Database Management Systems

LECTURE 2

Conceptual Design

IITU, ALMATY, 2019

Database Design Stages

1. Subject Area Analysis
2. Conceptual Design
3. Logical Design
4. Physical Design

Conceptual Modeling

ER model (entity-relationship model) is a way of graphically representing the logical relationships of entities in order to create a database.

The ER model was first proposed by Peter Chen of Massachusetts Institute of Technology (MIT) in the 1970s.

To design an ER model you should know …

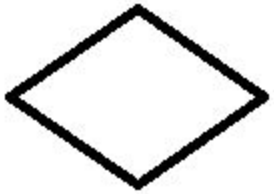
- Entities
- Attributes
- Relationships

First notation - Chen’s notation

- Entities (rectangle shape)

- Attributes (oval shape)

- Relationship (rhombus shape)



Example

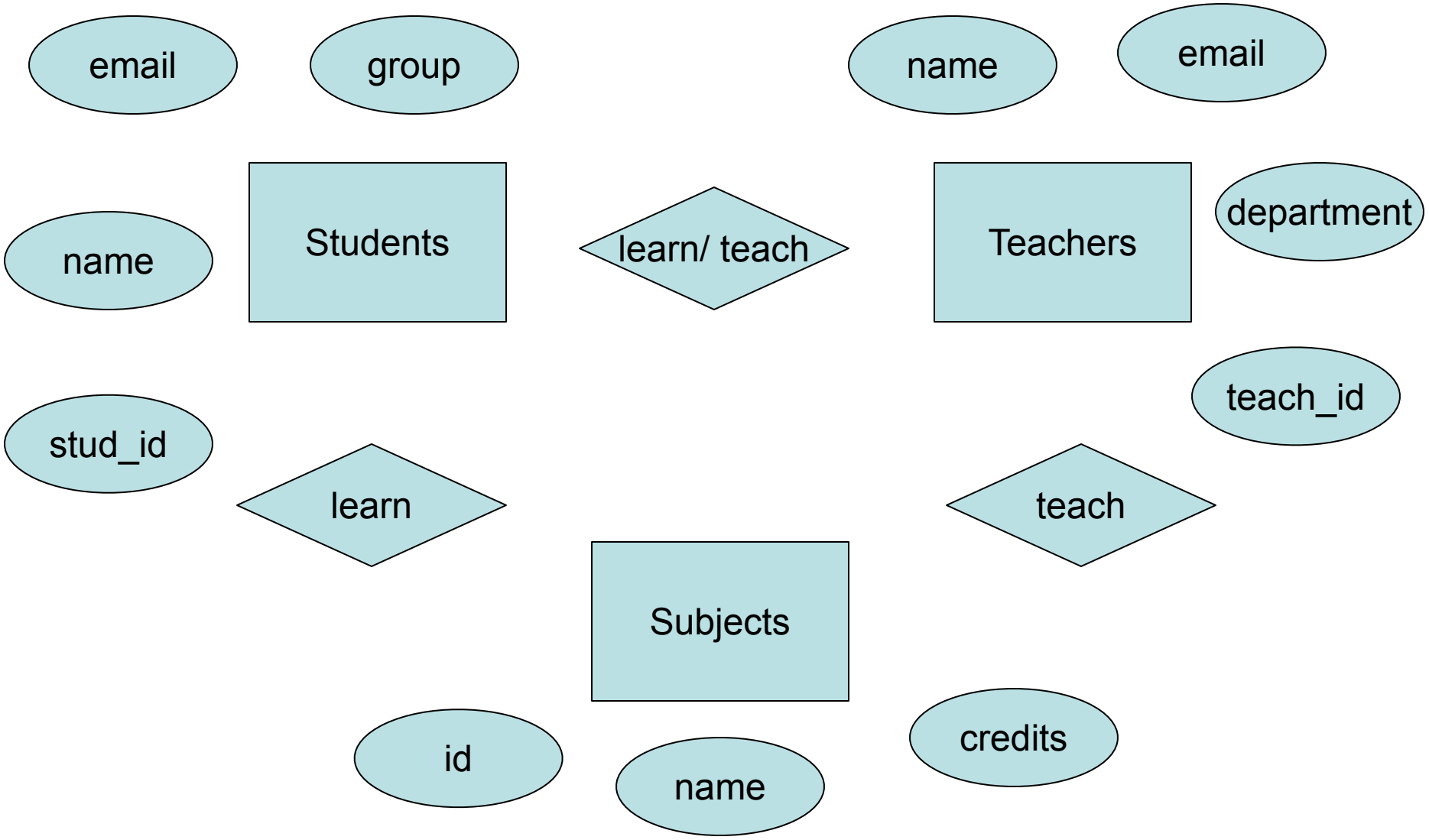
- Entities:

  Students
  Teachers
  Subjects

- Attributes

  Students (stud_id, name, email, group)
  Teachers (teach_id, name, email, department)
  Subjects (id, name, credits)

ER-diagram with Chen's notation

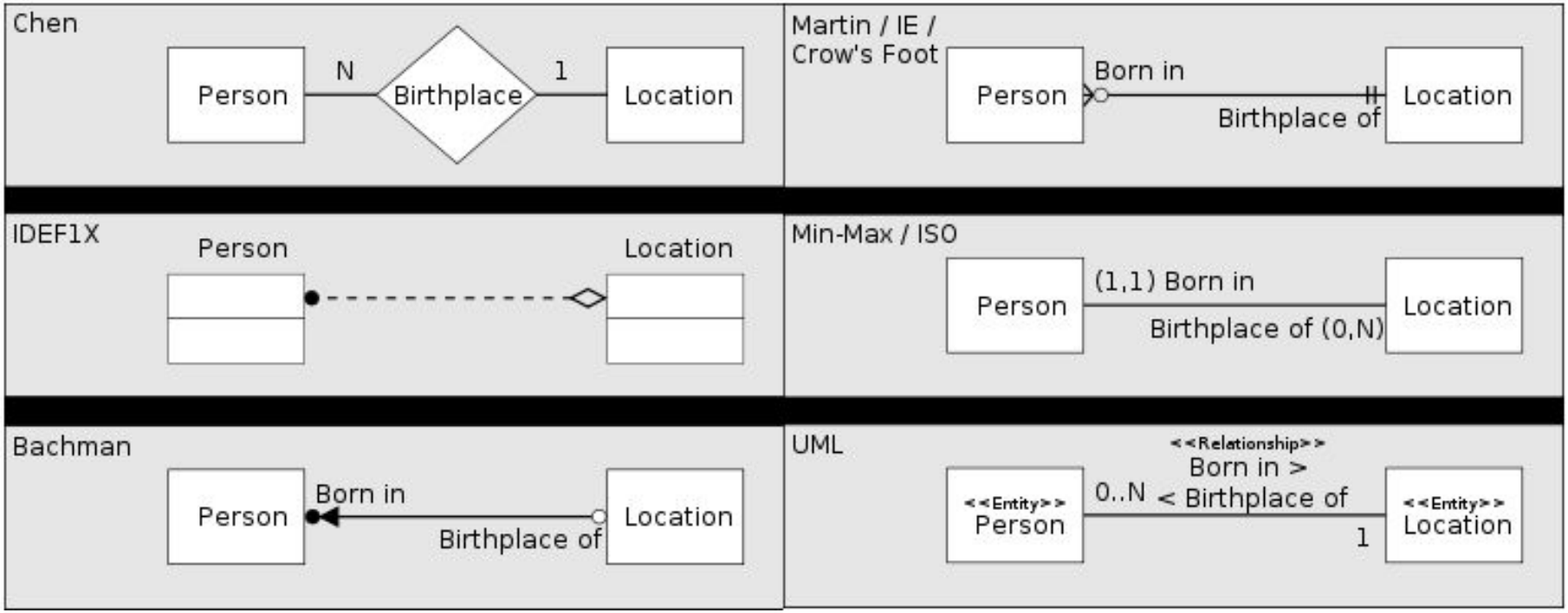


Different types of Notations

- Chen’s Notation
- Bachman notation
- IDEF1X
- Martin notation (Crow’s foot)
- min, max-notation
- UML class diagram

Different types of Notations

Various methods of representing the same one to many relationship. In each case, the diagram shows the relationship between a person and a place of birth: each person must have been born at one, and only one, location, but each location may have had zero or more people born at it.



Relationships

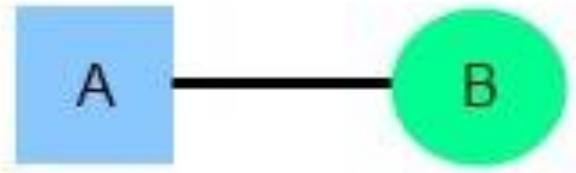
Types:

- One–to-One
- One-to-Many
- Many-to-Many

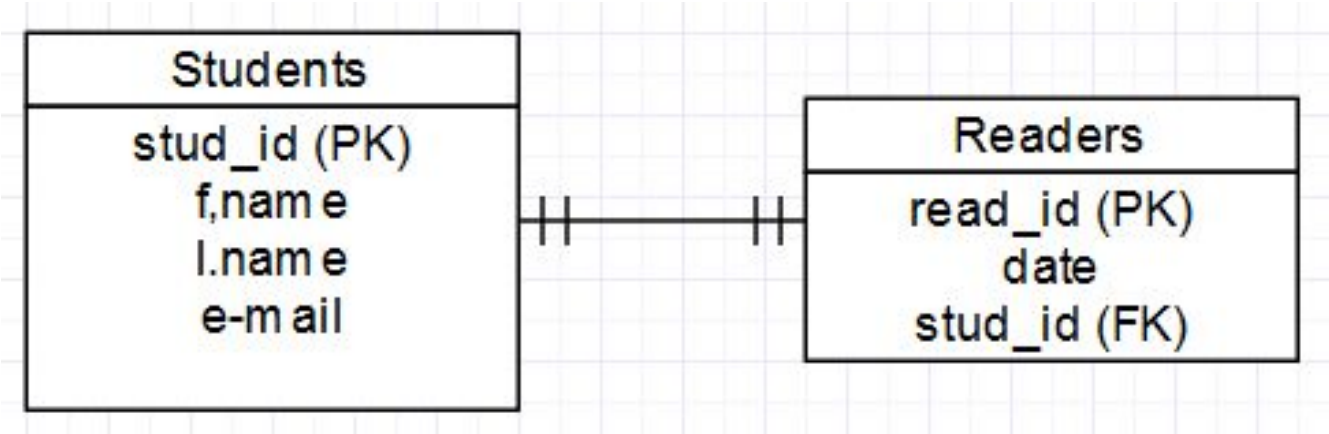
Rows in a table can be linked to rows in other tables by adding a column for the unique key of the linked row (such columns are known as **Foreign keys**)

One-to-one

One instance of an entity (A) is associated with one other instance of another entity (B).



Example of one-to-one



Students

stud_id	f.name	l.name	e-mail
001	…	…	…@gmail.com
002	…	…	…@gmail.com
003	…	…	…@gmail.com

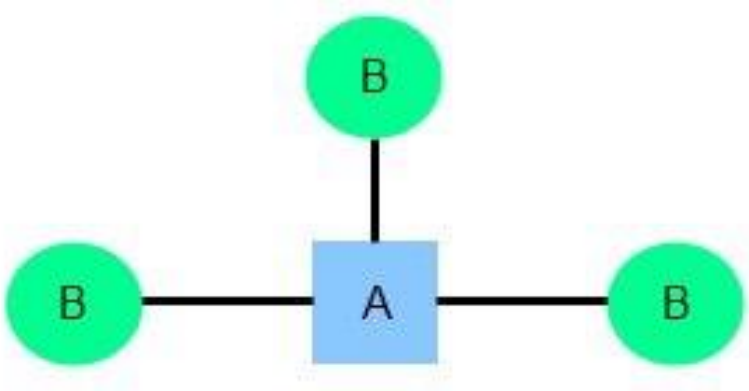
Readers

1	read_id	date	stud_id
	001	31.05.2020	001
	002	31.05.2020	003

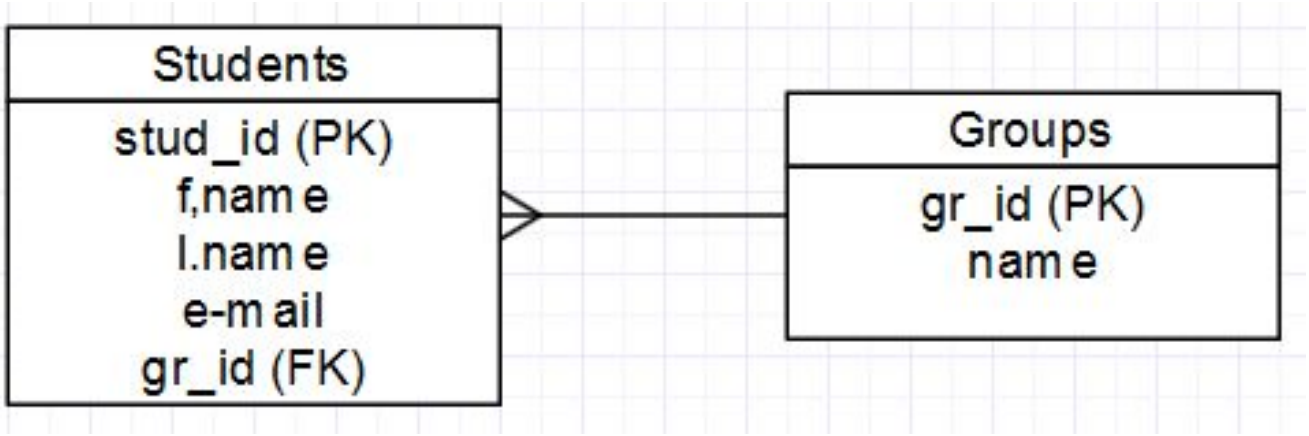
1

One-to-many

One instance of an entity (A) is associated with one or many instances of another entity (B), but for one instance of entity B there is only one instance of entity A.



Example of one-to-many



Students

stud_id	f.name	l.name	e-mail	gr_id
001	…	…	…@gmail.com	001
002	…	…	…@gmail.com	002
003	…	…	…@gmail.com	002

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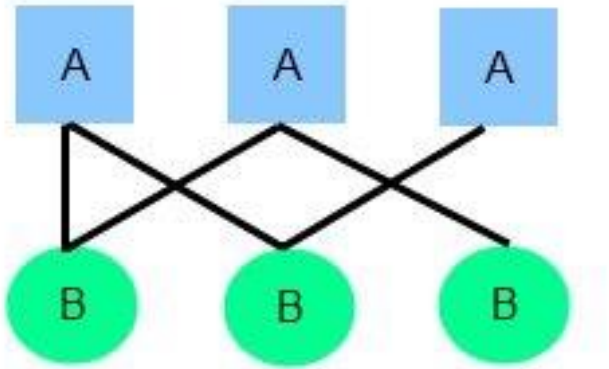
M

Groups

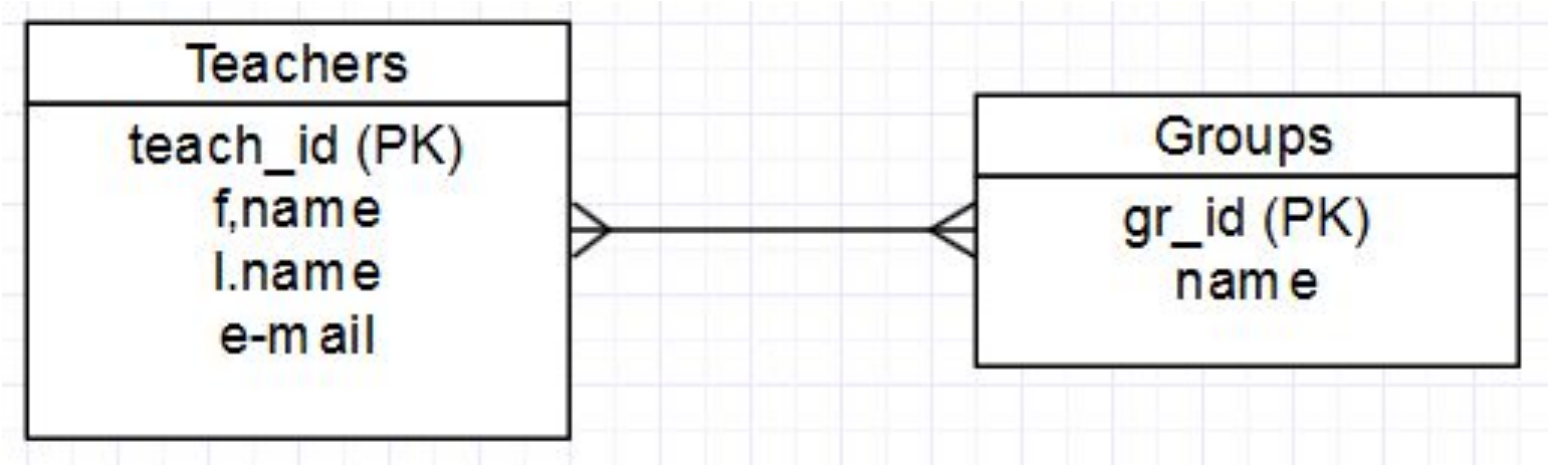
gr_id	name
001	CSSE-131
002	CSSE-132

Many-to-many

One instance of an entity (A) is associated with one or many instances of another entity (B), and one instance of entity B is associated with one or many instances of entity A.



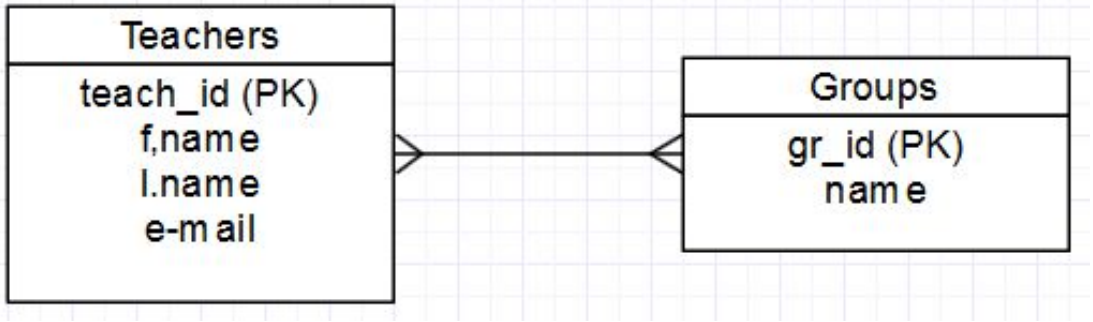
Example of many-to-many

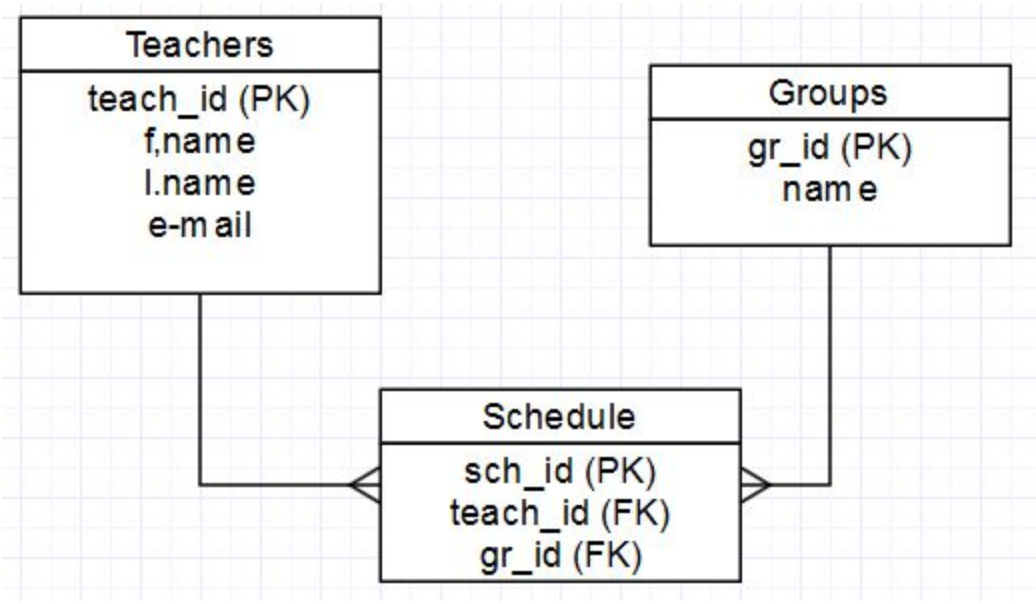


teach_id	f.name	l.name	e-mail
001	…	…	…@gmail.com
002	…	…	…@gmail.com
003	…	…	…@gmail.com

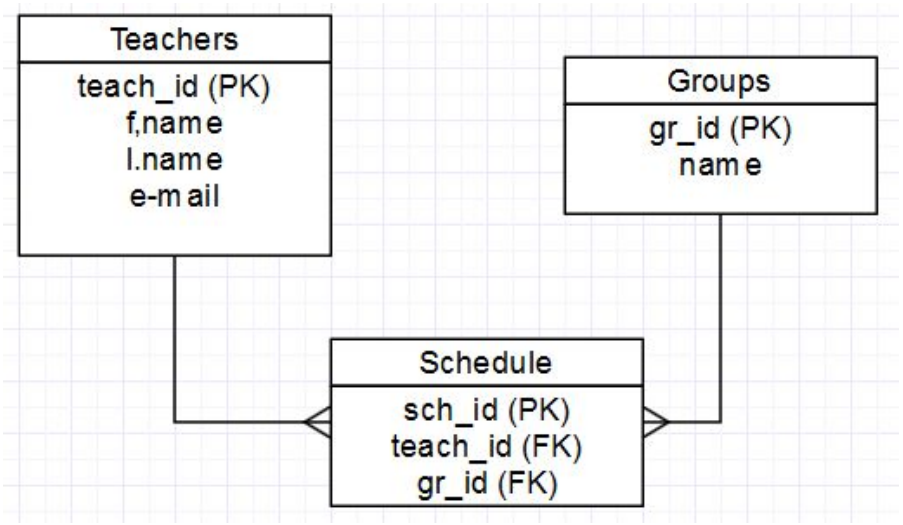
gr_id	name
001	CSSE-131
002	CSSE-132

Example of many-to-many





Example of many-to-many



Teachers

teach_id	f.name	l.name	e-mail
001	...	...	...@gmail.com
002	...	...	...@gmail.com
003	...	...	...@gmail.com

Groups

gr_id	name
001	CSSE-131
002	CSSE-132

1

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Schedule

M

sch_id	teach_id	gr_id
001	001	001
002	001	002
003	002	002

M

Tools

- Gliffy.com
- Creately.com
- Draw.io
- MS Visio
- Erwin
- etc.

Books

- Connolly, Thomas M. Database Systems: A Practical Approach to Design, Implementation, and Management / Thomas M. Connolly, Carolyn E. Begg.- United States of America: Pearson Education

- Garcia-Molina, H. Database system: The Complete Book / Hector Garcia-Molina.- United States of America: Pearson Prentice Hall

- Sharma, N. Database Fundamentals: A book for the community by the community / Neeraj Sharma, Liviu Perniu.- Canada