Consider the matrix \( A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \)

(a) Find the characteristic polynomial of \( A \).

(b) Find the eigenvalues and the corresponding eigenvectors of \( A \).

(c) Is the matrix \( A \) diagonalizable?? Why.

(d) If \( A \) is diagonalizable, find a nonsingular matrix \( P \) and a diagonal matrix \( D \) such that \( A = PDP^{-1} \).

(e) Find the determinant of \( A \).

(f) Use Cayley-Hamilton Theorem to find \( A^3 \) without multiplying \( A \) with itself.