(1) Suppose that S is an orthogonal matrix and $S^{-1}AS$ is diagonal. What can you say about A^T?

(2) Suppose that A is a 2×2 matrix with $E_3 = \operatorname{Span} \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ and $E_8 = \operatorname{Span} \begin{bmatrix} 1 \\ 2 \end{bmatrix}$. Find an orthonormal eigenbasis for A.