Null Space

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The null space of a matrix A is the subspace null(A) = {x such that Ax = 0 }

The solutions to the homogeneous system

The row space of an m x n matrix A is the subspace of IR^n spanned by the rows of A
row(A0 = span(R_1, R_2, …, R_m)

The column space of an m x n matrix A is the subspace of IR^n spanned by the columns of A
col(A) = span(c_1, c_2, …, c_n

The image or range of a linear transformation is the subspace im(A) or range(A) given by { Ax where x in IR^n }

How do we find all possible outputs

If A -> B by elementary row operations then row(A)=row(B)

If R is a row-echelon matrix

1. The nonzero rows or R are a basis for row IR
2. The columns of R that contain a leading 1 are a basis for col R

The rank of a matrix is the number of leading 1s in row echelon form

rank(A) = dm(row(A))=dim(col(A))

Let A be a m x n matrix with rank r. If A is row-reduced to REF R then

1. The nonzero rows of R are a basis for row(A)
2. The r columns of A that contain a leading 1 in REF are a basis for col(A)

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