Input: $\mathbf{Y} = \{Y_1, Y_2, \cdots, Y_T\}, \pi, \mathbf{A}, \mathbf{B}$
Output: $\mathbf{X} = \{X_1, X_2, \cdots, X_T\}$
begin
  $\mathbf{O} \leftarrow \{O_1, O_2, \cdots, O_N\}$;
  $\mathbf{S} \leftarrow \{S_1, S_2, \cdots, S_K\}$;
  for *each state* $i \in \{1, 2, \cdots K\}$ **do**
    $T_1[i, 1] \leftarrow \pi \cdot \mathbf{B}_{iy_1}$;
    $T_2[i, 1] \leftarrow 0$
  end
  for *each observation* $i \in \{2, 3, \cdots T\}$ **do**
    for *each state* $j \in \{1, 2, \cdots K\}$ **do**
      $T_1[j, i] \leftarrow \mathbf{B}_{jy_i} \cdot \max\{T_1[k, i-1] \cdot A_{kj}\}$;
      $T_2[j, i] \leftarrow \text{argmax}\{T_1[k, i-1] \cdot A_{kj}\}$
    end
  end
  $Z_T \leftarrow \text{argmax}\{T_1[k, T]\}$;
  $X_T \leftarrow S_{Z_T}$;
  for $i \leftarrow T, T-1, \cdots, 2$ **do**
    $Z_{i-1} \leftarrow T_2[Z_i, i]$;
    $X_{i-1} \leftarrow S_{Z_{i-1}}$
  end
end

Algorithm 1: Viterbi Algorithm