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★ Course / Week 3: Matrix-Vector Operations / 3.2 Special Matrices

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3.2.2 The Identity Matrix

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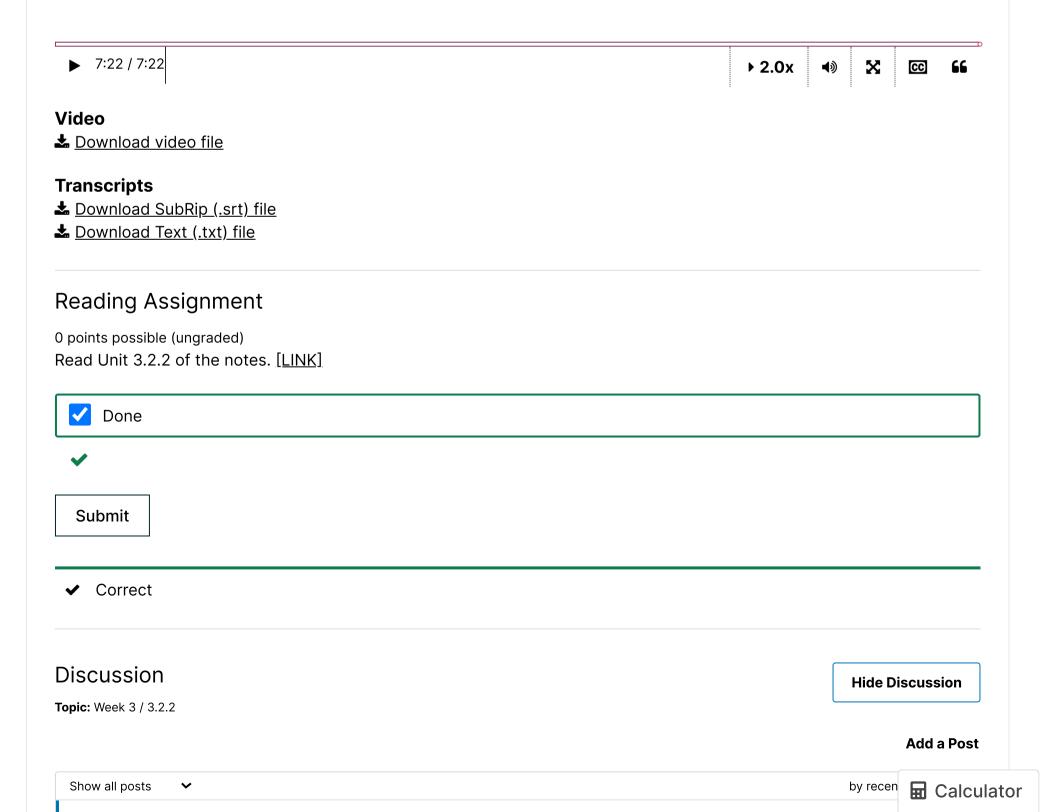
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■ Calculator

Week 3 due Oct 18, 2023 06:12 IST

3.2.2 The Identity Matrix





Homework 3.2.2.1

1/1 point (graded)

Let $L_1:\mathbb{R}^n o\mathbb{R}^n$ be the function defined for every $x\in\mathbb{R}^n$ as L_1 (x)=x.

 L_1 is a linear transformation.

TRUE ✓ ✓ Answer: TRUE

Explanation

 $L_{1}\left(lpha x
ight) =lpha x=lpha L_{1}\left(x
ight)$ and

$$L_{1}\left(x+y
ight) =x+y=L_{1}\left(x
ight) +L_{1}\left(y
ight) .$$

Submit

Answers are displayed within the problem

Homework 3.2.2.2

1/1 point (graded)

With the FLAME@lab API, write a function that sets the entries of a given square matrix to an identity matrix, one column at a time, based on the algorithm

Algorithm:
$$[A] := \text{SET.TO.IDENTITY}(A)$$

Partition $A \rightarrow \begin{pmatrix} A_{TL} & A_{TR} \\ A_{BL} & A_{BR} \end{pmatrix}$

where A_{TL} is 0×0

while $m(A_{TL}) < m(A)$ do

Repartition

$$\begin{pmatrix} A_{TL} & A_{TR} \\ A_{BL} & A_{BR} \end{pmatrix} \rightarrow \begin{pmatrix} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{pmatrix}$$

where α_{11} is 1×1

set current column to appropriate unit basis vector $a_{01} := 0$ set a_{01} 's components to zero $\alpha_{11} := 1$
 $a_{21} := 0$ set a_{21} 's components to zero

Continue with

$$\begin{pmatrix} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{pmatrix} \leftarrow \begin{pmatrix} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{pmatrix}$$
endwhile

You will use the functions $laff_{zerov}(x)$ and $laff_{onev}(x)$, which respectively return a zero vector and a vector of all ones of the same size and shape (column or row) as input vector x. Check if these routines are in directory

If not, download them into that directory from

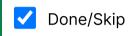
- laff_zerov.m
- laff_onev.m

and place them in that directory, in files $laff_{zerov.m}$ and $laff_{onev.m}$. Since this is the first time that you will "move" through a matrix from top-left to bottom-right (TL \rightarrow BR), you will want to follow the instructions in the video below this homework.

Some links that will come in handy:

- Spark (alternatively, open the file LAFF-2.0xM/Spark/index.html)
- <u>PictureFLAME</u> (alternatively, open the file LAFF-2.0xM/PictureFLAME/PictureFLAME.html)

You will need these in many future exercises. Bookmark them!





Answer:

- · See below video
- View a document that we put together that has most algorithms and MATLAB implementations that are homework problems in this week:

Week 3 algorithms and implementations.

This document is best viewed two pages, side by side, so that you can see the algorithm on the left and its implementation on the right.

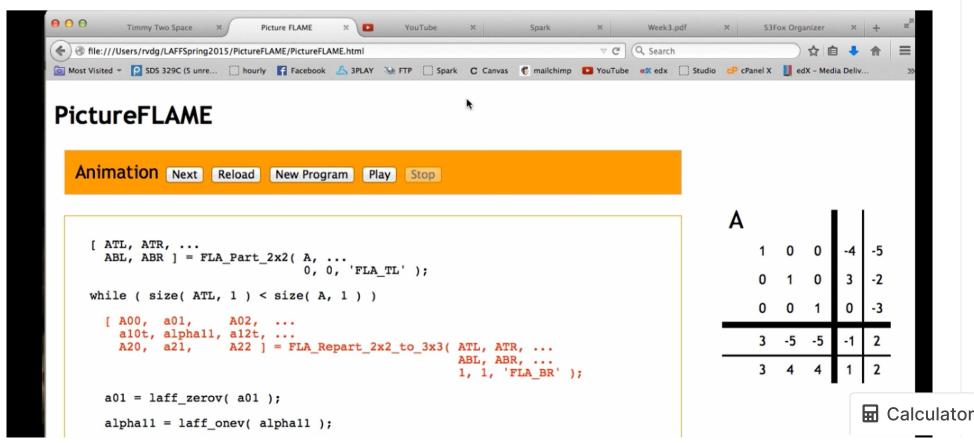
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Answers are displayed within the problem

On the slide used in video 3.2.2, around timestamp 3:12, that there's a couple little things that should be changed (but won't be because redoing videos is time consuming...):

- Eliminate the phrase *where 0 denotes the zero vector "of appropriate size":*. As the video and slide are about the identity transformation L_I, this seems to be irrelevant.
- Next to the first vector, I believe the "L_0" should be "L_I." Also there's that singular left parenthesis.

A thanks to participant "Zuarrie" for pointing this out.



```
a10t = laff_zerov( a10t );
[ ATL, ATR, ...
ABL, ABR ] = FLA_Cont_with_3x3_to_2x2( A00, a01,
                                                 al0t, alphal1, al2t, ...
                                                 A20, a21, 
'FLA_TL');
                                                                   A22, ...
```

8:24 / 8:28

▶ 2.0x

X

CC

66

Video

L Download video file

Transcripts

- **▲** Download SubRip (.srt) file

Homework 3.2.2.3

1/1 point (graded)

In the MATLAB Command Window, type

A = eye(4,4)

What is the resulting matrix?

- $0 \ 0 \ 0 \ 0$
 - 0 0 0 0 0
 - $0 \ 0 \ 0 \ 0$
 - 0 0 0 0 0
- \bigcirc 0 0 0 0
 - $0 \ 0 \ 0 \ 0$
 - 0 0 0 0
 - 0 0 0 0
 - 0 0 0 0



0 1 0 0 0

0 1 0 0

 $0 \ 0 \ 1 \ 0$

 $0 \ 0 \ 0 \ 1$

None of the above



The result is

```
>> eye( 4, 4)
ans =
```

Submit

1 Answers are displayed within the problem

⊞ Calculator

Homework 3.2.2	.4
1/1 point (graded)	riy ta Timmy Two Chago What hannana?
apply the identity mat	rix to Timmy Two Space. What happens?
Timmy shifts of	the grid.
Timmy disappea	ars into the origin.
Timmy become	s a line of the x-axis.
Timmy become	s a line of the y-axis.
Timmy doesn't o	change at all.
~	
Evolonation	
Explanation The identity matrix, wl	nen applied to any vector, will not change the original vector at all. This is part of the definition of the
dentity matrix.	
dentity matrix.	
dentity matrix. Submit	
Submit	layed within the problem
Submit	
Submit • Answers are disp	layed within the problem
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Answers are disp Homework 3.2.2 1/1 point (graded) The trace of a matrix of the trace of a matrix of the trace of a matrix of the trace of the tr	layed within the problem .5 equals the sum of the diagonal of the matrix. What is the trace of the identity $I \in \mathbb{R}^{nxn}$? \checkmark Answer: n
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Submit Answers are disp Homework 3.2.2 1/1 point (graded) The trace of a matrix of n Explanation There are \$ n \$ ones of	layed within the problem .5 equals the sum of the diagonal of the matrix. What is the trace of the identity $I \in \mathbb{R}^{nxn}$? \checkmark Answer: n

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