Conceptual Design

Table of Contents

[ ] Ch 2 R&G

Objectives of Conceptual design

- identify **entities** and **relationships**
- identify **information** to store about entities and relationships
- identify **integrity constraints**

Entities and Relationships

- **entity**: real-world object distinguishable from other objects
- **entity set**: collection of entities of the same type
  - need not be disjoint
  - set of n-tuples: $\{(e_1, \dots, e_n) | e_1 \in E_1, \dots, e_n \in E_n\}$
  - each n-tuple involves n entities e_i in entity set E_i
- **attributes**: describe each entity in a given entity set

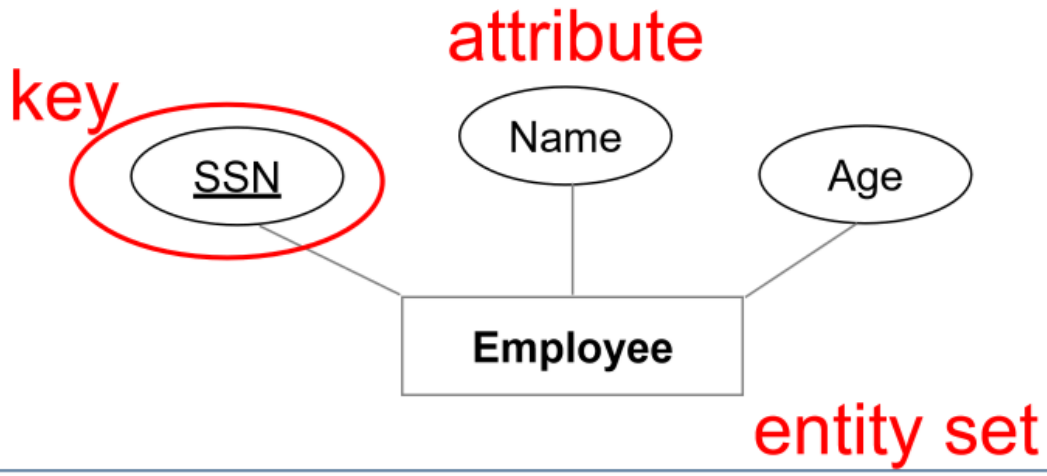


Figure 1: entity_set

- **relationship**: association among two or more entities
  - can have their own attributes
  - e.g. Fred *works* in pharmacy department
- **relationship set**: collection of relationships of the same type
  - e.g. employees *work in* departments
  - instance of relationship set: snapshot of relationship set in time

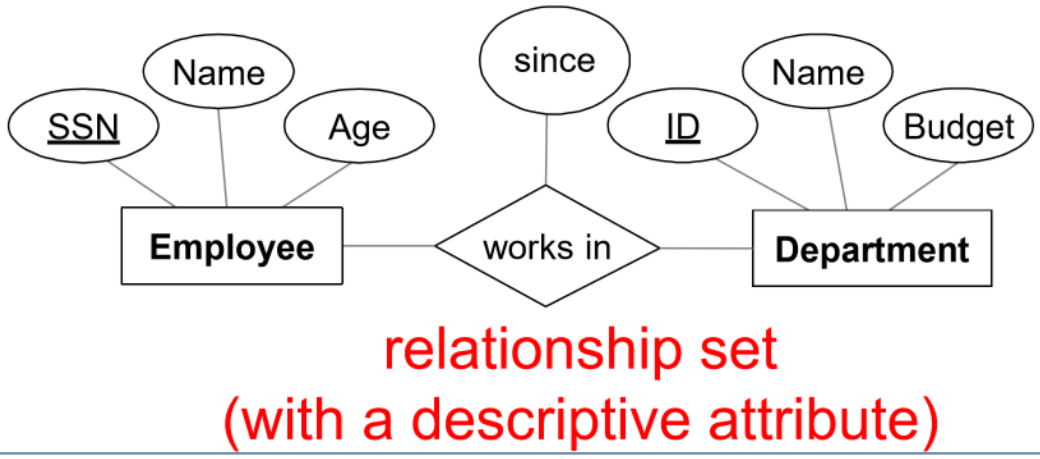


Figure 2: relationship_set

- same entity set can participate in

  - different relationship sets
  - different roles in the same set

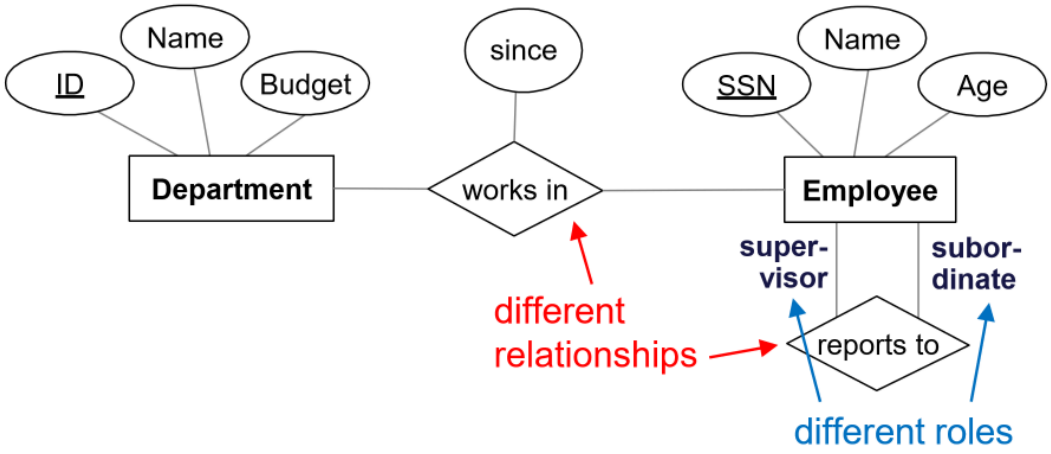


Figure 3: relationship_roles

- **entity-relationship (ER) data model**: tools to move from informal user needs to precise description that can be implemented

Constraints

- **key constraints**: determine number of objects taking part in relationship set
  - specifies *upper bound*, i.e. *many* implies you could have 0 relationships to more than 1

  - one of:

- **many-to-many**: employee can work in *many* departments; a department can have *many* employees
  - represented by a line

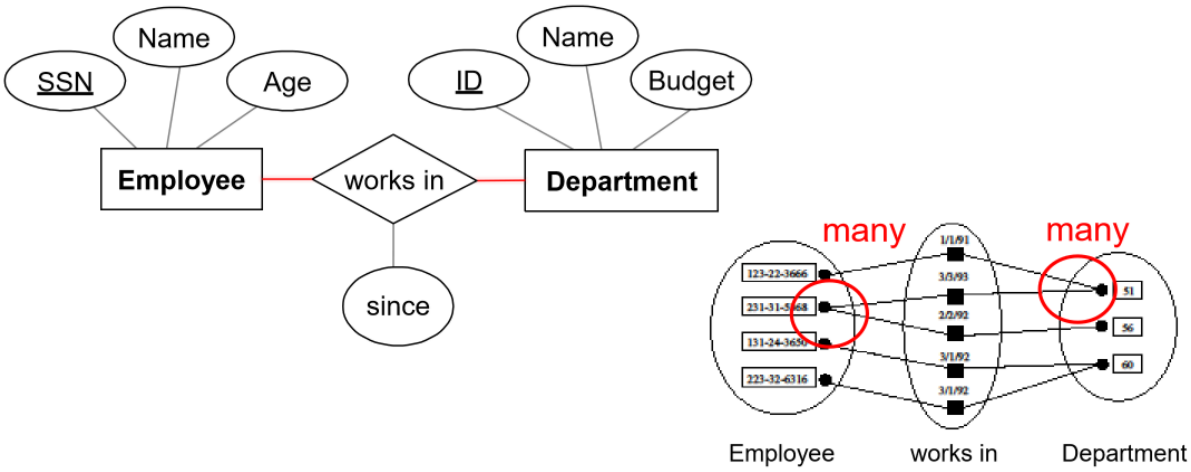
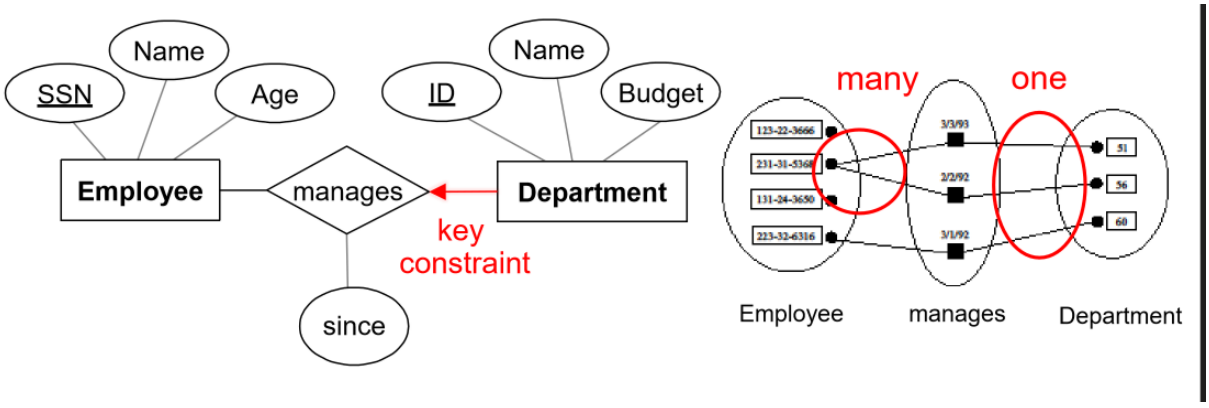


Figure 4: many_to_many

- **one-to-many**: single entity per relationship
  - represented by an arrow
  - e.g. each department has *at most one* manager



- **one-to-one**: e.g. each employee can manage at most one department

- **participation constraint**: do all entities of an entity set take part in a particular relationship?
  - **total participation**: every entity must take part in *at least 1* relationship
    - represented by a *bold line*
  - **partial participation**: otherwise

  - e.g. every employee must work in a department. each department has at least one employee each department has to have a manager (but not everyone is a manager)

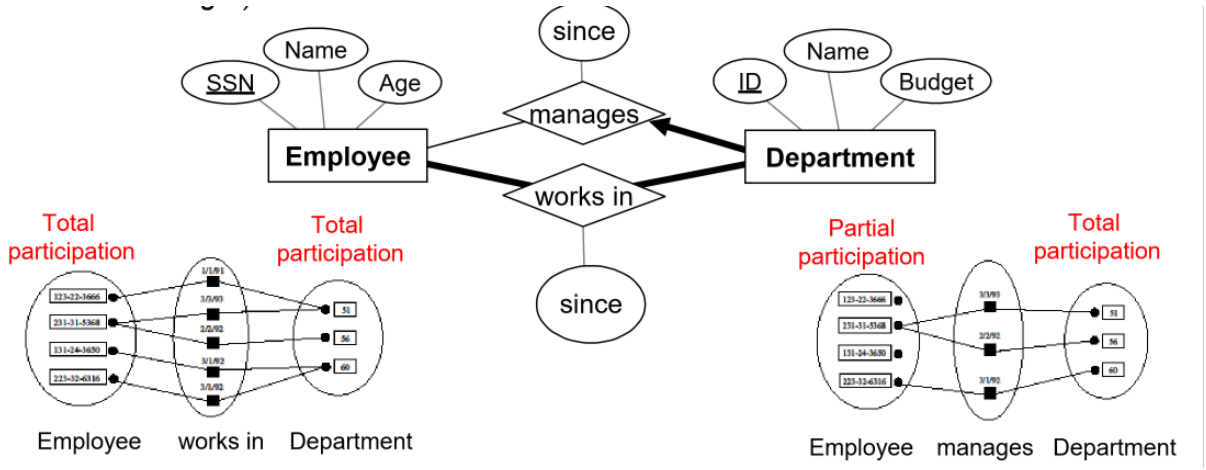


Figure 5: participation_constraints

- **weak entity**: uniquely identified by considering primary key of an owner entity
  - represented as *bold rectangle*
  - owner entity set and weak entity set must participate in a relationship where each weak entity has exactly one strong entity to depend on
- **partial key** uniquely identifies weak entity when considering primary key of owner entity
  - represented with *dashed underline*

Key constraint	Total participation	Partial participation
1	one-to-one	0-to-one
many	one-to-many	0-to-many

- **ternary relationships** [TODO]

Special attribute

- **multi-valued attributed**: multiple values of same type
  - e.g. employee home phone and work phone numbers
  - represented with *oval with double border*

- **composite attributes**: hidden structure, each element having different type
  - e.g. employee address composed of postcode, street name, street number

Conceptual Design [todo]

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