12.2.3 Diagonalization

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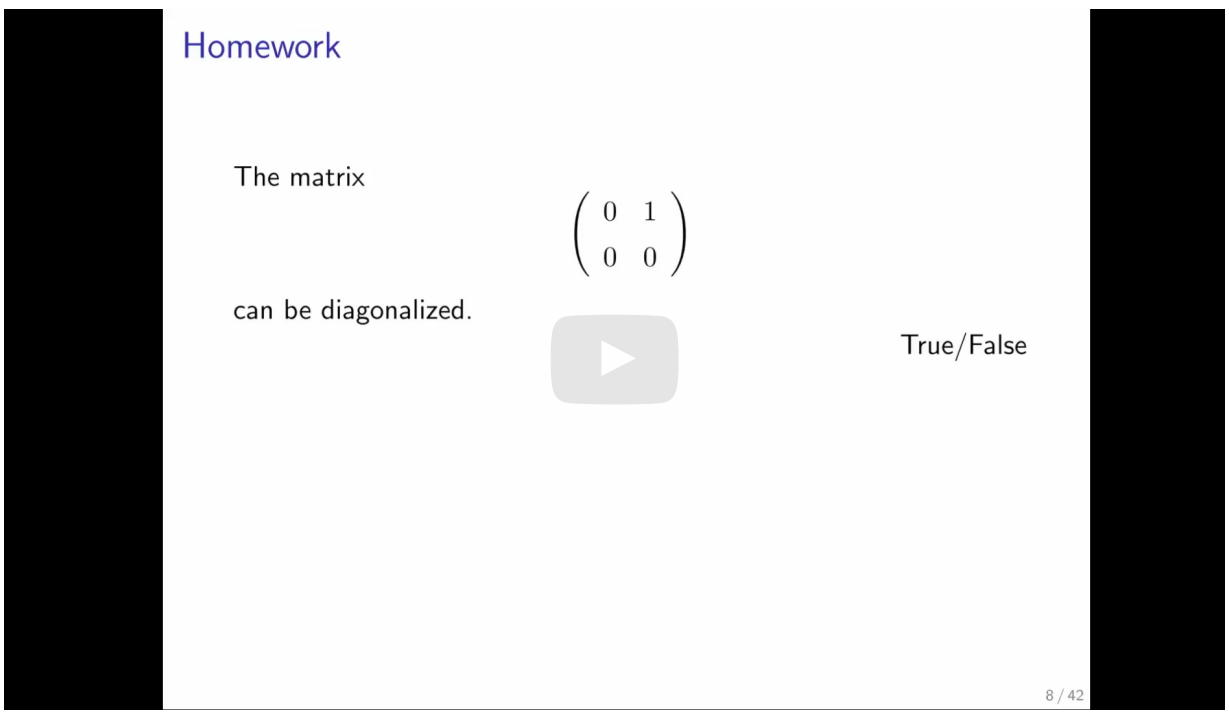
Week 12 due Dec 29, 2023 10:42 IST

12.2.3 Diagonalization

Video 12.2.3 Part 1



▶ 4:49 / 4:49 2.0x

many linearly independent eigenvectors

you can find.

And that tells you something about whether, at least,

you can use the steps for the last example

to find a matrix that diagonalizes this matrix.

Go and do this homework and see me in the next video.

End of transcript. Skip to the start.

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Reading Assignment

0 points possible (ungraded)
Read Unit 12.2.3 of the notes. [LINK]

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? Question 4

Calculator

Homework 12.2.3.1

10/10 points (graded)

The matrix $\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$ can be diagonalized.

FALSE ✔ Answer: FALSE

Since this matrix is upper triangular, we know that only the scalar $\lambda_0 = \lambda_1 = 0$ is an eigenvector. The problem is that the dimension of the null space of this matrix

$$\dim\left(\mathcal{N}\left(A - \lambda I\right)\right) = \dim(\mathcal{N}\left(\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}\right) = 1.$$

Thus, we cannot find two linearly independent eigenvectors to choose as the columns of matrix X.

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Answers are displayed within the problem

Video 12.2.3 Part 2

0:00 / 0:00 2.0x

Start of transcript. Skip to the end.

Dr. Robert van de Geijn: So clearly here the only eigenvalues

is allowed to equal 0.

Why?

Because this is an upper triangular matrix and it

has zeros on the diagonal.

We also know that the dimension of the null space

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Homework 12.2.3.2

10.0/10.0 points (graded)

In Homework 12.2.2.7 you considered the matrix

$$A = \begin{pmatrix} 1 & 3 \\ 3 & 1 \end{pmatrix}$$

and computed the eigenpairs

Calculator

$$(4, \begin{pmatrix} 1 \\ 1 \end{pmatrix}) \quad \text{and} \quad (-2, \begin{pmatrix} 1 \\ -1 \end{pmatrix}).$$

- Matrix A can be diagonalized by matrix $X =$

  (Yes, this matrix is not unique, so please use the info from the eigenpairs, in order...)

  1 ✔ Answer: 1 | 1 ✔ Answer: 1

  1 ✔ Answer: 1 | -1 ✔ Answer: -1

  $$\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$$

- $AX =$ 4 ✔ Answer: 4 | -2 ✔ Answer: -2; 4 ✔ Answer: 4 | 2 ✔ Answer: 2

  $$\begin{pmatrix} 4 & -2 \\ 4 & 2 \end{pmatrix}$$

- $X^{-1} =$ 1/2 ✔ Answer: .5 | 1/2 ✔ Answer: .5; 1/2 ✔ Answer: .5 | -1/2 ✔ Answer: -.5

  $$\begin{pmatrix} 0.5 & 0.5 \\ 0.5 & -0.5 \end{pmatrix}$$

- $X^{-1}AX =$ 4 ✔ Answer: 4 | 0 ✔ Answer: 0; 0 ✔ Answer: 0 | -2 ✔ Answer: -2

  $$\begin{pmatrix} 4 & 0 \\ 0 & -2 \end{pmatrix}$$

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