Database Fundamentals & Design

ITI-2021

Agenda

- What is a Relational Database?
- Basic Database Structure.
- Entity Relationship Modeling.
- ERD.

What is a Relational Database?

- A data structure through which data is stored in tables that are related to one another in some way.

- The way the tables are related is described through a **relationship.**

Basic Database Structure

Relation

Column

Record

SSAN	Name	Date of Birth			
999-9	Doug	7/52			

Entity Relationship Modeling

Entity-Relationship Diagram (ERD):

It identifies information required by the business by displaying the relevant entities and the relationships between them.

Important Questions?

- What entities need to be described in the model?
- What characteristics and attributes of these entities need to be recorded?
- Can an attribute or a set of attributes be identified that will be uniquely identify one specific occurrence of an entity?
- What associations or relationships exist between entities ?

Definitions

- **Entity** :
  It is any thing about which data is collected (any thing a user want to track) .

- **Weak Entity** :
  It is an entity whose existence is dependent on another entity.

- **Entity Instance** :
  An instance is a particular occurrence of an entity. For example, each person is an instance of an entity, each car is an instance of an entity, etc.

Definitions (cont.)

- **Attributes** :

They are the Characteristics of entities.

Types of attributes :

- **Simple (Scalars)** - smallest semantic unit of data, atomic (no internal structure)- singular e.g. city
- **Composite** - group of attributes e.g. address (street, city, state, zip)
- **Multi-valued (list)** - multiple values e.g. phone numbers.
- **Stored or Derived.**

Definitions (cont.)

- Attribute Values
  - ✓ Sometimes attribute values is set to null.
  - ✓ There are two meanings of null either not applicable or unknown values.
  - ✓ Default Value.

Definitions (cont.)

- **Primary Key**:

  Identifier used to uniquely identify one particular instance of an entity.

  - ✓ Can be one or more attributes.
  - ✓ Must be unique .
  - ✓ Value should not change over time.
  - ✓ Must always have a value .

Definitions (cont.)

- **Candidate Key** :

  when multiple possible identifiers exist, each is a candidate key.

- **Foreign Keys :**

  Foreign keys reference a related table through the primary key of that related table.

- **Referential Integrity Constraint**:

  For every value of a foreign key there is a primary key with that value in the referenced table e.g. if student name is to be used in a dormitory table then that name must exist in the student table.

Relationships

- A relationship is a connection between entity classes.

- **Types of relationships (cardinality) :**
  - ✓ **One-to-one relationship (1:1)**
  - ✓ **One-to-many relationship (1:M)**
  - ✓ **Many-to-many relationship (N:M)**

Relationships (cont.)

- **One-to-one relationship (1:1) :**

  A single record in table A is related to only one record in table B, and vice versa.

  Ex. : Emp. Uses at most one car, a car is used at most by one emp.

Relationships (cont.)

- **One-to-many relationship (1:M) :**

A single record in table (A) can be related to one or more records in table (B), but a single record in table (B) can be related to only one record in table (A).

Ex. : Emp. Uses at most one car, a car is used by many or several employees, student-advisor, customer-order

Relationships (cont.)

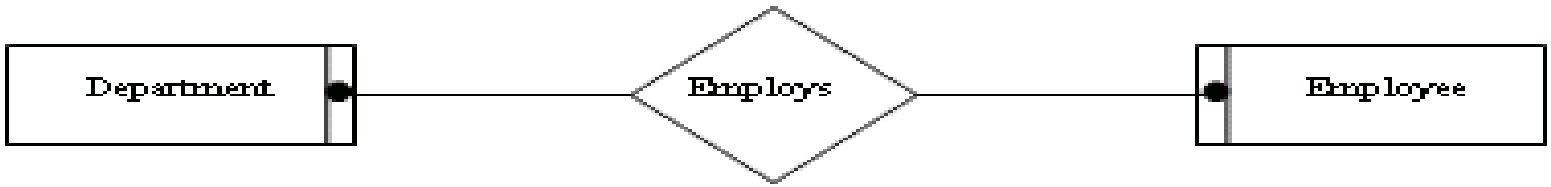
- **Many-to-many relationship (M:M) :**

  A single record in table A can be related to one or more records in table B, and vice versa.

  Ex. An emp. Uses several cars, a car can be used by several employees. Student-Club, order-products.

Relationships (cont.)

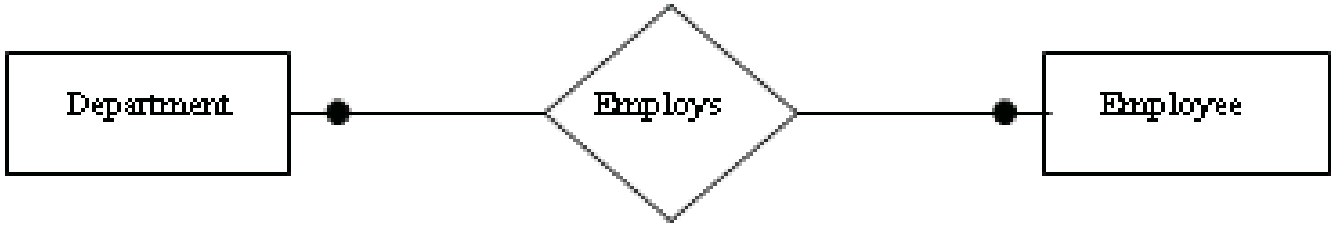
- **Membership class (obligatory & non-obligatory):**



(a)A department must employ at least one employee.
An employee must be employed by a department,
Department membership is obligatory
Employee membership is obligatory

Relationships (cont.)

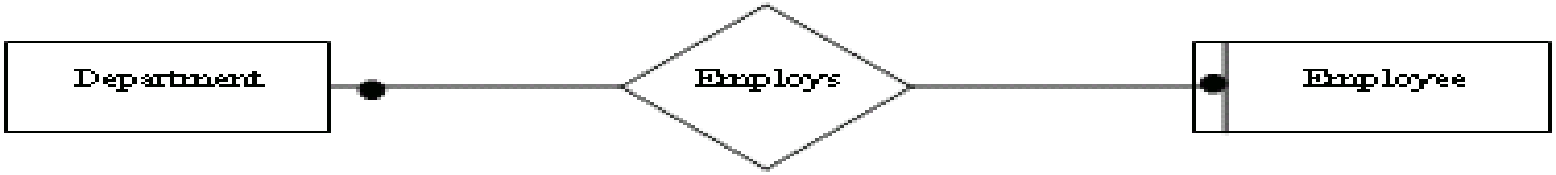
- **Membership class (obligatory & non-obligatory):**



- A department need not employ any employees. An employee need not be employed by any department. (Department membership is non-obligatory; Employ membership is non-obligatory)

Relationships (cont.)

- **Membership class (obligatory & non-obligatory):**



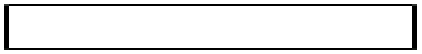
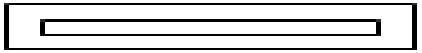
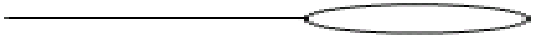
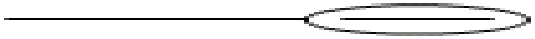
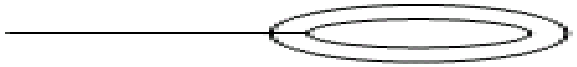
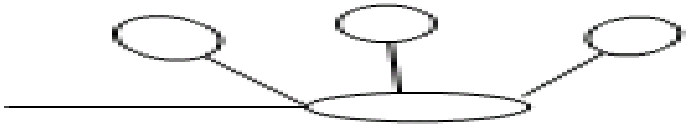
- A department need not employ any employees. An employee must be employed by a department. (Department membership is non-obligatory; Employ membership is obligatory)

Relationships (cont.)

- **Membership class (obligatory & non-obligatory):**

(d) A department must employ at least one employee. An employee need not be employed by any department.
Department membership is obligatory; Employ membership is non-obligatory

ERD notation

Symbol	Meaning
	Entity type
	Weak entity type
	Relationship type
	Attribute
	Key attribute
	Mutivalued attribute
	Derived attribute
	Composite attribute
	Total Participation of E_2 on
	Cardinality ratio 1:M

shows summary of ERD notation

Guidelines

• In building a data model a number of questions must be addressed:

- ✓ What entities need to be described in the model?
- ✓ What characteristics or attributes of those entities need to be recorded?
- ✓ Can an attribute or a set of attributes be identified that will uniquely identify one specific occurrence of an entity?
- ✓ What associations or relationships exist between entities?

Summary

- What is a Relational Database??
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Thank You…