ICS499 – Software Engineering and Capstone Project

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Data Modelling and ERD

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Data modeling: outline

- Understand basics of data modeling
- Learn how the entities and relationships are identified
- Develop ERD based on the domain model
- Design DB model from ERD.

Data model

- Model: an abstraction of a real-world object or event
  - Useful in understanding complexities of the real-world environment

- Data model
  - A diagram that displays a set of tables and the relationships between them

What is Entity Relationship Diagram (ERD)?

- ERD is a data modeling technique to produce a conceptual data model.

- So, ERDs illustrate the logical structure of a domain (problem we are trying to solve).

Why do we need ERDs?

- ERDs provide higher level abstraction
- All people may not understand the databases / tables / relational schema.
- However, everyone can understand the ERD.
  - a data model diagram vs. a list of tables
  - Used as an effective Communication Tool
  - Improve interaction among the managers, the designers, and the end users
- ERD is independent from a particular DBMS implementation
  - Network DB, Object-oriented DB, etc.
  - MySQL, SQLIte, DB2, Oracle, Postgres

Element of ERD

Elements of ERD are:

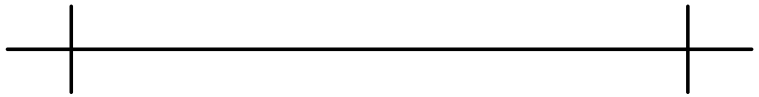
- entities,
- attributes, and
- their relationships

What is cardinality?

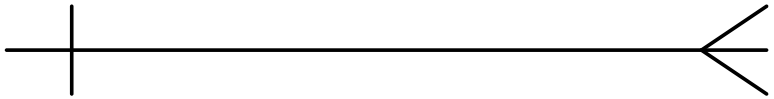
- The cardinality is the number of occurrences in one entity which are associated to the number of occurrences in another.
- There are three basic cardinalities (degrees of relationship).
  - one-to-one (1:1)
  - one-to-many (1:M)
  - many-to-many (M:N)

Basic cardinalities in crow’s foot notation

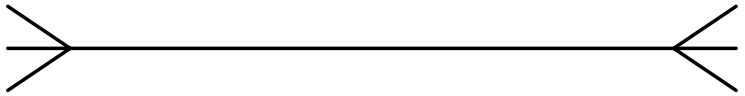
- 1-to-1 relationship



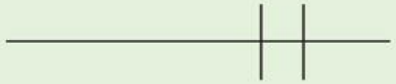
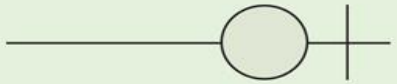
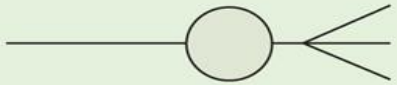
- 1-to-M relationship



- M-to-N relationship



Cardinalities

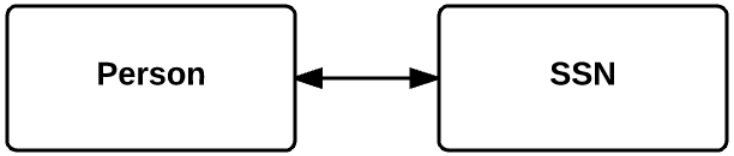
Symbol	Meaning
	Mandatory—One
	Mandatory—Many
	Optional—One
	Optional—Many

Classes of attributes

- Simple attribute
- Composite attribute
- Derived attributes
- Single-valued attribute
- Multi-valued attribute

one to one relationships

- **Country - capital city**: Each country has exactly one capital city. Each capital city is the capital of exactly one country.
- **Person - their fingerprints**. Each person has a unique set of fingerprints. Each set of fingerprints identifies exactly one person.
- **Email - user account**. For many websites, one email address is associated with exactly one user account and each user account is identified by its email address.
- **User profile - user settings**. One user has one set of user settings. One set of user settings is associated with exactly one user.



one to many relationships

- **Clients-Orders:**

A ‘client’ will have 0 or 1 or more orders.

An ‘order’ must have only 1 client (customer)

- **Manufacturers – Products**

A manufacturer may produce 1 or more products.

A product is made by one manufacturer.

- **Shopping Mall – Shops**

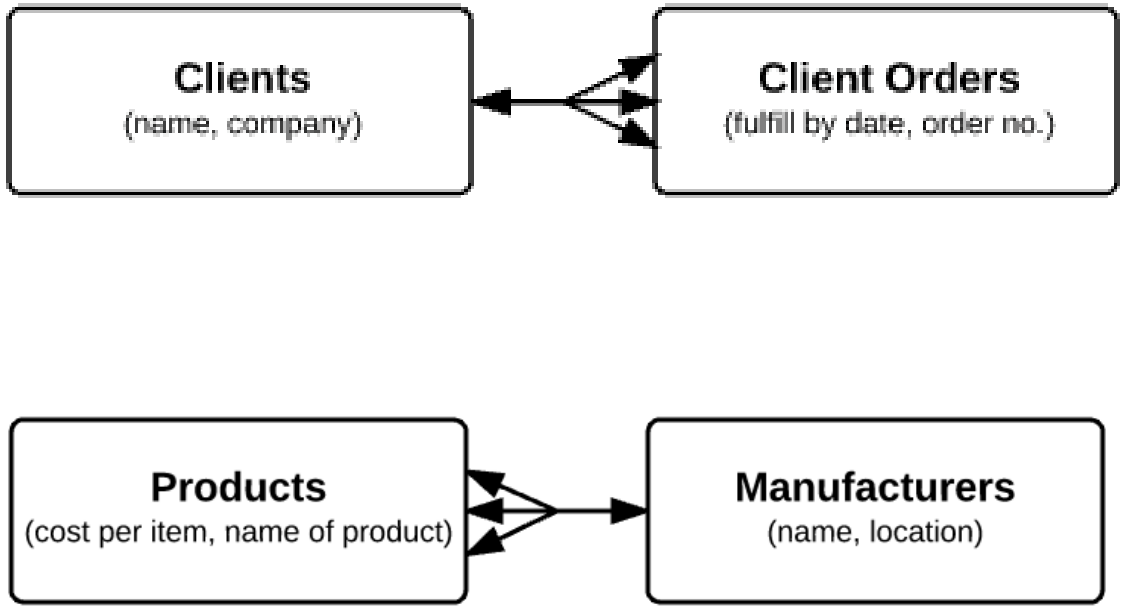
A shopping mall have 1 or more shops.

A shop exists only in one shopping mall.

- **Books-Pages:**

A book will have more pages.

But a page belongs to only one book.



many-to-many relationships

Books-Authors:

A book may be written by many Authors.
An ‘author’ may write many books

Student – Class:

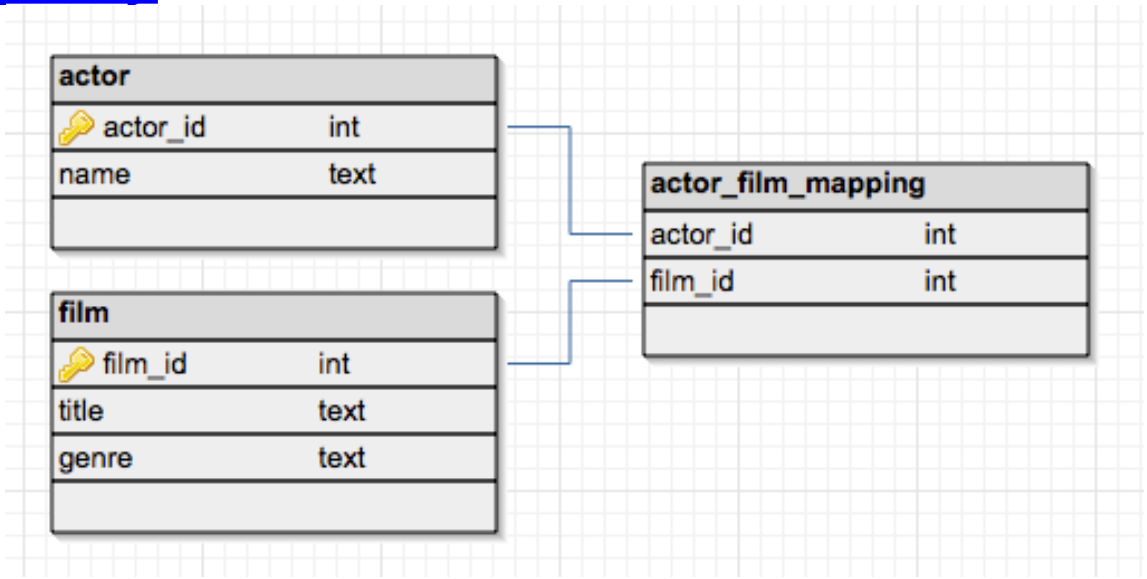
A student may register for several classes.
A class may be registered by several students.

Such relationships are usually implemented by means of an associative table (also known as join table, junction table or *cross-reference table*),

many-to-many relationships

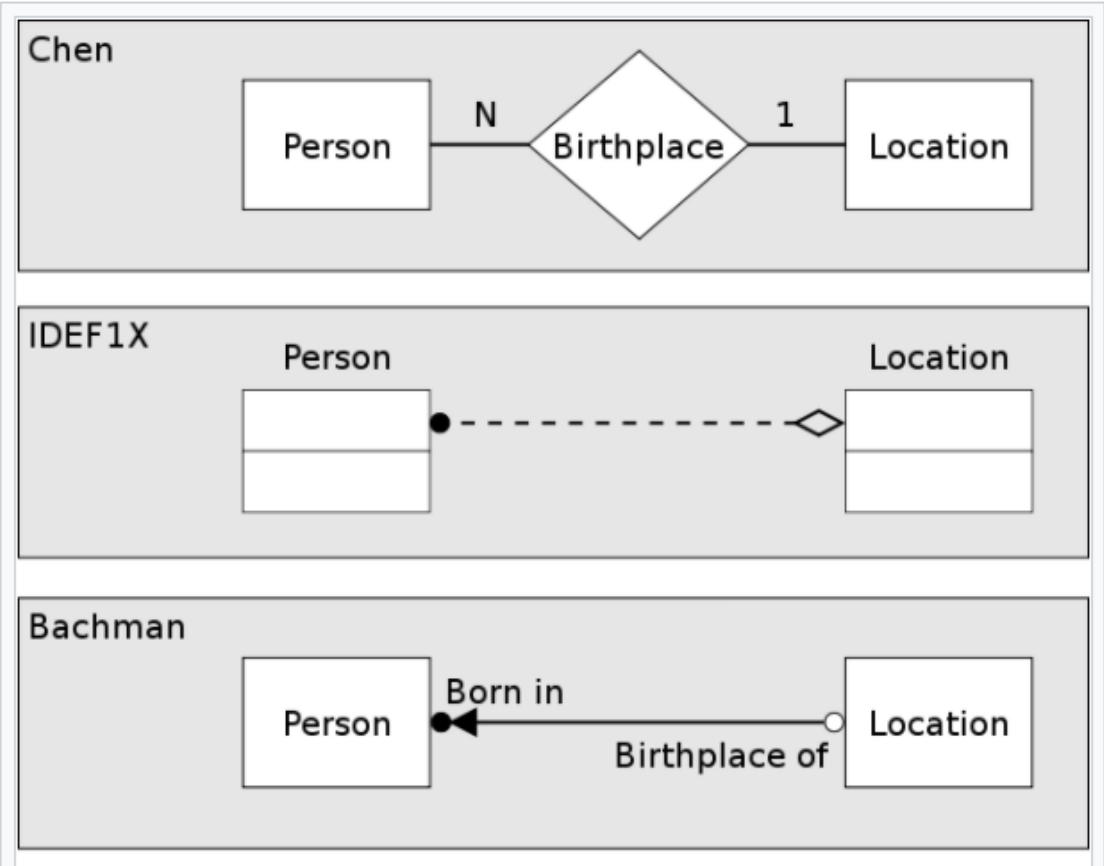
Many-to-many relationships are reflected through “Associative entities”.

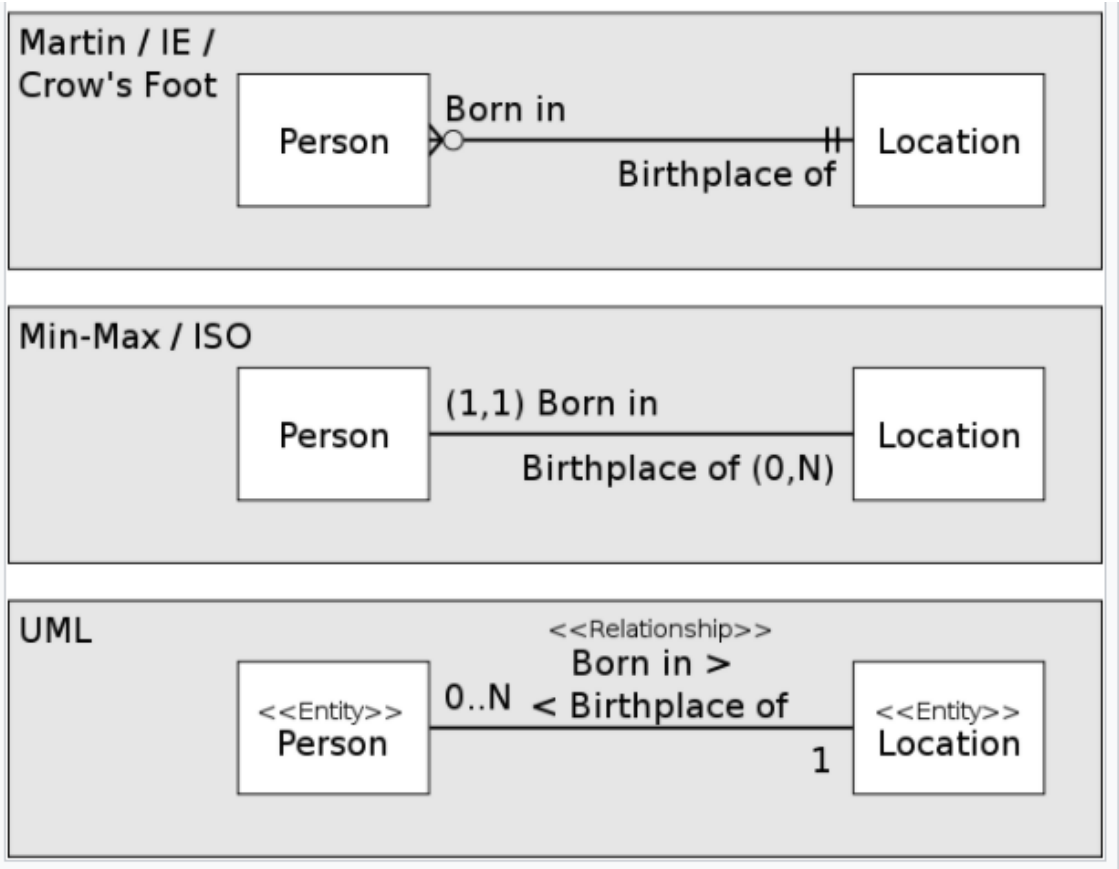
- https://en.wikipedia.org/wiki/Associative_entity



- The “Associative” (relationship) entity simply records a combination of “left” key and “right” key.

Many notations for Cardinality





- A “Person” is born in one location.
- A “location” may have zero or one or many people.

References

- ER Modeling Basics (youtube)
- draw.io (diagramming tool)
- What is ERD? Visual paradigm
- Associative Entity (wiki)
- Entity-Relationship Model (wiki)

Q&A