TECHNISCHE UNIVERSITÄT DRESDEN

INTRODUCTION TO MATLAB

Vectors and matrices

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01 Review of previous session

- Concatenating vectors
- Defining matrices
- Transpose of matrices
- Matrix indexing
- Wildcard :
- Operations between scalars, vectors and matrices

02 Exercises with matrices

Create the following matrices using one line of code:

1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

0	1	1	1	1	10
2	1	1	1	1	9
4	1	1	1	1	8
6	1	1	1	1	7
8	1	1	1	1	6
10	1	1	1	1	5
12	1	1	1	1	4
14	1	1	1	1	3
16	1	1	1	1	2
18	1	1	1	1	1
20	1	1	1	1	0

0	2	4	6	8	10
0	1	1	1	1	10
2	1	1	1	1	9
4	1	1	1	1	8
6	1	1	1	1	7
8	1	1	1	1	6
10	1	1	1	1	5
12	1	1	1	1	4
14	1	1	1	1	3
16	1	1	1	1	2
18	1	1	1	1	1
20	1	1	1	1	0
20	16	12	8	4	0

02 Matrix multiplication

For two matrices $\mathrm{A}_{\mathrm{n}\times\mathrm{m}}$ and $\mathrm{B}_{\mathrm{m}\times\mathrm{l}}$,
Then $\mathrm{C} = \mathrm{A} * \mathrm{B}$ is of size $\mathrm{n} \times \mathrm{l}$
The number of columns of A must be the same as the number of rows in B.
For example:

$$\mathrm{A} = \texttt{ones(3,4)} = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{pmatrix}, \mathrm{B} = \texttt{zeros(4,2)} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\mathrm{A} * \mathrm{B} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$

`size(A)`$= 3 \times 4$, `size(B)`$= 4 \times 2$, `size(A*B)`$= 3 \times 2$
Try the command: `size(ones(3,4)*zeros(4,2))`

02 Exersamples

1. Define the matrix MatA = $\begin{pmatrix} 1 & 2 & \cdots & 10 \\ 10 & 20 & \cdots & 100 \\ 100 & 200 & \cdots & 1000 \end{pmatrix}$
2. Create the matrix MatI = `eye(4)`
3. Create a matrix MatB with columns of MatA such that you can do MatB*MatI
4. Add rows to MatA so that you can multiply MatI*MatA. The new rows must follow the pattern in MatA
5. Create the vector VecA with the second row of MatA. Then delete the values 20 and 90 from it by assigning them to the empty vector "[ ]".
6. Delete the extra rows created in MatA by assigning an empty vector "[ ]" to these rows.
7. Select the appropiate operations that are possible: A□A′□`eye(3)` =

03 Operations

Matrix times matrix:

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \; B = \begin{pmatrix} w & x \\ y & z \end{pmatrix}$$

$$A. * B = \begin{pmatrix} aw & bx \\ cy & dz \end{pmatrix} \neq A * B$$

$$A./B = \begin{pmatrix} a/w & b/x \\ c/y & d/z \end{pmatrix} \neq A/B$$

$$A. \pm B = A \pm B = \begin{pmatrix} a \pm w & b \pm x \\ c \pm y & d \pm z \end{pmatrix}$$

$$A.\,\hat{}\,2 = \begin{pmatrix} a^2 & b^2 \\ c^2 & d^2 \end{pmatrix} \neq A\,\hat{}\,2$$

Note: the sizes of the two matrices in elementwise operations must be exactly the same.

03 Exceptions

- `2+ones(2,3)`
- `2*ones(2,3)`
- `2./ones(2,3)`
- `2.^ones(2,3)`

03 Exercises

1. Compute $S(N) = \sum_{n=1}^{N} \frac{1}{n} = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{N}$, for $N = 100$
2. Compute $G(N) = \sum_{n=1}^{N} x^n = x + x^2 + x^3 + \cdots + x^N, x = 0.5$, for $N = 100$