6.2.3 Gauss Transforms

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Week 6 due Nov 13, 2023 12:12 IST Completed

6.2.3 Gauss Transforms

Start of transcript. Skip to the end.

Dr. Robert van de Geijn: Next on our journey towards an algorithm,

we introduce a special kind of matrix called a Gauss transform.

Here is our appended system again.

And we're still going to reduce our appended system to upper triangular

form, but now we're going to use Gauss

0:00 / 0:00 2.0x

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Reading Assignment

0 points possible (ungraded)

Read Unit 6.2.3 of the notes. [LINK]

Done

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Homework 6.2.3.1

60/60 points (graded)

Be careful filling in the answers. The "boxes" are place a bit awkwardly. The formatting gave us trouble...

Print out the Downloadable PDF for the exercise and fill in the values in the boxes. Then, answer the questions at the end of this homework.

$$\begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & -2 \\ 4 & -2 & 6 \\ 6 & -4 & 2 \end{pmatrix} = \begin{pmatrix} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ \boxed{\alpha_{1,0}} & \boxed{\alpha_{1,1}} & \boxed{\alpha_{1,2}} \\ \boxed{\alpha_{2,0}} & \boxed{\alpha_{2,1}} & \boxed{\alpha_{2,2}} \end{pmatrix}.$$

Calculator

$$\begin{pmatrix} \alpha_{0,0} & \alpha_{0,1} & \alpha_{0,2} \\ \alpha_{1,0} & \alpha_{1,1} & \alpha_{1,2} \\ \alpha_{2,0} & \alpha_{2,1} & \alpha_{2,2} \end{pmatrix} =$$

2 ✔ Answer: 2 | 4 ✔ Answer: 4 | -2 ✔ Answer: -2

0 ✔ Answer: 0 | -10 ✔ Answer: -10 | 10 ✔ Answer: 10

6 ✔ Answer: 6 | -4 ✔ Answer: -4 | 2 ✔ Answer: 2

Explanation

$$\left(\begin{array}{ccc} 1 & 0 & 0 \\ -2 & 1 & 0 \\ 0 & 0 & 1 \end{array}\right)\left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 4 & -2 & 6 \\ \hline 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 0 & -10 & 10 \\ \hline 6 & -4 & 2 \end{array}\right).$$

$$\left(\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 345 & 0 & 1 \end{array}\right)\left(\begin{array}{ccc} 2 & 4 & -2 \\ 4 & -2 & 6 \\ 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ \boxed{\alpha_{1,0}} & \boxed{\alpha_{1,1}} & \boxed{\alpha_{1,2}} \\ \star & \star & \star \end{array}\right).$$

$$\begin{matrix} \alpha_{0,0} & \alpha_{0,1} & \alpha_{0,2} \\ \alpha_{1,0} & \alpha_{1,1} & \alpha_{1,2} \end{matrix} =$$

2 ✔ Answer: 2 | 4 ✔ Answer: 4 | -2 ✔ Answer: -2

4 ✔ Answer: 4 | -2 ✔ Answer: -2 | 6 ✔ Answer: 6

Explanation

$$\left(\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 345 & 0 & 1 \end{array}\right)\left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 4 & -2 & 6 \\ \hline 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 4 & -2 & 6 \\ \hline \star & \star & \star \end{array}\right).$$

$$\left(\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -3 & 0 & 1 \end{array}\right)\left(\begin{array}{ccc} 2 & 4 & -2 \\ 4 & -2 & 6 \\ 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ \boxed{\alpha_{1,0}} & \boxed{\alpha_{1,1}} & \boxed{\alpha_{1,2}} \\ \boxed{\alpha_{2,0}} & \boxed{\alpha_{2,1}} & \boxed{\alpha_{2,2}} \end{array}\right).$$

$$\begin{pmatrix} \alpha_{0,0} & \alpha_{0,1} & \alpha_{0,2} \\ \alpha_{1,0} & \alpha_{1,1} & \alpha_{1,2} \\ \alpha_{2,0} & \alpha_{2,1} & \alpha_{2,2} \end{pmatrix} =$$

2 ✔ Answer: 2 | 4 ✔ Answer: 4 | -2 ✔ Answer: -2

4 ✔ Answer: 4 | -2 ✔ Answer: -2 | 6 ✔ Answer: 6

0 ✔ Answer: 0 | -16 ✔ Answer: -16 | 8 ✔ Answer: 8

Calculator

Explanation

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -3 & 0 & 1 \end{pmatrix} \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 4 & -2 & 6 \\ 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 4 & -2 & 6 \\ 0 & -16 & 8 \end{array}\right).$$

$$\begin{pmatrix} 1 & 0 & 0 \\ \boxed{\lambda_{1,0}} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & -2 \\ 2 & -2 & 6 \\ 6 & -4 & 2 \end{pmatrix} = \begin{pmatrix} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ 0 & \alpha_{1,1} & \alpha_{1,2} \\ \boxed{\alpha_{2,0}} & \boxed{\alpha_{2,1}} & \boxed{\alpha_{2,2}} \end{pmatrix}.$$

$$\begin{matrix} \alpha_{0,1} & \alpha_{0,2} \\ \alpha_{1,1} & \alpha_{1,2} \\ \alpha_{2,1} & \alpha_{2,2} \end{matrix} = \begin{matrix} \text{4} \\ \text{-6} \\ \text{-4} \end{matrix} \begin{matrix} \text{✔ Answer: 4} \\ \text{✔ Answer: -6} \\ \text{✔ Answer: -4} \end{matrix} \quad \begin{matrix} \text{-2} \\ \text{8} \\ \text{2} \end{matrix} \begin{matrix} \text{✔ Answer: -2} \\ \text{✔ Answer: 8} \\ \text{✔ Answer: 2} \end{matrix}$$

$\lambda_{1,0} =$ -1 ✔ Answer: -1

$\alpha_{0,0} =$ 2 ✔ Answer: 2

$\alpha_{2,0} =$ 6 ✔ Answer: 6

Explanation

$$\begin{pmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \left(\begin{array}{ccc} 2 & 4 & -2 \\ 2 & -2 & 6 \\ \hline 6 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ 0 & -6 & 8 \\ \hline 6 & -4 & 2 \end{array}\right).$$

$$\begin{pmatrix} 1 & 0 & 0 \\ \boxed{\lambda_{1,0}} & 1 & 0 \\ \boxed{\lambda_{2,0}} & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & -2 \\ 2 & -2 & 6 \\ -4 & -4 & 2 \end{pmatrix} = \begin{pmatrix} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ 0 & \boxed{\alpha_{1,1}} & \boxed{\alpha_{1,2}} \\ 0 & \boxed{\alpha_{2,1}} & \boxed{\alpha_{2,2}} \end{pmatrix}.$$

$$\begin{matrix} \alpha_{0,1} & \alpha_{0,2} \\ \alpha_{1,1} & \alpha_{1,2} \\ \alpha_{2,1} & \alpha_{2,2} \end{matrix} = \begin{matrix} \text{4} \\ \text{-6} \\ \text{4} \end{matrix} \begin{matrix} \text{✔ Answer: 4} \\ \text{✔ Answer: -6} \\ \text{✔ Answer: 4} \end{matrix} \quad \begin{matrix} \text{-2} \\ \text{8} \\ \text{-2} \end{matrix} \begin{matrix} \text{✔ Answer: -2} \\ \text{✔ Answer: 8} \\ \text{✔ Answer: -2} \end{matrix}$$

$\lambda_{1,0} =$ -1 ✔ Answer: -1

Calculator

$\lambda_{2,0} =$

2 ✔ Answer: 2

$\alpha_{0,0} =$

2 ✔ Answer: 2

Explanation

$$\begin{pmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 2 & 0 & 1 \end{pmatrix} \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 2 & -2 & 6 \\ \hline -4 & -4 & 2 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 0 & -6 & 8 \\ \hline 0 & 4 & -2 \end{array}\right).$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \boxed{\lambda_{2,1}} & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & -2 \\ 0 & -10 & 10 \\ 0 & -16 & 8 \end{pmatrix} = \begin{pmatrix} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & \boxed{\alpha_{0,2}} \\ \boxed{\alpha_{1,0}} & \boxed{\alpha_{1,1}} & \boxed{\alpha_{1,2}} \\ \boxed{\alpha_{2,0}} & 0 & \boxed{\alpha_{2,2}} \end{pmatrix}.$$

$$\begin{matrix} \alpha_{0,0} & \alpha_{0,2} \\ \alpha_{1,0} & \alpha_{1,2} \\ \alpha_{2,0} & \alpha_{2,2} \end{matrix} =$$

2 ✔ Answer: 2 -2 ✔ Answer: -2

0 ✔ Answer: 0 10 ✔ Answer: 10

0 ✔ Answer: 0 -8 ✔ Answer: -8

$\lambda_{2,1} =$

-8/5 ✔ Answer: -1.6

$\alpha_{0,1} =$

4 ✔ Answer: 4

$\alpha_{1,1} =$

-10 ✔ Answer: -10

$$\begin{pmatrix} 1 & 0 & \boxed{\upsilon_{0,2}} \\ 0 & 1 & \boxed{\upsilon_{1,2}} \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & 4 & -8 \\ 1 & 1 & -4 \\ -1 & -2 & 4 \end{pmatrix} = \begin{pmatrix} \boxed{\alpha_{0,0}} & \boxed{\alpha_{0,1}} & 0 \\ \boxed{\alpha_{1,0}} & \boxed{\alpha_{1,1}} & 0 \\ \boxed{\alpha_{2,0}} & \boxed{\alpha_{2,1}} & \boxed{\alpha_{2,2}} \end{pmatrix}.$$

$$\begin{matrix} \alpha_{0,0} & \alpha_{0,1} \\ \alpha_{1,0} & \alpha_{1,1} \\ \alpha_{2,0} & \alpha_{2,1} \end{matrix} =$$

0 ✔ Answer: 0 0 ✔ Answer: 0

0 ✔ Answer: 0 -1 ✔ Answer: -1

-1 ✔ Answer: -1 -2 ✔ Answer: -2

$\upsilon_{0,2} =$

2 ✔ Answer: 2

$\upsilon_{1,2} =$

1 ✔ Answer: 1

Calculator

$\alpha_{2,2} =$

4 ✔ Answer: 4

Explanation

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -1.6 & 1 \end{pmatrix} \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 0 & -10 & 10 \\ \hline 0 & -16 & 8 \end{array}\right) = \left(\begin{array}{ccc} 2 & 4 & -2 \\ \hline 0 & -10 & 10 \\ \hline 0 & 0 & -8 \end{array}\right).$$

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Answers are displayed within the problem

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✖

Grrrr. In the following video, Robert made a sign error in the final step:

From one of the particupants:

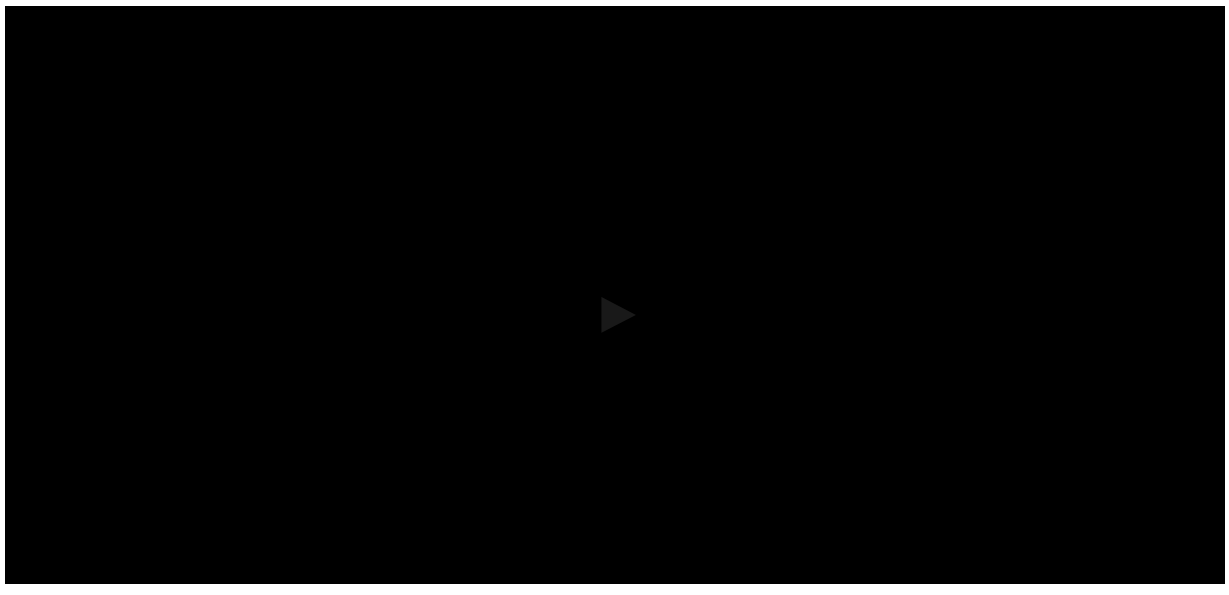
I just want to clarify that the final answer for the homework 6.2.3.2 shown in the video should be

```
1     1     2    -1
0    -2     1    -4
0     0    **2**    -4
```

NOT

```
1     1     2    -1
0    -2     1    -4
0     0    **-2**    -4
```

Video for Homework 6.2.3.2



And you see that this term becomes a 0 minus 3 times that plus that is

minus 2.

Minus 3 times that plus that is 1.

Minus 3 times that plus that is minus 4.

Let's see, this minus that is 0.

This minus that, a 6.

This minus that is minus 1.

This minus that is 8.

And then you need a new Gauss transform, where again if you just have 1's

on the diagonal that's just the ic

and nothing happens

Calculator

and nothing happens.

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Calculator