

$u_1 \rightarrow$
 $u_2 \rightarrow$
 $u_3 \rightarrow$
 $u_4 \rightarrow$

$A = (a_{ij})$
 $12u_1 - u_2 + u_3 = 0$ Lij. zbirka

$\begin{pmatrix} * & * & * & * \\ * & * & * & * \\ * & * & * & * \end{pmatrix} \rightsquigarrow \begin{pmatrix} * & * & * & * \\ 0 & * & * & * \\ 0 & 0 & * & * \end{pmatrix}$

$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$

11 1-17:58

$0 + t(1, 1, 0)$

11 1-18:10

$A \cdot x = b$ $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$a x_1 + b x_2 = b_1$
 $c x_1 + d x_2 = b_2$

$\frac{a}{c} = \frac{b}{d}$
 $ad - bc = 0$

$\det A$

$\begin{pmatrix} * & * \\ * & * \end{pmatrix} \begin{matrix} + & 1 & 2 \\ - & 2 & 1 \end{matrix}$

11 1-18:20

$\begin{pmatrix} 1 & 2 & 3 & 7 \\ 3 & 4 & 1 & 2 \end{pmatrix}$ $\begin{pmatrix} 1 & 2 & 3 & 7 \\ 3 & 4 & 1 & 2 \end{pmatrix}$ transpozicija

$\begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{matrix}$

$+123 -132$
 $-213 +231$
 $-321 +312$

Th. Matematički indukcijom pokaži:

pokaži za $n=1$: jedna permutacija
 $n=2$: $\sigma(1)=1$ $\sigma(2)=2$
 $\sigma(2)=2$ $\sigma(1)=1$

$sp: \Sigma_n \rightarrow \{+1, -1\}$

11 1-18:28

rekursivno po $n+1$ permutacija σ :
 $\sigma(1), \sigma(2), \dots, \sigma(n), \sigma(n+1)$

lažna rekursivna

① permutacija od n elemenata
 $\Rightarrow n!$ mogućih σ_1, \dots

② uzmemo elemente $\sigma(1), \dots, \sigma(n)$ i stavimo ih na njihovo pravo mjesto u permutaciji σ i onda se $\sigma(n+1)$ može pojaviti na bilo kojem mjestu.

$\Rightarrow (n+1) \cdot n!$ mogućih σ s permutacijom σ

11 1-18:44

Th (elementarna determinanta)
 $A^T = (a'_{ij})$ $a'_{ij} = a_{ji}$ $A = (a_{ij})$

$|A^T| = \sum_{\sigma \in \Sigma_n} \text{sgn } \sigma \cdot a'_{1\sigma(1)} \cdot \dots \cdot a'_{n\sigma(n)}$

$= \sum_{\sigma \in \Sigma_n} \text{sgn } \sigma \cdot a_{\sigma(1)1} \cdot \dots \cdot a_{\sigma(n)n}$

$= \sum_{\tau \in \Sigma_n} \text{sgn } \tau^{-1} \cdot a_{1\tau(1)} \cdot a_{2\tau(2)} \cdot \dots \cdot a_{n\tau(n)}$

11 1-18:49

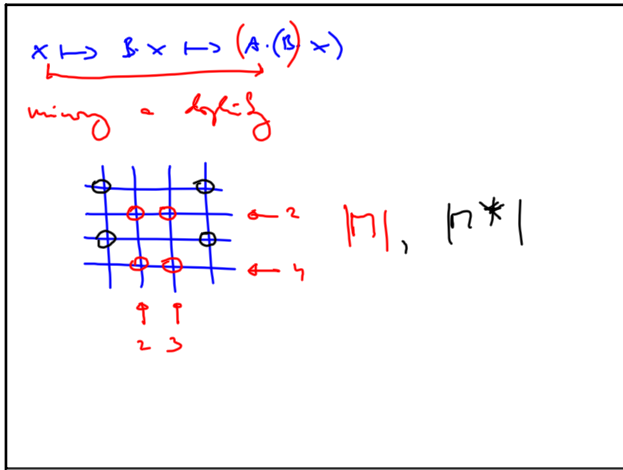
$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = \dots - a_{11}(a_{23} + a_{32}) + \dots$$

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$$

11 1-19:05

$$\det \begin{pmatrix} 2 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 0 \end{pmatrix} = \det \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1/2 & -1/2 \\ 0 & 1 & 0 \end{pmatrix} = \det \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = 1$$

11 1-19:10

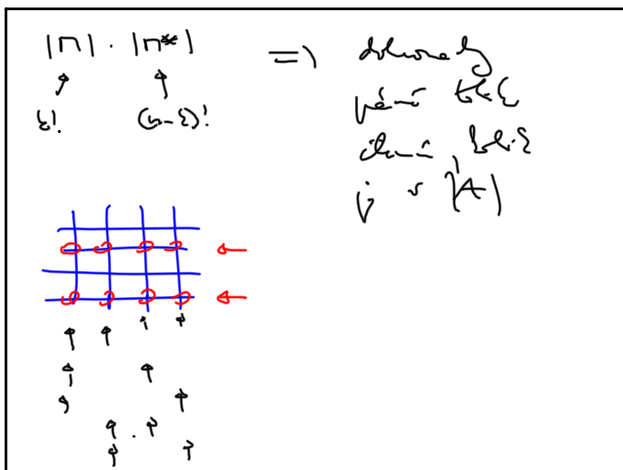


11 1-19:20

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad A \cdot A^* = \begin{pmatrix} ad-bc & 0 \\ 0 & ad-bc \end{pmatrix} = |A| \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$(A^*)^T = \begin{pmatrix} d & -c \\ -b & a \end{pmatrix}$$

11 1-19:32



11 1-19:38

$$\det \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix} = \det \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix} = 0$$

11 1-19:42

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \cdot \begin{pmatrix} b_{11} \\ b_{21} \end{pmatrix} = \begin{pmatrix} a_{11} \cdot b_{11} + a_{12} \cdot b_{21} \\ a_{21} \cdot b_{11} + a_{22} \cdot b_{21} \end{pmatrix}$$

11 1-19:45