theoretical multiplication arguments:

$AB = \left[ \begin{array}{ccc} A.\text{col}1B & \ldots & A.\text{col}nB \end{array} \right]$

OR

Multiply both sides on side it makes sense: $A^{-1}(A\vec{x}) = A^{-1}\vec{b}$

Reorder parentheses by associativity: $(A^{-1}A)\vec{x} = A^{-1}\vec{b}$

Cancel A by its inverse: $I_{n\times n}\vec{x} = A^{-1}\vec{b}$

Reduce identity: $\vec{x} = A^{-1}\vec{b}$

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- $A_{n\times n}$ must have full pivots to be invertible because by above $A\vec{x} = \vec{b}$ never inconsistent (full row pivots) and $A$ is square so full column pivots too, and $A$ reduces to $I_{n\times n}$

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- $A_{n\times n}$ isn't invertible must be missing row and column pivots
- $A$ not square must be missing a row pivot or a column pivot (but not necessarily both)

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$

Catalog description: A study of vectors, matrices and linear transformations, principally in two and three dimensions, including treatments of systems of linear equations, determinants, and eigenvalues. Prerequisite: MAT 1120 or permission of the instructor.

## Course Goals

- Develop algebraic skills
- Develop mathematical reasoning and problem solving
- Develop spatial visualization skills
- Learn about some applications of linear algebra
- An introduction to a computer algebra software system as it applies to linear algebra

## Mapping of the Topics in the Catalog Description to the Text

Systems of Linear Equations: 1.1, 1.2, 1.5
Vectors: 1.3, 1.4, 1.7
Matrices: earlier +2.1, 2.2, 2.3
Linear transformations 1.8, 1.9 (1-1 & onto eliminated), 2.7, 6.1
Determinants: 3.1, 3.2, 3.3
Eigenvalues 2.8, 5.1, 5.2, 5.6

- computer algebra software programs like Maple will output a *condition number* corresponding to a matrix.
- The order $k$ in scientific notation ($10^k$) is useful, rather than the number, which can be different in different programs

- computer algebra software programs like Maple will output a *condition number* corresponding to a matrix.
- The order $k$ in scientific notation ($10^k$) is useful, rather than the number, which can be different in different programs
- measures asymptotically worst case scenario that we may lose up to $k$ digits in roundoff errors
- issue with decimals in the matrix, not with Maple
- using $r$ digits gets at least $r - k$ accuracy [ex: 21-19=2]


[1]

http://c.asstatic.com/images/1639965_634936497651212500-1.jpg

- Hill Cipher: message goes in as column vectors
- $A$.[uncoded message] $=$ [coded message]

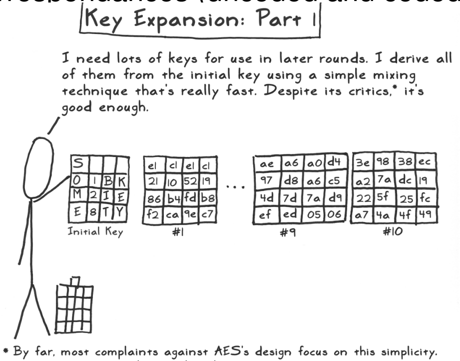
$$A \begin{bmatrix} \text{col1=start of message} & \ldots & \text{coln=end of message} \end{bmatrix}$$

- [uncoded message] $=$

- Hill Cipher: message goes in as column vectors
- $A$.[uncoded message] $=$ [coded message]

$$A\left[\begin{array}{ccc} \text{col1=start of message} & \ldots & \text{coln=end of message} \end{array}\right]$$

- [uncoded message] $= A^{-1}$.[coded message]
- Vulnerable because of its linearity—intercept enough vector correspondances (uncoded and coded)




http://www.moserware.com/2009/09/stick-figure-guide-to-advanced.html

A Stick Figure Guide to the Advanced Encryption Standard (AES)