1. Obtain the LU factorization \((A = LU)\) of the matrix on the right. Is the matrix SPD? If so what is its Cholesky factorization?

\[
\begin{pmatrix}
4 & 2 & -2 \\
2 & 2 & -1 \\
-2 & -1 & 5 \\
\end{pmatrix}
\]

2. (a) Show that if \(A\) is Symmetric Positive Definite (SPD) then \(\text{Trace}(AX) > 0\) for all SPD matrices \(X\). (b) Show that if \(\text{Trace}(AX) \geq 0\) for all Symmetric Positive Semi-Definite (PSD) matrices \(X\) then \(A\) is PSD.