

# **MATLAB for beginners**

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## MATLAB Tutorial III

### • Properties of the matrix product

For any  $A \in \mathbb{R}^{p \times q}$  and  $B, C \in \mathbb{R}^{q \times r}$ ,

i) Not commutative:  $\mathbf{AB} \neq \mathbf{BA}$

$$\begin{aligned} \text{Let } A &= \begin{bmatrix} a & b \\ c & d \end{bmatrix}, B = \begin{bmatrix} e & f \\ g & h \end{bmatrix} \\ AB &= \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix} \\ BA &= \begin{bmatrix} e & f \\ g & h \end{bmatrix} \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix} \end{aligned}$$

```
A = [1 2;3 4];
```

```
B = [5 6;7 8];
```

```
A*B
```

```
B*A
```

ii) Distributive over matrix addition:  $\mathbf{A(B+C)} = \mathbf{AB+AC}$

```
A = [1 2;3 4];
```

```
B = [5 6;7 8];
```

```
C = [9 10;11 12];
```

```
A*(B+C)
```

```
A*B+A*C
```

iii) Associative:  $\mathbf{ABC} = \mathbf{A(BC)} = \mathbf{(AB)C}$

```
A = [1 2;3 4];
```

```
B = [5 6;7 8];
```

```
C = [9 10;11 12];
```

```
A*B*C
```

A\*(B\*C)

(A\*B)\*C

iv) Transpose of matrix product:  $(\mathbf{AB})^T = \mathbf{B}^T \mathbf{A}^T$

$$\mathbf{B}^T \mathbf{A}^T = \begin{bmatrix} e & g \\ f & h \end{bmatrix} \begin{bmatrix} a & c \\ b & d \end{bmatrix} = \begin{bmatrix} & \\ & \end{bmatrix}$$

A = [1 2; 3 4];

B = [5 6; 7 8];

(A\*B)'

B'\*A'

v) Traces:  $\mathbf{tr}(\mathbf{AB}) = \mathbf{tr}(\mathbf{BA})$

A = [1 2; 3 4];

B = [5 6; 7 8];

trace(A\*B)

trace(B\*A)

- **How to load/save variables from/to a file?**

**save filename (variable1 variable2...)** : Save workspace variables to file.

```
clear all;  
A = [1 2;3 4];  
B = [5 6;7 8];  
save data1.mat % save all variables in workspace to data1.mat  
save data2.mat A % save A only to data2.mat
```

**load filename (variable1 variable2...)** : Load variables from file into workspace.

```
clear all;  
load data1.mat A % load A only from data2.mat to workspace  
load data1.mat % load all variables from data1.mat to workspace
```

- **Q&A for homework 1**