Linear Algebra MAS4105 5441 | **A-InClass** | Prof. JLF King *Touch*: 16Mar2016

Please. Do ***not*** approx.: If your result is "$\sin(\sqrt{\pi})$" then write that rather than .9797$\cdots$.Use "$f(x)$ notation" when writing fncs; in particular, for trig and log fncs. E.g, write "$\sin(x)$" rather than the horrible $\sin x$ or $[\sin x]$. Write expressions unambiguously e.g, "$1/a+b$" should be bracketed either $[1/a]+b$ or $1/[a+b]$. (Be careful with **negative** signs!) Short answer: Show no work.

A6: Please write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed.

a $\mathsf{A} := \begin{bmatrix} \sqrt{2} & 0 & -\sqrt{3} \\ 0 & -1 & 5 \end{bmatrix}$. Then $\mathsf{A}^2 =$ _____.

b $\mathsf{M} := \begin{bmatrix} -4 & 7 \\ 1 & 2 \end{bmatrix}$. Compute M^{-1} over these three fields. [Write your $\mathbb{Z}_p$ answers using symmetric residues.]

Over $\mathbb{Z}_5$: $\mathsf{M}^{-1} =$ _____. Over $\mathbb{Z}_7$: $\mathsf{M}^{-1} =$ _____.

Over $\mathbb{Q}$: $\mathsf{M}^{-1} =$ _____.

c $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}^{16} =$ _____.

d,e Let $\mathsf{P}:\mathbb{R}^{\times 2}\circlearrowleft$ be orthogonal projection on the slope=5 line through the origin. W.r.t. the std basis,

then, the 2×2 matrix $[\mathsf{P}]_{\mathcal{E}}^{\mathcal{E}} =$ _____.

A7: *Here*, let *AT* mean "Always True", *AF* mean "Always False" and *Nei* mean "Neither always true nor always false". Below, $\mathbf{v}, \mathbf{w}, \mathbf{x}$ repr. *distinct, non-zero* vectors in $\mathbb{R}^4$, a $\mathbb{R}$-VS. Please circle the correct response:

y1 If $\mathbf{x} \notin \text{Spn}\{\mathbf{v}, \mathbf{w}\}$ then $\{\mathbf{v}, \mathbf{w}, \mathbf{x}\}$ is linearly independent. *AT AF Nei*

y2 Collection $\{\mathbf{0}, \mathbf{x}\}$ is linearly-indep. *AT AF Nei*

y3 $\text{Spn}\{\mathbf{v}, \mathbf{w}, \mathbf{x}, \mathbf{v}+2\mathbf{w}+3\mathbf{x}\}$ is all of $\mathbb{R}^4$. *AT AF Nei*

y4 If none of $\mathbf{v}, \mathbf{w}, \mathbf{x}$ is a multiple of the other vectors, then $\{\mathbf{v}, \mathbf{w}, \mathbf{x}\}$ is linearly independent. *AT AF Nei*

A8: Let $\mathsf{R} := \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix}$. Then

$$\mathsf{R}^{147} = \begin{bmatrix} & \\ & \end{bmatrix}.$$

[*Hint:* The linear trn R is a rotation followed by a dilation.]

A9: A system of 3 linear equations in unknowns $x_1, \ldots, x_5$ reduces to the augmented matrix

$$\left[\begin{array}{ccccc|c} 1 & 1 & 0 & 0 & 1 & 12 \\ 0 & 0 & 1 & 0 & -8 & 34 \\ 0 & 0 & 0 & 1 & 5 & -56 \end{array}\right],$$

which is in RREF. Please circle each *pivot entry.*

OYOP, describe the *general solution* in this form,

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} ? \\ ? \\ ? \\ ? \\ ? \end{bmatrix} + \alpha \begin{bmatrix} ? \\ ? \\ ? \\ ? \\ ? \end{bmatrix} + \beta \begin{bmatrix} ? \\ ? \\ ? \\ ? \\ ? \end{bmatrix} + \gamma \begin{bmatrix} ? \\ ? \\ ? \\ ? \\ ? \end{bmatrix} + \ldots$$

where each $\alpha, \beta, \gamma, \delta, \ldots$ is a free variable (either x_1 or$\ldots$or x_5), and each column vector has specific numbers in it. $\text{Dim}(\mathit{SolnFlat}) =$ _____.

A10: OASSOP, write out the following sentences, and complete them to give the correct definitions. Be specific with phrases "every", "all", "some", "there exists", etc.. *Avoid* the word "any".

A (possibly infinite) set $\mathcal{S} \subset \mathbf{V}$ of vectors is ***linearly dependent*** *IFF...*

A $K \times N$ matrix U is in ***reduced row echelon form*** *IFF...*

End of A-InClass

A-Home:	___ ___ ___	255pts
A6:	___ ___	50pts
A7:	___ ___	20pts
A8:	___ ___	20pts
A9:	___ ___	40pts
A10:	___ ___	30pts
Total:	___ ___ ___	415pts

Please PRINT your name and ordinal. Ta:

Ord: _____

HONOR CODE: *"I have neither requested nor received help on this exam other than from my professor."*

Signature: _____

Filename: `Classwork/LinearAlg/LinA2005t/a-cl.LinA2005t.latex`

As of: *Monday 31Aug2015.* Typeset: *16Mar2016* at *00:29.*