Null space and column space intro

Linear Algebra

November 3 2020

Consider the following matrices. For each given value of A, consider:

How many solutions does the homogenous equation $Ax = 0$ have? (Note that x will have the form $\begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix}$ where n is the number of columns of A.)

When the answer is "infinitely many," what tools might we have to describe the size of that set?

How many possible outcomes b are there for the equation $Ax = b$? (Again, note that b is of the form $\begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{pmatrix}$. ...How do we know what m is in this case?)

$$A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 3 \\ 0 & 0 & 0 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 2 & -1 \\ 1 & -1 & 0 \\ 3 & 3 & -2 \end{pmatrix}$$