

D-BAUG Informatik I

Exercise session: week 5

HS 2018

Homework

■ Questions?

Matrix and Vector in Java

Vector v of length n :

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```
double[] v = new double[n];
```

Matrix M with n rows and m columns:

Matrix and Vector in Java

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```
double[] v = new double[n];
```

Matrix M with n rows and m columns:

```
double M[][] = new double[n][m];
```

(a vector of length n of vectors of length m)

Task

Write a program that reads an $n \times m$ matrix of integers from the input. The input is top to bottom, left to right: elements of the first column, followed by elements of the second column, etc. Print the matrix in the typical orientation (a row on the matrix on each row of the output).

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- 2 For each column j (m in total), row i (n in total), read an integer from input and store it in the matrix.

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- 1 Allocate an $n \times m$ matrix.
- 2 For each column j (m in total), row i (n in total), read an integer from input and store it in the matrix.
- 3 For each row i (n in total), column j (m in total), print $M[i][j]$. Print a new line at the end of each row.

Matrix-Matrix-Multiplication

Let an $n \times m$ matrix A and an $m \times p$ matrix B be given

$$A = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1m} \\ A_{21} & A_{22} & \cdots & A_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nm} \end{bmatrix}$$

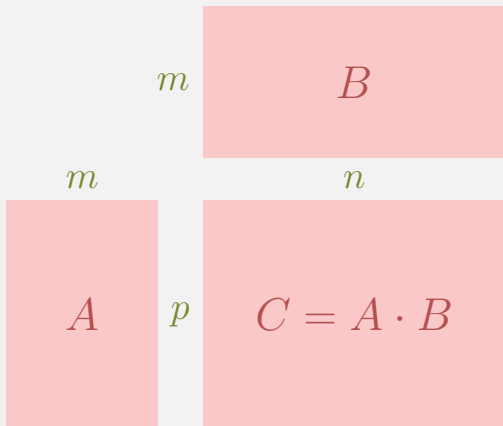
$$B = \begin{bmatrix} B_{11} & B_{12} & \cdots & B_{1p} \\ B_{21} & B_{22} & \cdots & B_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ B_{m1} & B_{m2} & \cdots & B_{mp} \end{bmatrix}$$

Matrix-Matrix-Multiplication

The matrix product of $n \times m$ matrix A and $m \times p$ matrix B is a new $n \times p$ matrix C

$$A \cdot B = C =: \begin{bmatrix} C_{11} & C_{12} & \cdots & C_{1p} \\ C_{21} & C_{22} & \cdots & C_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ C_{n1} & C_{n2} & \cdots & C_{np} \end{bmatrix}$$

Matrix-Matrix-Multiplication



Matrix-Matrix-Multiplication

$$C_{ij} = \sum_{k=1}^m A_{ik} \cdot B_{kj} \quad 1 \leq i \leq p, 1 \leq j \leq n$$

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- 2 Now think about the output: what kind of format do you use for output?
- 3 Write functions for In- and Output and test them. Always test small parts. What do you write first: input or output function?

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- 4 Write the core function for matrix multiplication.

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- 1 First think about the input: what kind of format do you use for input?
- 2 Now think about the output: what kind of format do you use for output?
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- 4 Write the core function for matrix multiplication.
- 5 Test your function with some test cases. How do you choose the cases?

Challenge

Now use your working function in our setup for image transformation: consider the Main method and add your matrix-matrix- multiplication function accordingly.