# Worksheet: From linear system to LU factorization 

Do these problems with a group, if possible!
I. Consider the following linear system $A \mathbf{x}=\mathbf{b}$ :

$$
\begin{aligned}
2 x_{1}+x_{2}-9 x_{3} & =-6 \\
4 x_{1}-3 x_{2}-21 x_{3} & =-20 \\
-6 x_{1}-13 x_{2}+24 x_{3} & =5
\end{aligned}
$$

Solve the linear system by elimination and then back-substitution. Use the standard algorithm. Show your work, and in particular show, as an intermediate stage, the triangular system which you get after elimination.
II. (a) From problem I, what elimination matrices $E_{21}, E_{31} E_{32}$ did the row operations?
(b) What are the inverses $L_{21}=E_{21}^{-1}, L_{31}=E_{31}^{-1}, L_{32}=E_{32}^{-1}$ ?
(c) From problem I, what numbers were the pivots? What is the determinant of A?
(d) The computation in problem I can regarded as factoring $A=L U$. What lower triangular matrix $L$ and upper triangular matrix $U$ were computed?
(e) Multiply $L U$ and confirm you get the original matrix $A$.

