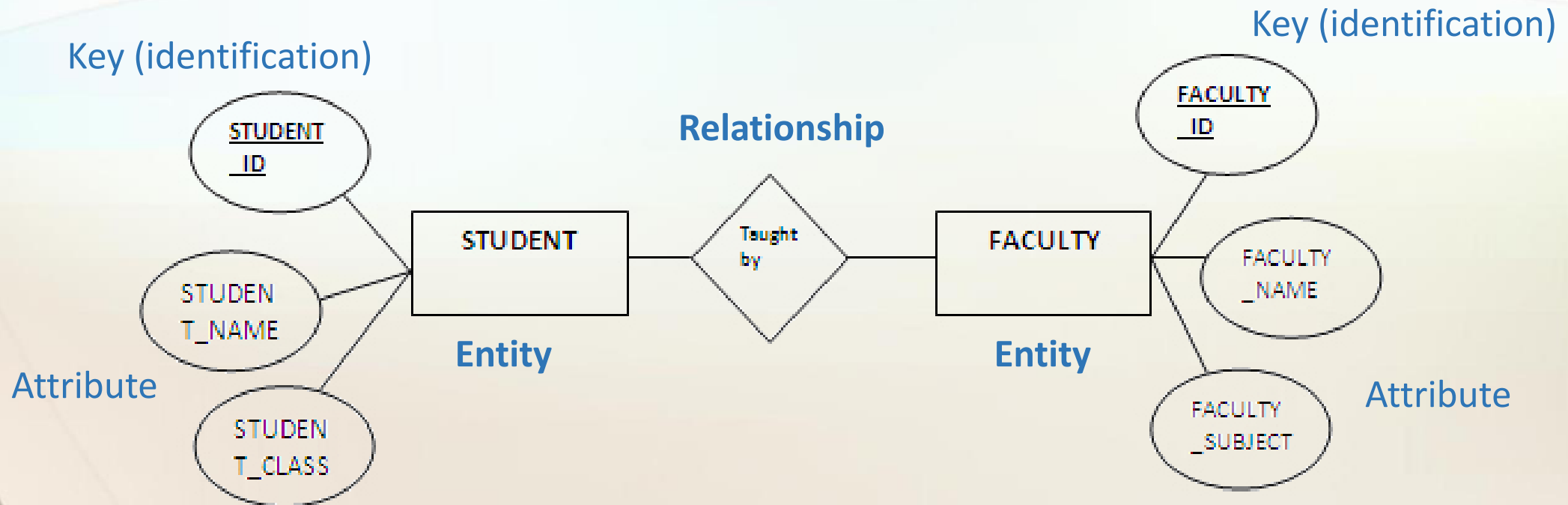# E/R-Modeling
UML-Modeling

E/R-Modeling

An **entity–relationship model** (**ER model**) is composed of entity types and specifies relationships that can exist between instances of those entity types.

Key (identification)

Key (identification)

Relationship

STUDENT
ID

FACULTY
ID

STUDENT

Taught by

FACULTY

STUDEN
T_NAME

FACULTY
_NAME

Entity

Entity

Attribute

STUDEN
T_CLASS

FACULTY
_SUBJECT

Attribute

student — LeaderOf — **team**
1   1

1:1 relationship
One student is a leader of one team.
One team is led by one student.

Person — N — Birthplace — 1 — **Location**

1:N relationship
One location is a birthplace of several persons.
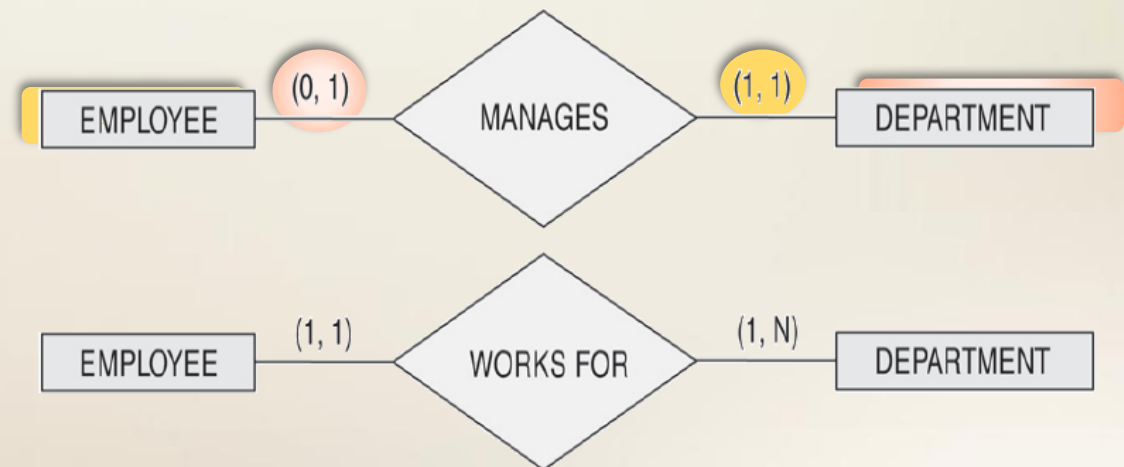The birthplace of one person is one location.

student — N — MemberOf — M — **team**

N:M relationship
One student is a member of several teams.
One team consists of several students.

(min, max)-Notation
One employee manages 0 or 1 department.
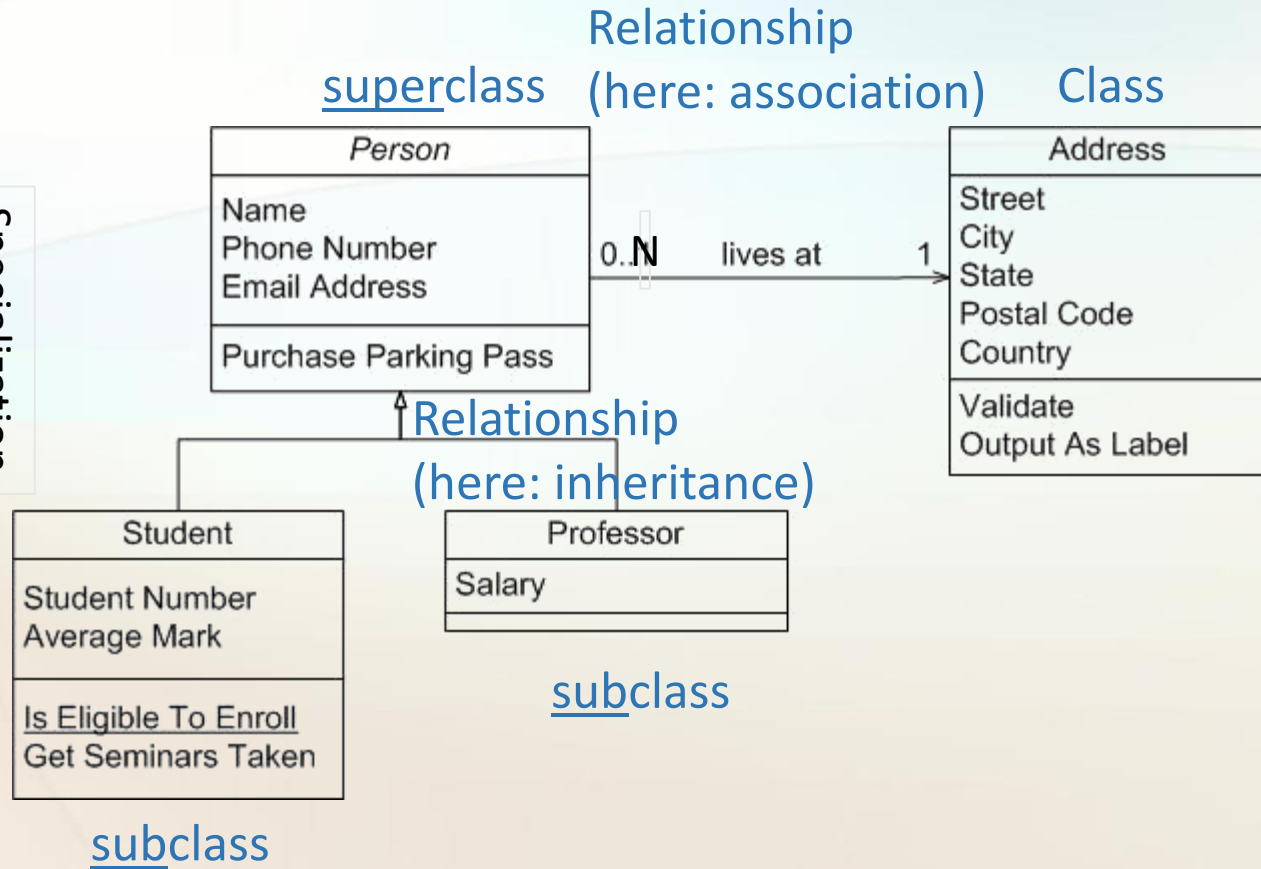One department is managed by exactly one employee.

One employee works for exactly one department.
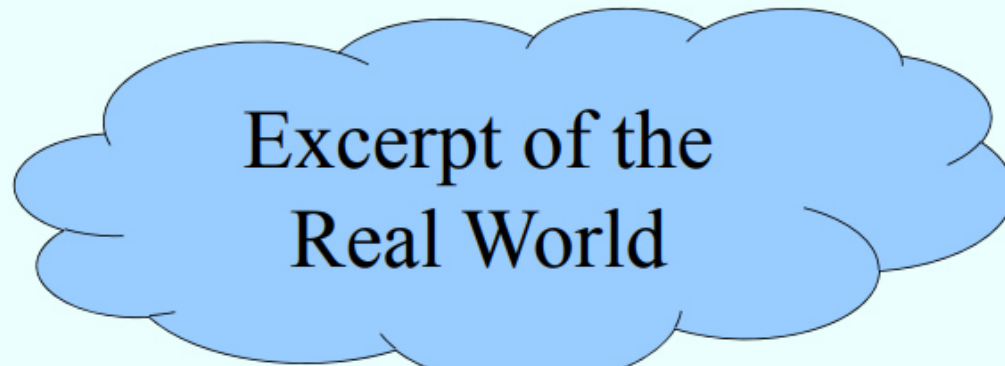In one department work(s) from 1 to N employee(s).

EMPLOYEE — (0, 1) — MANAGES — (1, 1) — DEPARTMENT

EMPLOYEE — (1, 1) — WORKS FOR — (1, N) — DEPARTMENT

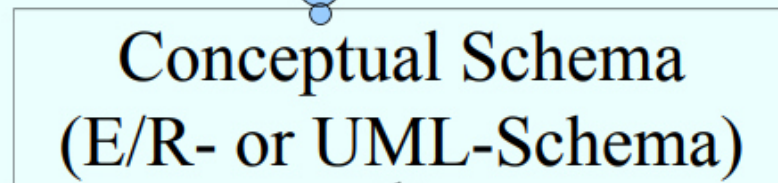# UML-Modeling

Relationship
(here: association)

superclass

Class

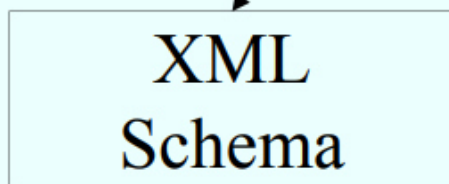One person lives at one address.
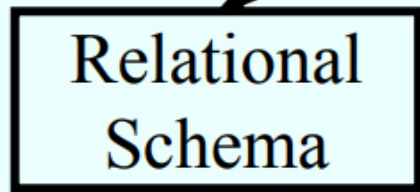One address belongs to 0 to N persons.

Person

Name
Phone Number
Email Address

Purchase Parking Pass

0..N   lives at   1

Address

Street
City
State
Postal Code
Country

Validate
Output As Label

Relationship
(here: inheritance)

Generalization

Specialization

Student

Student Number
Average Mark

Is Eligible To Enroll
Get Seminars Taken

Professor

Salary

subclass

subclass

Data modeling

Excerpt of the Real World

Manual/intellectual Modeling

Conceptual Schema (E/R- or UML-Schema)

Semi-automatic Transformation

Relational Schema

XML Schema

Network Schema

Object-orientierted Schema

ER Diagram:

StudNr, Name — Students — N — attend — M — Lectures — LectureNr, Title
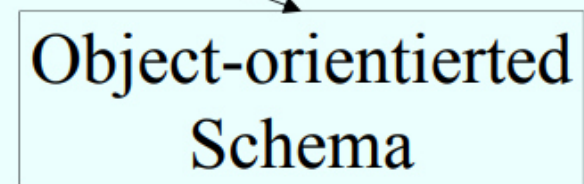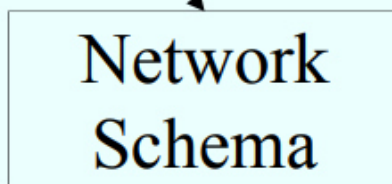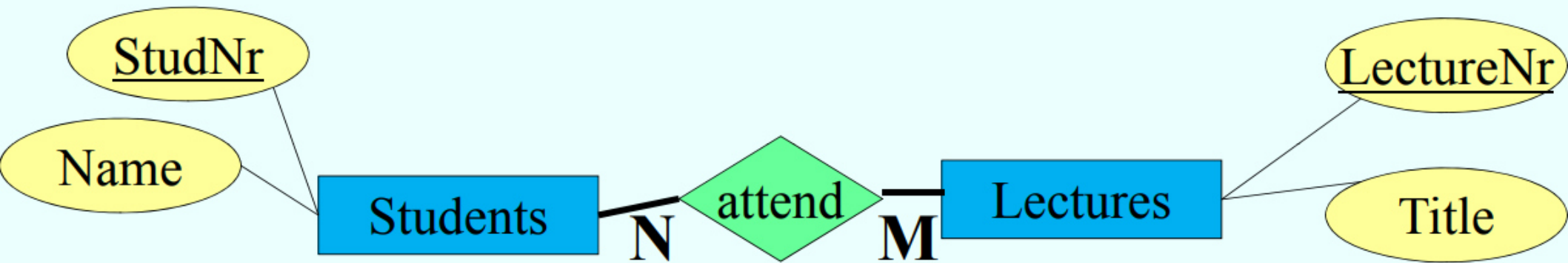
Students	
StudNr	Name
26120	Fichte
25403	Jonas
...	...

attend	
StudNr	Lecture Nr
25403	5022
26120	5001
...	...

Lectures	
Lecture Nr	Title
5001	Grundzüge
5022	Glaube und Wissen
...	...

| Phone book		
Name	**Street**	**Phone#**
Mickey Mouse	Main Street	4711
Minnie Mouse	Broadway	94725
Donald Duck	Broadway	95672
...	...	...

- **Instance:** current state of the data base

- **Candidate Key:** minimal set of attributes whose values
  uniquely identify a tuple

- **Primary Key:** underlined

Weak entities

Students		
StudNr	Name	Semester
24002	Xenokrates	18
25403	Jonas	12
26120	Fichte	10
26830	Aristoxenos	8
27550	Schopenhauer	6

test			
StudNr	LectureNr	PersNr	Grade
28106	5001	2126	1
25403	5041	2125	2
27550	4630	2137	2

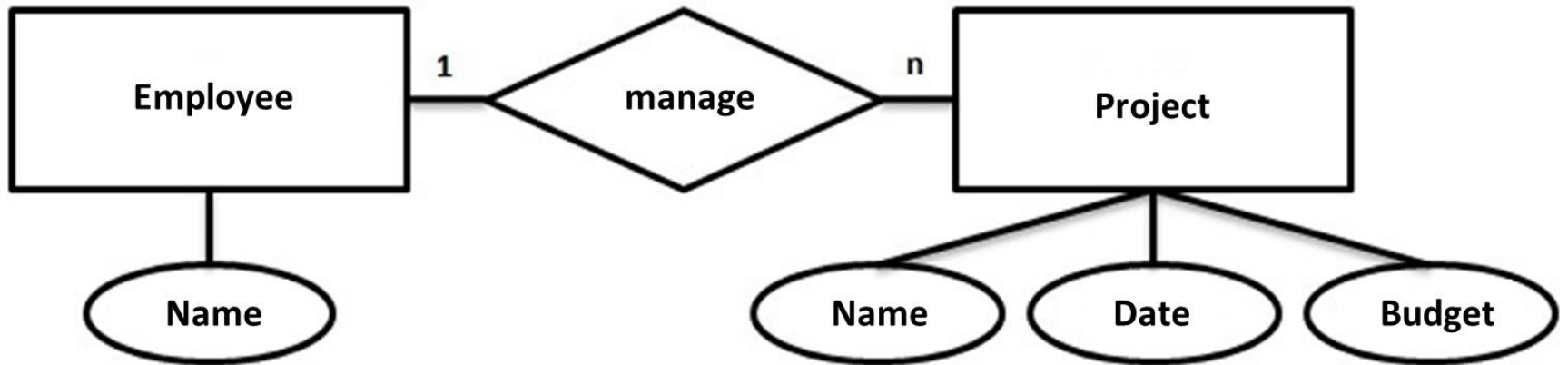| Lectures	
LectureNr	Title
5001	Grundzüge
5041	Ethik
5043	Erkenntnistheorie
5049	Mäeutik
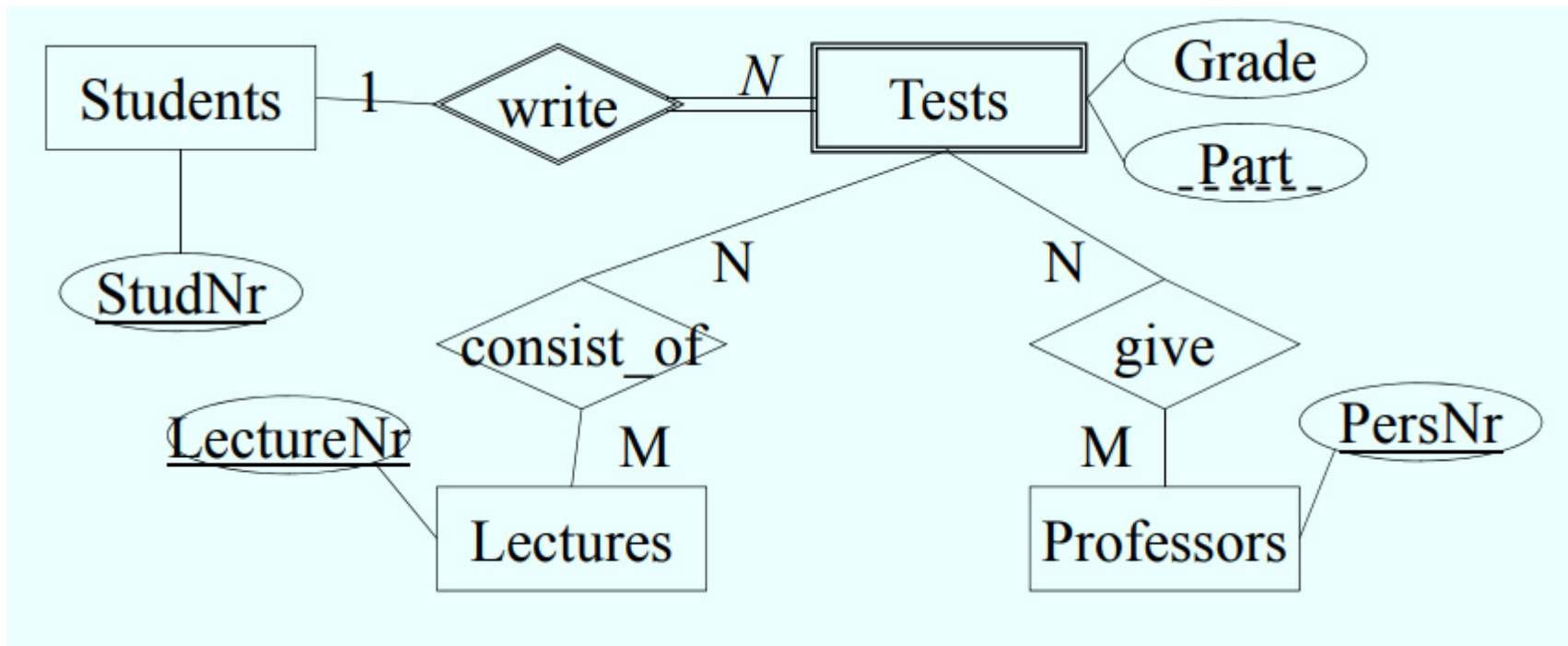
Exercise E/R Modeling

- An employee has a name. A project has a name, a date and a budget. An employee can manage several projects but one project can only be managed by one employee.

Solution E/R Modeling

Exercise UML Modeling

- There are two kinds of person (age): Student(id) and Professor (title) which can teach. Each Student can be taught by one or more professors and each professor teaches at least three students.

Solution UML Modeling