ (print all T-strings from S on in alphabetical order) .
Define $T =$ (S is a T-string) $= \neg\exists i, j, k\cdot\ 0{\le}i{<}j{<}k{\le}{\leftrightarrow}S\ \wedge\ S_{i;..j} = S_{j;..k}$.
Define $U =$ (S has no adjacent nonempty identical segments of length $< l$)
$= \neg\exists i, j, k\cdot\ 0{\le}i{<}j{<}k{\le}{\leftrightarrow}S\ \wedge\ j{-}i{<}l\ \wedge\ S_{i;..j} = S_{j;..k}$.

$R \Longleftarrow S{:}=$ “”. $T{\Rightarrow}Z$
$T{\Rightarrow}Z \Longleftarrow\ !S.\ S{:}= S;$“a”. Z
$Z \Longleftarrow l{:}= 1.\ U{\Rightarrow}Z$
$U{\Rightarrow}Z \Longleftarrow$
  if ${\leftrightarrow}S \ge 2{\times}i$
  then **if** $S_{{\leftrightarrow}S-2\times i;..{\leftrightarrow}S-i} = S_{{\leftrightarrow}S-i;..{\leftrightarrow}S}$
    then $S{:}=$ (the alphabetically next text that is not longer). Z
    else $i{:}= i{+}1.\ U{\Rightarrow}Z$ **fi**
  else $T{\Rightarrow}Z$ **fi**
$S{:}=$ (the alphabetically next text that is not longer) $\Longleftarrow$
  if $S_{{\leftrightarrow}S-1} =$ “a” **then** $S{:}= S_{0;..{\leftrightarrow}S-1}$;“b”
  else if $S_{{\leftrightarrow}S-1} =$ “b” **then** $S{:}= S_{0;..{\leftrightarrow}S-1}$;“c”
  else $S{:}= S_{0;..{\leftrightarrow}S-1}$. $S{:}=$ (the alphabetically next text that is not longer) **fi fi**

The one insight is the fact that a non-T-string cannot be made into a T-string by extending it, hence the assignment $S{:}=$ (the alphabetically next text that is not longer) . We are assured that there is one by Thue.