Cheatography

Matrix Properties Cheat Sheet

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Definition

Leading Variables: variables corresponding to leading 1s.	**Free Variables:** variables with no pivot 1s.
Parameters: symbol (s, t, ...) for free variable.	**Basic Solutions:** vectors where s=1 and t,u,..=0.
Rank A: number of leading 1s.	If A(m x n) and rank A = r, there are n-r free variables.
REF: leading 1s with 0s at the bottom.	**RREF:** leading 1s with 0s at the top and bottom.
Main Diagonal: a_{11}, a_{22}, a_{33}, ... entries of a matrix.	**Diagonal Matrix:** sq. matrix with entries outside main diagonal = 0.
Symmetric Matrix: sq. matrix where $A = A^T$.	**Skew-symmetric:** square matrix where $A^T = -A$.
Identity Matrix (I): square matrix where main diagonal entries = 1.	**Zero Matrix:** square matrix where all entries = 0.
Invertible Matrix: sq. matrix that has an inverse.	

Elementary Row Operations

I. Interchange two rows.

II. Multiply a row by non-zero integer.

III. Add multiple of a row with another row.

Transposition Properties

If A = $[a_{ij}]$, then $A^T = [a_{ji}]$

If A is (m×n), then A^T is (n×m).

$(A^T)^T = A$

$(kA)^T = kA^T$

$(A+B)^T = A^T+b^T$

Matrix Inverse Properties

$AA^{-1} = I = A^{-1}A$

*det*A = ad - bc

*adj*A = [d -b]
[-c a]

A is non-invertible if *det*A = 0.

$A^{-1} = (1/\mathit{det}A)\mathit{adj}A$

A**x** = b ⇒ **x** = $A^{-1}b$

[A I] → [I A^{-1}]

Addition and Scalar Multiplication Properties

A+B = B+A	commutativity
A+(B+C) = (A+B)+C	associativity
0+A = A	additive identity element
A+(−A) = 0	additive inverse
k(A+B) = kA+kB	scalar distributivity
(k+ p)A = kA+ pA	scalar distributivity
(kp)A = k(pA)	scalar associativity
1A = A	multiplicative scalar identity

Matrix-Vector Multiplication Properties

x is the solution to A**x** = b

A(**x**+**y**) = A**x**+A**y**

A(a**x**) = a(A**x**) = (aA)**x**

(A+B)**x** = A**x**+B**x**

Associated homogeneous system: A**x** = 0

Matrix-Matrix Multiplication Properties

IA = A and AI = A

A(BC) = (AB)C

A(B+C) = AB+AC

(B+C)A = BA+CA

a(AB) = (aA)B = A(aB)

$(AB)^T = B^TA^T$

Idempotent: $A^2 = A$

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