10.2.1 Example

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Week 10 due Dec 16, 2023 07:42 IST Completed

10.2.1 Example

Video

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Dr. Robert van de Geijn: All you will find in this unit

is a problem that we will use to illustrate insights

in subsequent units.

Go ahead and do the homework.

0:00 / 0:00 2.0x

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Reading Assignment

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Calculator

Homework 10.2.1.1

20/20 points (graded)

Consider the linear system of equations

$$\underbrace{\begin{pmatrix} 1 & 3 & 1 & 2 \\ 2 & 6 & 4 & 8 \\ 0 & 0 & 2 & 4 \end{pmatrix}}_{A} \underbrace{\begin{pmatrix} \chi_0 \\ \chi_1 \\ \chi_2 \\ \chi_3 \end{pmatrix}}_{x} = \underbrace{\begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix}}_{b}.$$

After writing the above as an appended system and reducing it to row echelon form (but NOT reduced row echelon form) we end up with the following appended system:

$$\left(\begin{array}{cccc|c} \alpha_{0,0} & \alpha_{0,1} & \alpha_{0,2} & \alpha_{0,3} & \beta_0 \\ \alpha_{1,0} & \alpha_{1,1} & \alpha_{1,2} & \alpha_{1,3} & \beta_1 \\ \alpha_{2,0} & \alpha_{2,1} & \alpha_{2,2} & \alpha_{2,3} & \beta_2 \end{array}\right).$$

where

$$\begin{matrix} \alpha_{0,0} & \alpha_{0,1} & \alpha_{0,2} & \alpha_{0,3} \\ \alpha_{1,0} & \alpha_{1,1} & \alpha_{1,2} & \alpha_{1,3} \\ \alpha_{2,0} & \alpha_{2,1} & \alpha_{2,2} & \alpha_{2,3} \end{matrix} =$$

1 ✔	3 ✔	1 ✔	2 ✔
Answer: 1	Answer: 3	Answer: 1	Answer: 2
0 ✔	0 ✔	2 ✔	4 ✔
Answer: 0	Answer: 0	Answer: 2	Answer: 4
0 ✔	0 ✔	0 ✔	0 ✔
Answer: 0	Answer: 0	Answer: 0	Answer: 0

$$\begin{matrix} \beta_0 \\ \beta_1 \\ \beta_2 \end{matrix} = \begin{matrix} 1 \text{ ✔ Answer: 1} \\ 1 \text{ ✔ Answer: 1} \\ 0 \text{ ✔ Answer: 0} \end{matrix}$$

The pivot in the first row is:

- (●) $\alpha_{0,0}$
- ( ) $\alpha_{0,1}$
- ( ) $\alpha_{0,2}$
- ( ) $\alpha_{0,3}$
- ( ) none

✔

Calculator

The pivot in the second row is:

- $\alpha_{1,0}$
- $\alpha_{1,1}$
- **$\alpha_{1,2}$** ✔
- $\alpha_{1,3}$
- none

✔

The pivot in the third row is:

- $\alpha_{2,0}$
- $\alpha_{2,1}$
- $\alpha_{2,2}$
- $\alpha_{2,3}$
- none ✔

✔

Identify the free variables (mark all):

- χ_0
- χ_1 ✔
- χ_2
- χ_3 ✔

✔

Identify the dependent variables (mark all):

- χ_0 ✔
- χ_1
- χ_2 ✔
- χ_3

✔

$$\left(\begin{array}{cccc|c} 1 & 3 & 1 & 2 & 1 \\ 2 & 6 & 4 & 8 & 3 \end{array}\right) \rightarrow \left(\begin{array}{cccc|c} \boxed{1} & 3 & 1 & 2 & 1 \\ 0 & 0 & \boxed{2} & 4 & 1 \end{array}\right).$$

Calculator

$$\left(\begin{array}{cccc|c} 0 & 0 & 2 & 4 & 1 \end{array}\right) \qquad \left(\begin{array}{cccc|c} 0 & 0 & 0 & 0 & 0 \end{array}\right)$$

The pivots are highlighted. The free variables are χ_1 and χ_3 and the dependent variables are χ_0 and χ_2.

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