

Chapter 6

- **Entity-Relationship(E-R) Data Model:** it is a data model that facilitates the database design by allowing specification of a *schema* that represents the overall logical structure of the database.
- The E-R Model has **three** main concepts

1. entity sets:

entity: is a thing in the real world for example a person is an entity, a course, or a building.

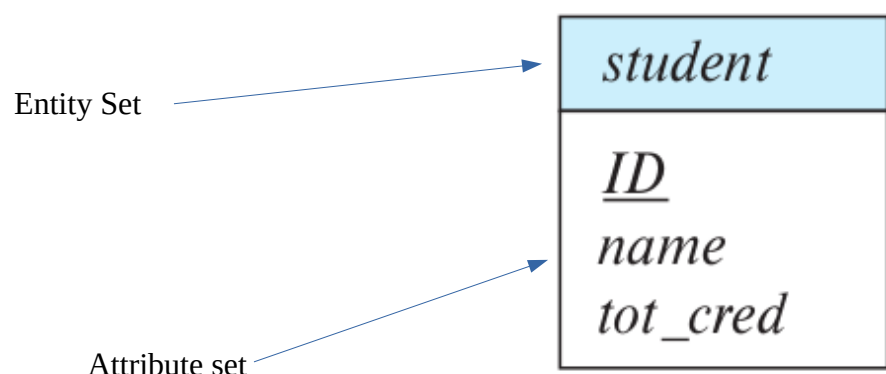
Entity sets is a set of entities of the same type that share the same properties.

Extension of an entity set: is the real representation of the entity set for example the extension of instructors in ain shams university database is an extension of the entity set instructors.

2. Attribute sets:

Attributes: are descriptive properties possessed by each member of an entity sets

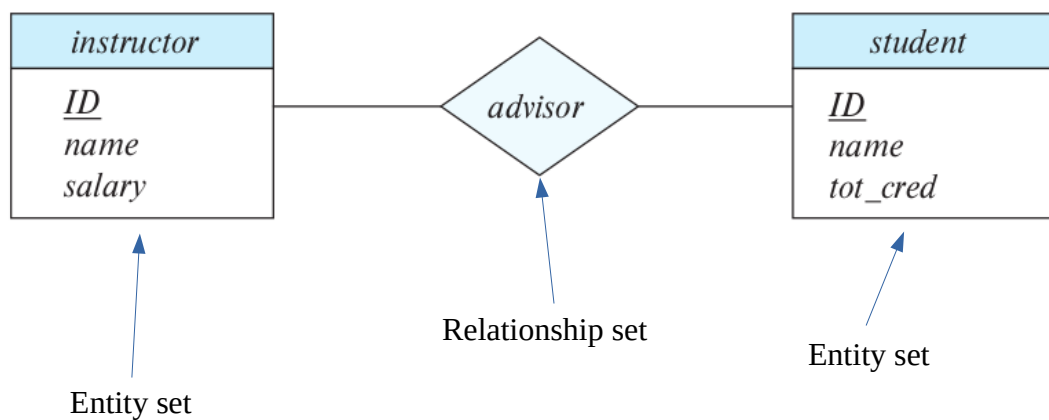
attributes could be name, id, or age for student entity set



3. Relationship sets:

A **relationship** is an association among several entities. For example, we can define a relationship advisor that associates instructor Katz with student Shankar.

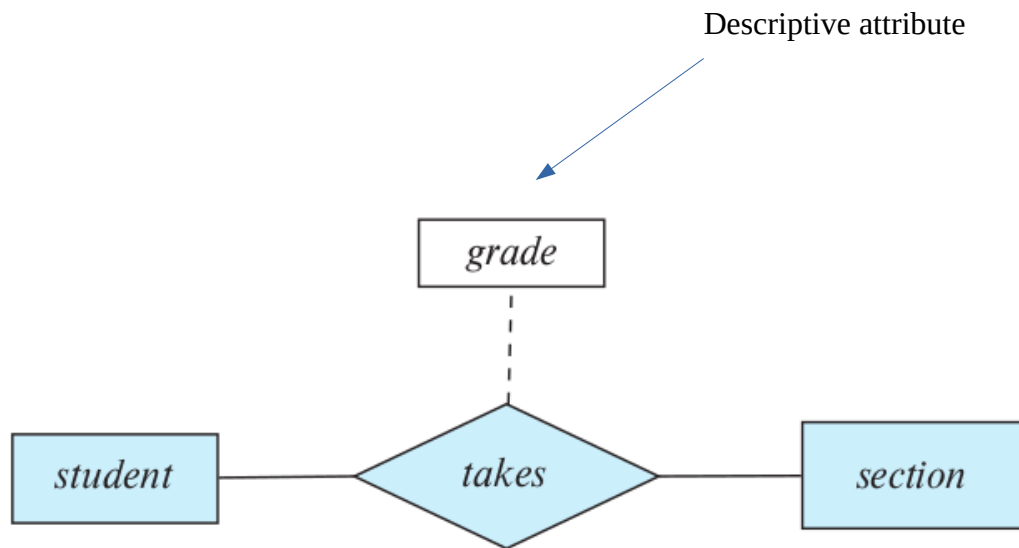
A **relationship set** is a set of relationships of the same type.



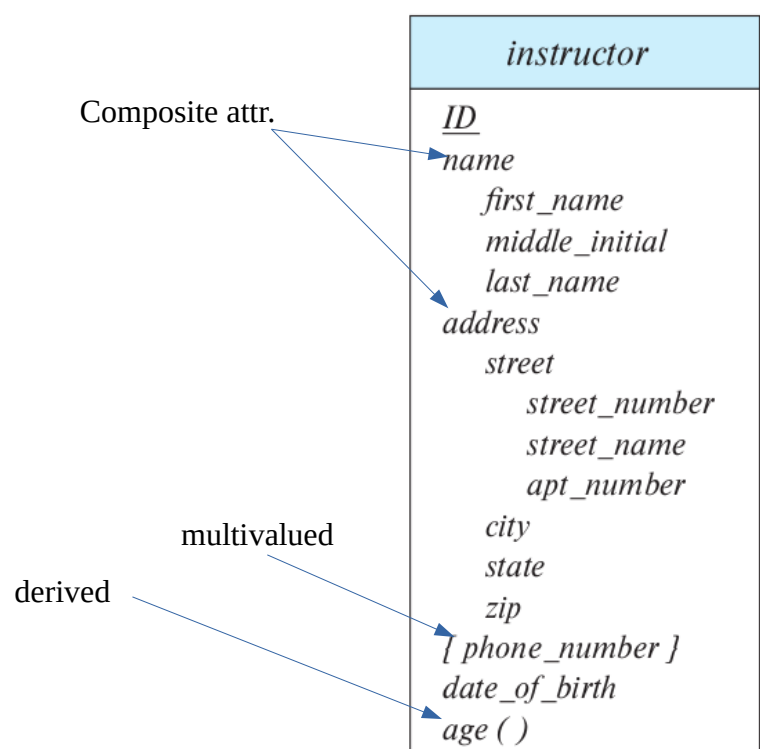
An entity set **participates** in a relationship set.

An entity **role** is the function that it plays in the relationship set.

A relationship may also have attributes called **descriptive attributes**



- the **Domain or Value set** of an attribute is the set of permitted value.
- There are different types of attributes
 - ➔ an attribute could be **simple or composite**
 - ➔ it could be **single-valued or multivalued**
 - ➔ **Derived attributes**



- **Mapping Cardinality:** expresses the number of entities to which another entity can be associated via a relationship set.
 - ➔ One-to-one
 - ➔ One-to-Many
 - ➔ Many-to-One
 - ➔ Many-to-Many
- The relationship set is said to be **total** if every entity in a participated entity sets must participate in at least one relationship, or else it is said to be **Partial**, to indicate that a relationship is total the line to the entity set is drawn as two lines in the E-R diagram.
- **Weak entity set:** is an entity set whose existence is dependant on another entity set called **Identifying entity set**, then the primary key of the weak entity set is the primary key of the Identifying entity set along side with extra attribute called **discriminator attribute**, the weak entity set is always total and many to one toward the identifying entity set
- **Converting the E-R model into relational model**
- the strong entity set with simple attributes is converted directly into schema.
- When the strong entity set contains some complex attributes
 - ➔ the composite attribute is handled such that, every component attribute is modeled in the relational model as single separate attribute and the composite attribute is ignored.
 - ➔ Multivalued attributes are modeled as separate relation with attributes that model the main

multivalued attribute, and attributes that model the primary key of the entity set.

➔ the derived attributes are not modeled in the relational model, they can be stored as functions or procedures in other data models

- we model the weak entity set by a relation with all the attributes of this weak entity set plus the primary key of the dependant strong entity set,

and the primary key of this relation is the primary key of the strong entity set plus the discriminator attributes of the weak entity set.

- We model the relationship set by a relation that has the primary keys of the participating entity set plus any descriptive attributes of the relationship set as attributes for that relation.
- If the participation of an entity set in a relation set is total and it is of "one" type(many-to-one) then both modeled relations are combined together, that is the relation for the relation set and the relation for the entity set.
- If the participation is partial and we want to combine anyways then we have to allow null values.

- **Extended E-R diagram**

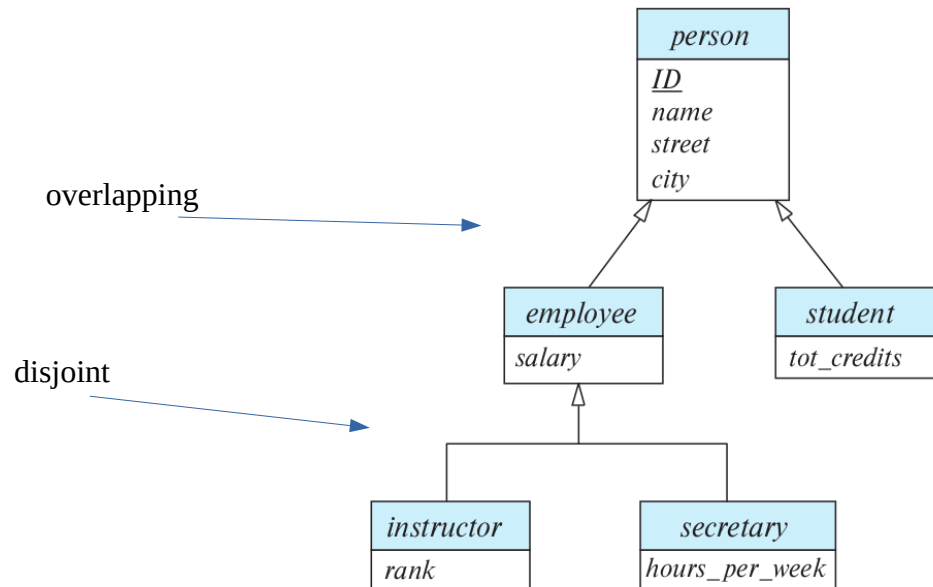
- an entity set could have a subgroup of entities that shares some special attributes that the rest of the entitie doesn't have for example person→employee,

this subgrouping is named **Specialization**

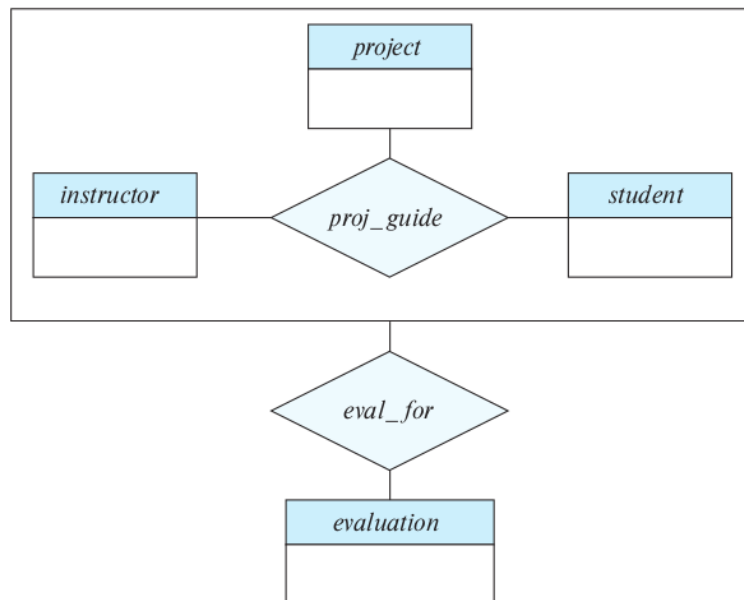
- we can depict the specialization in the E-R diagram as hollow arrow from the specialized to the general(like inheritance in UML)
- when we allow an entity to be in more than one specialization then it is an **overlapping**

specialization else it is **disjoint specialization**

in overlapping specialization we draw two separate arrows, in disjoint we draw one arrow.



- If the superclass participate in a relationship set then all of its subclasses participate in the same relationship set implicitly
- Constraints on Specialization
 - ➔ overlapping or disjoint constraint
 - ➔ Completeness constraint
 - **Total Completeness constraint:** every entity in the high-level entity set must belong to a lower level entity set
 - **Partial Completeness constraint:** entities in the superclass may not be part of the subclasses
- **Aggregation:** we can treat relationship set as higher level entity set that can participate in other relationship set



- Relational diagram modelling of the extended E-R Model

- ➔ Modeling Generalization

1. create a schema for the higher level entity set
2. create a schema for the lower level entity set and add attributes that corresponds to the higher level entity set's primary key, and these attributes become also the low level relations primary key with foreign key constraint to the higher level one

person (*ID*, *name*, *street*, *city*)

employee (*ID*, *salary*)

student (*ID*, *tot_cred*)

