## 4.2.1 Partitioned Matrix-vector Multiplication

# 4.2.1 Partitioned Matrix-Vector Multiplication

Consider the given 5 by 5 matrix A and vectors x and y each of size 5.

In this example, we partition the matrix into a 3

by 3 matrix of submatrices delineated by the shown lines.

Correspondingly, x and y are subdivided into 3 subvectors.

A partitioned matrix vector multiplication

is now a matrix vector multiplication where

we work with the submatrices and subvectors that

result from the partitioning.

Here we just showed symbols used to describe the submatrices

and subvectors.

A00, A01, et cetera.

When you perform the

4:48 / 4:50 1.0x

when you perform the
partitioned matrix vector
multiplication,

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# Homework 4.2.1.1

1/1 point (graded)

Consider

$$A = \begin{pmatrix} -1 & 2 & 4 & 1 & 0 \\ 1 & 0 & -1 & -2 & 1 \\ 2 & -1 & 3 & 1 & 2 \\ 1 & 2 & 3 & 4 & 3 \\ -1 & -2 & 0 & 1 & 2 \end{pmatrix} \text{ and } x = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{pmatrix},$$

and partition these into submatrices (regions) as follows:

$$\left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline a_{10}^T & \alpha_{11} & a_{12}^T \\ \hline A_{20} & a_{21} & A_{22} \end{array}\right) \text{ and } \left(\begin{array}{c} x_0 \\ \hline \chi_1 \\ \hline x_2 \end{array}\right),$$

where $A_{00} \in \mathbb{R}^{3x3}$, $x_0 \in \mathbb{R}^3$, $\alpha_{11}$ is a scalar, and $\chi_1$ is a scalar. Show with lines how $A$ and $x$ are partitioned:

$$\left(\begin{array}{cc|c|cc} -1 & 2 & 4 & 1 & 0 \\ 1 & 0 & -1 & -2 & 1 \\ \hline 2 & -1 & 3 & 1 & 2 \\ \hline 1 & 2 & 3 & 4 & 3 \\ -1 & -2 & 0 & 1 & 2 \end{array}\right), \quad \left(\begin{array}{c} 1 \\ 2 \\ \hline 3 \\ \hline 4 \\ 5 \end{array}\right)$$

$$\left(\begin{array}{c|c|ccc} -1 & 2 & 4 & 1 & 0 \\ \hline 1 & 0 & -1 & -2 & 1 \\ \hline 2 & -1 & 3 & 1 & 2 \\ 1 & 2 & 3 & 4 & 3 \\ -1 & -2 & 0 & 1 & 2 \end{array}\right), \quad \left(\begin{array}{c} 1 \\ \hline 2 \\ \hline 3 \\ 4 \\ 5 \end{array}\right)$$

$$\left(\begin{array}{ccc|c|c} -1 & 2 & 4 & 1 & 0 \\ 1 & 0 & -1 & -2 & 1 \\ 2 & -1 & 3 & 1 & 2 \\ \hline 1 & 2 & 3 & 4 & 3 \\ \hline -1 & -2 & 0 & 1 & 2 \end{array}\right), \quad \left(\begin{array}{c} 1 \\ 2 \\ 3 \\ \hline 4 \\ \hline 5 \end{array}\right)$$

Not enough information

## Explanation

**Answer:**

$$\left(\begin{array}{rrr|r|r} -1 & 2 & 4 & 1 & 0 \\ 1 & 0 & -1 & -2 & 1 \\ 2 & -1 & 3 & 1 & 2 \\ \hline 1 & 2 & 3 & 4 & 3 \\ \hline -1 & -2 & 0 & 1 & 2 \end{array}\right) \left(\begin{array}{c} 1 \\ 2 \\ 3 \\ \hline 4 \\ \hline 5 \end{array}\right).$$

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Answers are displayed within the problem