Introduction to Database System

2019

Sophie Ammann

Lecture 1

1.1 Terminology :

- **Data** : facts, basis for reasoning, useful or irrelevant (only 10% of data is useful). Must be *processed* to be meaningful. “Everything that can be mathematicaly defined is data”
- **Information** : meaning, relevant to the problem
- **Database (DB)** : large, integrated, structured collection of data
- **Database Management System (DBMS)** : software system designed to store, manage and facilitate access to databases (connected bridge btw user and database)
- **Data model** : collection of concepts for describing data (relational, hierarchical, graph,…)
- **Relational data model** : set of records represented by a table.

1.2 Relational data model

- **Relation** : table with row and columns
- **Schema** : Describes the structure (columns) of a relation

1.3 Logical and physical data independence

Data independence is the ability to change the schema at one level of the database system without changing the schema at the next higher level

- **Logical data independence** : capacity to change the conceptual schema without changing the user views
- **Physical data independence** : capacity to change the internal schema without having to change the conceptual schema or user views

---

Lecture 2 : ER model

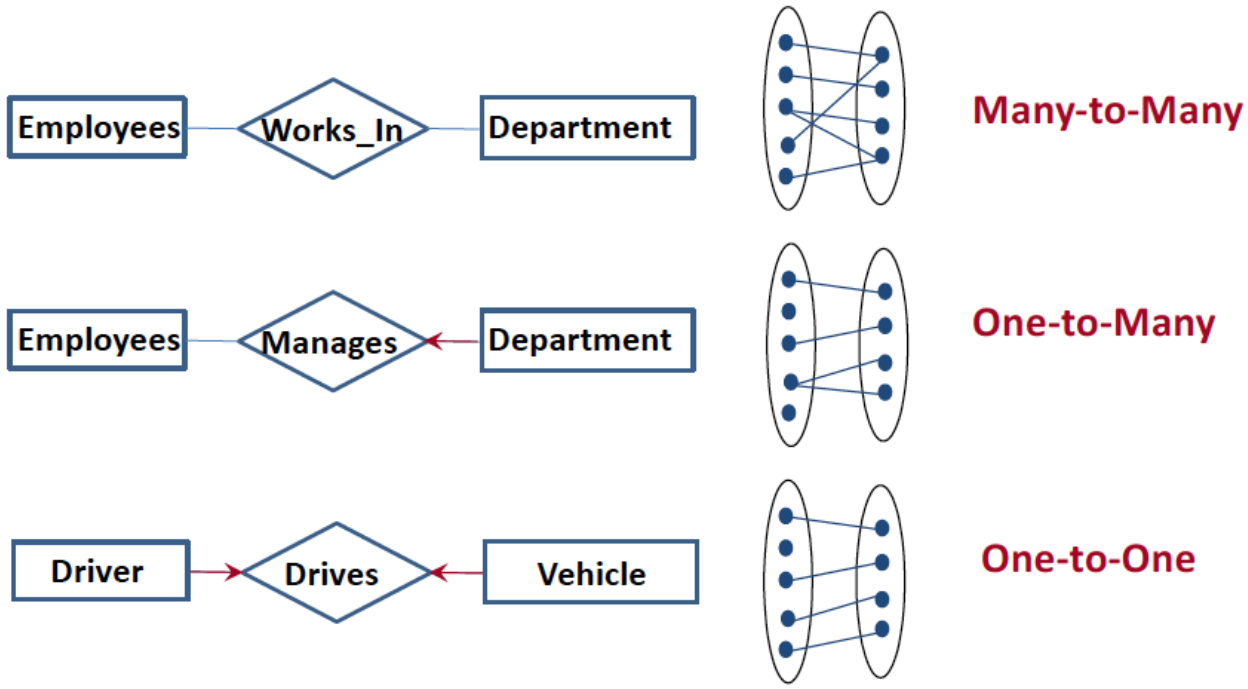
2.1 Conceptual design

ER model = entity-relationship model

- **Entity** : real-world object, distinguishable from other objects.
  Attributes are used to describe an entity. (defined in a domain)
- **Entity set** : A collection of similar entities. E.g., all employees
  Key : each entity set has a key
- **Relationship** : association between entities, can have their own attributes.

2.2 Constraints

2.2.1 Key constraints



- Many-to-many :
  an employee can work in many departments; a department can have many employees

- One-to-many :
  each department has at most one manager

- One-to-one :
  each driver can drive at most one vehicle and each vehicle will have at most one driver.

2.2.2 Participation constraints

Total Participation

Means: “exactly one”

Partial Participation

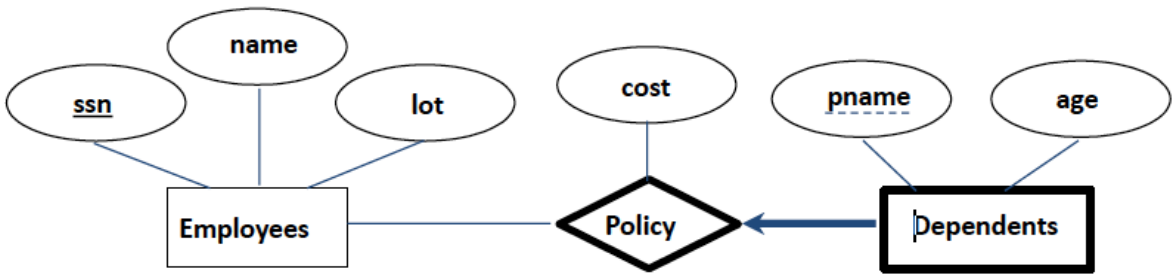
- Total participation :
  Every employee should work in at least one department.
  Every department should have at least one employee.

- Participation + key constraint :
  There could be some employees who are not managers.
  Every department should have at least one manager.

- Partial participation :
  There could be some customers who do not buy any products.
  There could be some products which are not bought by any customers.

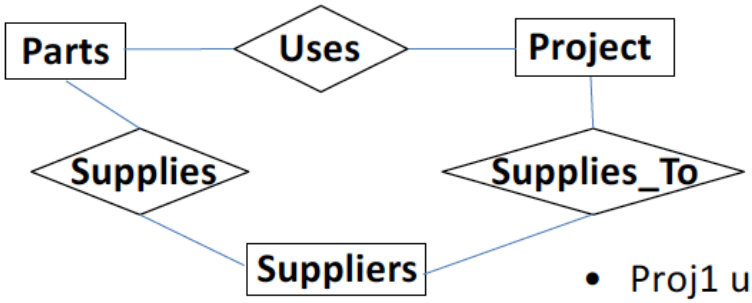
2.3 Weak entities

Entity that can be identified uniquely only by considering the primary key of another entity (owner).



There has to be a one-to-many relationship (one owner, many weak entities).
The weak entity set must have total participation

2.4 Ternary relationships

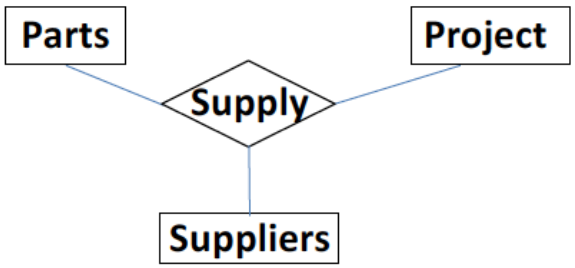


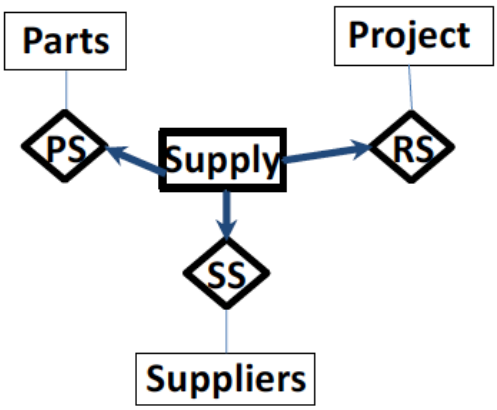
- Proj1 uses Part1
- Supp1 supplies to Proj1
- Supp1 supplies Part1

does this imply

- Proj1 uses Part1 supplied by Supp1

No

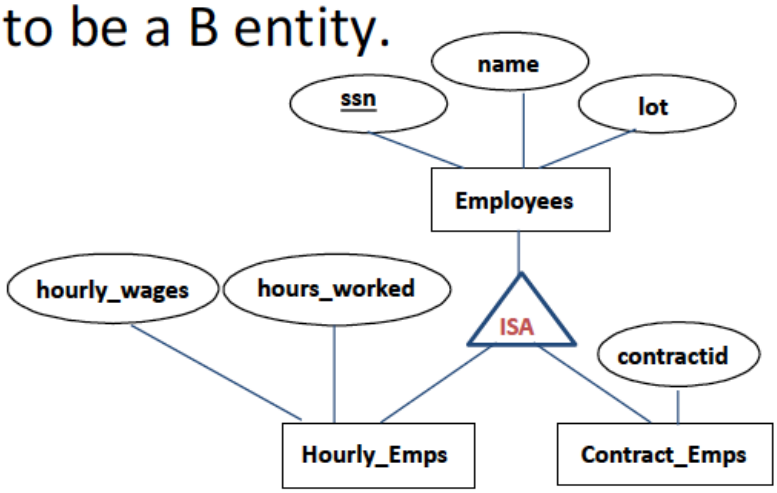




2.5 ISA ('is a') hierarchies

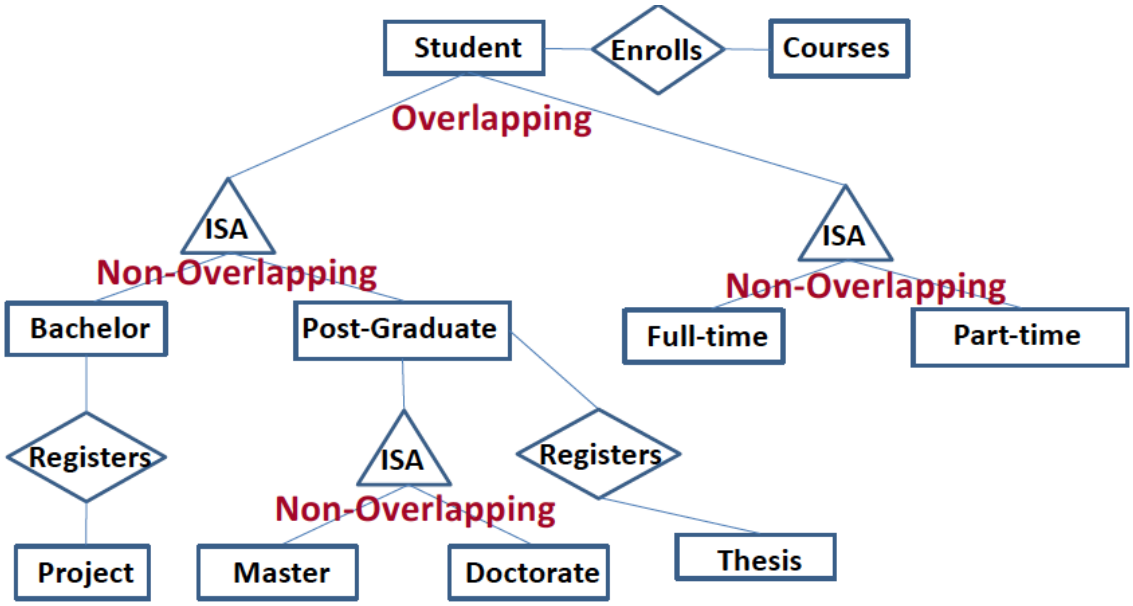
Attributes inherited

- If we declare A **ISA** B, every A entity is also considered to be a B entity.



2.5.1 Constraints :

- **Overlap cosntraints** : *Can a student be a master as well as a doctorate entity? (Allowed/Disallowed)*
- **Covering constraints** : *Does every Employees entity also have to be an Hourly_Emps or a Contract_Emps entity? (Yes/No)*



2.6 Aggregation :

Can treat a relationship set as an entity set.