

Row Exchanges in Gaussian Elimination

So far G-E as we have defined it requires:

- same number of equations as unknowns
- only one operation: adding a multiple of one row to another
- pivots in positions 11, 22, 33, etc.

What do we do if the third item breaks down, i.e. a zero appears in one of the diagonal positions?

Example

$$\underbrace{\begin{bmatrix} 0 & 2 & | & 2 \\ 3 & 4 & | & -5 \end{bmatrix}}_{\text{no pivot in 11 position}} \iff \begin{cases} 0u + 2v = 2 \\ 3u + 4v = -5 \end{cases}$$
$$\iff \begin{cases} 3u + 4v = -5 \\ 0u + 2v = 2 \end{cases} \iff \underbrace{\begin{bmatrix} 3 & 4 & | & -5 \\ 0 & 2 & | & 2 \end{bmatrix}}_{\text{G-E can now proceed}}$$

So we need to introduce row exchanges.