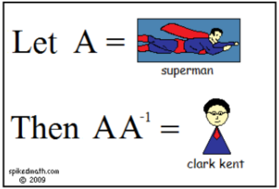
Group Debrief 2

Learning Goal 1: determine scalar multiples, transposes, sums, and products of matrices and inverses of 2×2 matrices

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

Each group member takes a turn for each learning outcome.
Try to help each other as material in this class builds upon itself.

Use linear algebra to find the identity of superman.



http://spikedmath.com/042.html

Learning Goal 2: link matrix multiplication to matrix-vector products, systems of equations, and row operations

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

Each group member takes a turn for each learning outcome. Try to help each other as material in this class builds upon itself.

https://marksaroufim.substack.com/p/machine-learning-the-great-stagnation

Learning Goal 3: apply the inverse matrix theorem

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

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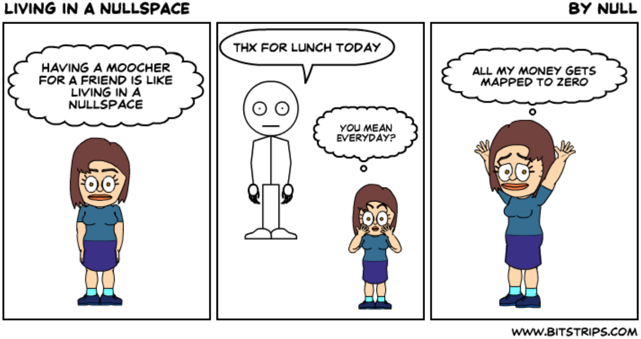
Try to help each other as material in this class builds upon itself.

- A is an invertible matrix
- A is row equivalent to the $n \times n$ identity matrix
- A has n pivot positions
- $A\vec{x} = \vec{0}$ has only the trivial solution
- columns of A form a linearly independent set
- $A\vec{x} = \vec{b}$ has at least one solution for each $\vec{b}$ in $\mathbb{R}^n$
- columns of A span $\mathbb{R}^n$
- there is an $n \times n$ matrix C such that $CA = I$
- there is an $n \times n$ matrix D such that $AD = I$
- A^T is an invertible matrix

Learning Goal 4: determine column spaces, nullspaces, bases and dimensions of subspaces of matrices

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

Each group member takes a turn for each learning outcome.
Try to help each other as material in this class builds upon itself.



Learning Goal 5: apply the rank-nullity theorem

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

Each group member takes a turn for each learning outcome.
Try to help each other as material in this class builds upon itself.

[HTML] The convex basis of the left **null space** of the stoichiometric matrix leads to the definition of metabolically meaningful pools
I Famili, BO Palsson - Biophysical journal, 2003 - Elsevier
… between the reaction rate vectors, v, and time derivative of metabolite concentrations, dx/dt or x ˙ . Each two subspaces in the domain (ie, the **null space** and row space) and codomain (ie, the left **null space** and **column space**) form orthogonal pairs with one another …
☆ 99 Cited by 103 Related articles All 15 versions

Closed-loop subspace identification using the parity space
J Wang, SJ Qin - Automatica, 2006 - Elsevier
… It is shown that the **column space** of the observability matrix extracted from SOPIM is equivalent to that from SIMPCA-Wc … (9), we have (11) lim N → ∞ 1 N (Γ f ⊥) T [I - H f] Z f Z p T = 0 . Therefore, (Γ f ⊥) T [I - H f] is in the left **null space** of lim N → ∞ (1 / N) Z f Z p T . If we …
☆ 99 Cited by 92 Related articles All 6 versions

Production frontiers with cross-sectional and time-series variation in efficiency levels
C Cornwell, P Schmidt, RC Sickles - Journal of econometrics, 1990 - Elsevier
… Let PL, = Q(Q'Q>-IQ' be the projection onto the **column space** of Q and ML, = I - Pp be the projection onto the **null space** of Q. We derive three different estimators for (2.3), each of which is a straight- forward extension of an established procedure for the standard panel data …
☆ 99 Cited by 1352 Related articles All 13 versions

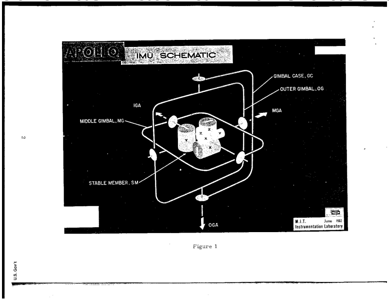
Degrees of freedom of the MIMO Y channel: Signal space alignment for network coding
N Lee, JB Lim, J Chun - IEEE Transactions on Information …, 2010 - ieeexplore.ieee.org
… designed to lie in the **null space** of channel matrix , ie … Since all users have antennas and the relay equips antennas, there exists a -dimensional intersection subspace consti- tuted by the **column space** of channel matrices for each user pair. Let denote the …
☆ 99 Cited by 216 Related articles All 5 versions

Google Search for null space and column space

Learning Goal 6: link algebra and geometry of the above, explore applications, and interpret statements

1. What are significant take aways of this learning outcome?
2. Also reflect on personal connections, experiences and/or any remaining questions you have.
3. Prepare to share from your group's discussion with the class.

Each group member takes a turn for each learning outcome. Try to help each other as material in this class builds upon itself.



https://www.hq.nasa.gov/alsj/imu-2.jpg

Module 1 and 2 Overview

- Linear Systems of Matrix and Vector Equations
  - 1.1, 1.2 & 1.5: Gaussian elimination, algebra and geometry of solutions of systems of equations
  - 1.4: connects all via multiplying a matrix and a vector
  - 1.3 and 1.7: algebra and geometry of column vectors (linear combinations/mixing, span, linear independence)

  problem set 1
- Matrix Algebra and Spaces
  - 2.1 and 2.2 : matrix algebra: $A + B$, cA, A^T, AB, $A^{-1}_{2\times 2}$, $\det(A_{2\times 2})$ [extends 1.3 and 1.4]
  - 2.3: theorem 8: what makes a matrix invertible [connects 2.2 to 1.1, 1.2, 1.3 and 1.7] and condition number
  - 2.8 and 2.9: subspace, basis, column space and null space and their dimensions [connects spaces to 1.3, 1.5 and 1.7]

  problem set 2

  in-class assessment 1

Module 3 Overview

- Linear Transformations and Orthogonality
  - 1.8 and 1.9: linear transformations as left multiplication of matrices
  - 6.1: length & angle of a vector, orthogonal vectors
  - 2.7: computer graphics, including the application of orthogonal vectors, matrix inverses and transposes

  problem set 3
- Determinants, Eigenvalues and Eigenvectors
  problem set 4
  in-class assessment 2
  final project

2240 Exam - Name: ______________________________

Part 2 Group Component.

If you finish the individual component early, turn it in up front and proceed with the group component on your own until I announce group time—the idea is to have silence for a good portion of class before we switch to "group time." If you finish the entire assessment early, then you may leave early. You work alone until I say it is "group time" and time to turn in the individual portion. Then you may continue to work alone or in groups (or a combination!). The idea is to give you opportunities to communicate course content with your peers, since this is one of ASU's main educational goals. The only guidelines are that each person must eventually write up and turn in their own and the only resources you are allowed to use is each other.

In this section, full credit answers are ones that demonstrate correctness, clarity and deep understanding of linear algebra using the language of our course as well as connections among the interrelated concepts.