

## Mathematics:

***N-ary relation  $R$  on  $n$  sets  $A_1, A_2, \dots, A_n$ :***

$$R \subseteq A_1 \times A_2 \times \dots \times A_n = \{(a_1, a_2, \dots, a_n) \mid a_1 \in A_1, a_2 \in A_2, \dots, a_n \in A_n\}$$

### ***Ex) Domains and relations***

$D_{LOGIN} = \{xsmith00, xsmith01, xblack00, xgreen05, xtaylor02, \dots\}$

$D_{FNAME} = \{Eve, Paul, Peter, Jane, \dots\}$

$D_{LNAME} = \{Adams, Black, Smith, Taylor, Green, \dots\}$

$D_{TOWN} = \{London, Prague, Lisbon, Ankara, \dots\}$

A relation  $R_{STUDENT}$  could look, for example, like this:

$R_{STUDENT} = \{(xblack00, Peter, Black, Prague),$   
 $(xadams00, Eve, Adams, Ankara),$   
 $(xadams01, Paul, Adams, Ankara)\}.$

This relation could be visualized as a table:

LOGIN	FNAME	LNAME	TOWN
xblack00	Peter	Black	Prague
xadams00	Eve	Adams	Ankara
xadams01	Paul	Adams	Ankara

### ***Ex) Normalised relation***

LOGIN	FNAME	LNAME	ADDRESS	
xblack00	Peter	Black	TOWN	FROM
			Prague	2000
xadams00	Eve	Adams	TOWN	FROM
			London	1990
			Ankara	2015
Xadams01	Paul	Adams	TOWN	FROM
			Ankara	1992

LOGIN	FNAME	LNAME	TOWN	FROM
xblack00	Peter	Black	Prague	2000
xadams00	Eve	Adams	London	1990
xadams00	Eve	Adams	Ankara	2015
Xadams01	Paul	Adams	Ankara	1992

**Ex) Primary and foreign keys**

## STUDENT

LOGIN	FNAME	LNAME	TOWN
xblack00	Peter	Black	Prague
xadams00	Eve	Adams	Ankara
Xadams01	Paul	Adams	Ankara

## PROJECT

NUMBER	NAME	STATEMENT	LOGIN
1	E - shop	Implement ...	adams01
2	OO databases	Study ...	xblack00
3	Web application	Develop ...	xadams00
4	Simple compiler	Design and ...	

### Ex) Determination of candidate keys in a relation

TEACHES (TEACHERNo, COURSENo, FORM, HOURS)

BORROWING (READERNo, BOOK\_COOPYNo, DATE\_FROM, DATE\_TO)

DISPOSES (CLIENTNo, CLIENT\_SSN, ACCOUNTNo, LIMIT)

### Ex) R where not c

## Ex) Expressions of the relational algebra as a query language

### STUDENT

LOGIN	FNAME	LNAME	TOWN
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### PROJEKT

NUMBER	NAME	STATEMENT	LOGIN
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Where does the student Peter Black live?

(STUDENT where FNAME='Peter' and LNAME='Black')[TOWN]

What is the name of project solved by the student Peter Black?

((STUDENT join PROJECT) where FNAME='Peter' and ,LNAME='Black')  
[NAME]