EX.2.4.10.a, Sauer3

Assume that $A = (a_{ij})$ is a $n \times n$ matrix with entries $|a_{ij}| \leq 1$ for all $1 \leq i, j \leq n$. Prove that the matrix $U = (u_{ij})$ in its $PA = LU$ factorization satisfies $|u_{ij}| \leq 2^{n-1}$ for all $1 \leq i, j \leq n$.