1. For each of the following matrices say if it is (H) Hermitian; (S) Skew-Hermitian; (N) Normal; (C) Circulant; (T) Toeplitz [all that apply, for example: “Matrix X is N and H”]

\[
A = \begin{pmatrix}
0 & 1 & -1 \\
-1 & 0 & 1 \\
1 & -1 & 0 \\
\end{pmatrix};
B = \begin{pmatrix}
0 & i & -1 \\
i & 0 & 2 \\
1 & -2 & 0 \\
\end{pmatrix};
C = \begin{pmatrix}
1 & -1 & 2 \\
-1 & 2 & 1 - i \\
2 & 1 + i & -1 \\
\end{pmatrix}
\]

2. What are all 2 × 2 (real) matrices that are normal?

3. Prove that a lower triangular matrix that is normal must be a diagonal matrix. [Hint: Consider the (1,1) entries of the products \(AA^T\) and \(A^TA\) and use induction]