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AI 61003 Lineau Algebra fou AI & ML Assignment 02 - Peroblem 02

Consider A E IR^{nxn} where A is an invertible matrix.

 $\max \max_{\mathbf{X}} (\mathbf{A}) = \max_{\mathbf{X}} \frac{\|\mathbf{A}\mathbf{X}\|_{2}}{\|\mathbf{X}\|_{2}}$

Equivalently, maxmag(A) = max || Ax ||₂ x \in ||₁ x ||₂ ||₁

minmag (A) = min $\|Ax\|_2$ $x \in \mathbb{R}^n$ $\|x\|_2$

Equivalently, min mag (A) = min 1/Ax/12 XERN

So maxmag (A) is the maximum magnificat that is produced by A & IR NXN on X & IR N when A linearly transforme x to Ax.

minmag (A) is the minimum magnification that is produced by A & IR NXN on X & IR N when A linearly transformed to Ax.

cond (A) is the condition number of matrix A that measures how much the output of linear transformat by A change for a small change in



	PAGE
	Input.
	For a matrix (invertible) AERNXN
	marmin moum 11.11
	$cond(A) = A A^{-1} $
	For 11. 112 moun (operator noun)
	cond, (A) (on K2 (A)) = 11 A112 11 A-112
	Equivalently k2(A) = max mag (A)
	min mag (A)
(0	$\frac{1}{x_{E_1R^n}} \frac{1}{\ x\ _2}$
	X ≠ 0
	A-I EIRMXH, y EIRM So suplace x by
	A-1 & IRMXN y & IRM So suplace x by A-1 y (& IRM) in the definith.
	maxmag (A) = max 1/4/12
	9 E IK 11 A -1 4 11 2
	$A \cdot y \neq 0$
	Since A-1 is inventible, A-1y = 0 <=> y = 0
	: maxmg (A) = max 11 y 112
	9 e 1R 11 A -1 y 112
	$g \neq o$
	(-: y + 0 in the definit 1)
	maxmag (A) = [mm A-14112]
	ye 1R" 11y112
	9 = 0
	= (mmmag (A-1))
	Y
	: maxmag (A) = (minimag (A-1))
	U
	12. [1] - "이 전 다면기들은 15. [2] 전 다 이다면, 다니면 비용 다 생활했다면 하면보다는 나라들이 보고 있습니다. 나는 다른 다 모든 다 되었다.

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(b)	$coud(A) = A _2 A^{-1} _2$ = $max mag(A) \cdot max mag(A^{-1})$
	From (a), maxmag (A) = 1/minmag (A-1) Replace A by A-1. maxmag (A-1) = 1/minmag ((A-1)-1) = 1/minmag (A)
	=) cond (A) = maxmag (A) min mag (A)
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