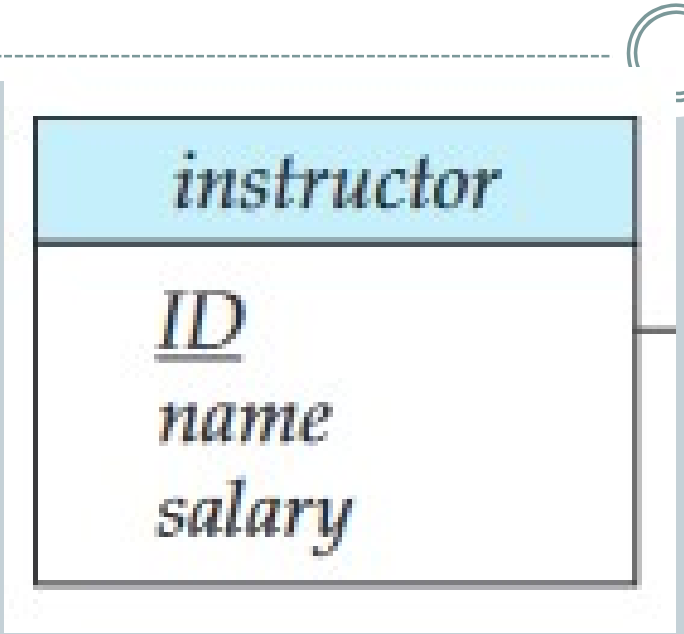
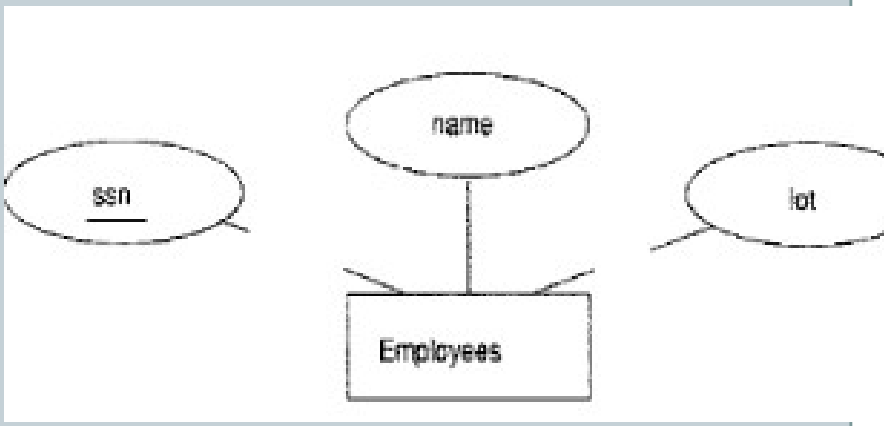
Entity-Relationship Diagrams

- An E-R diagram can express the overall logical structure of a database graphically.
- Basic Structure
- An E-R diagram consists of the following major components
- **Rectangles divided into two parts** :represent entity sets. The first part, contains the name of the entity set. The second part contains the names of all the attributes of the entity set.





- Diamonds represent relationship sets.

- **Undivided rectangles** represent the attributes of a relationship set. Attributes that are part of the primary key are underlined.
- **Lines** link entity sets to relationship sets.
- **Dashed lines** link attributes of a relationship set to the relationship set.
- **Double lines** indicate total participation of an entity in a relationship set
- **Double diamonds** represent identifying relationship sets linked to weak entity sets

Figure 7.7 E-R diagram corresponding to instructors and students.

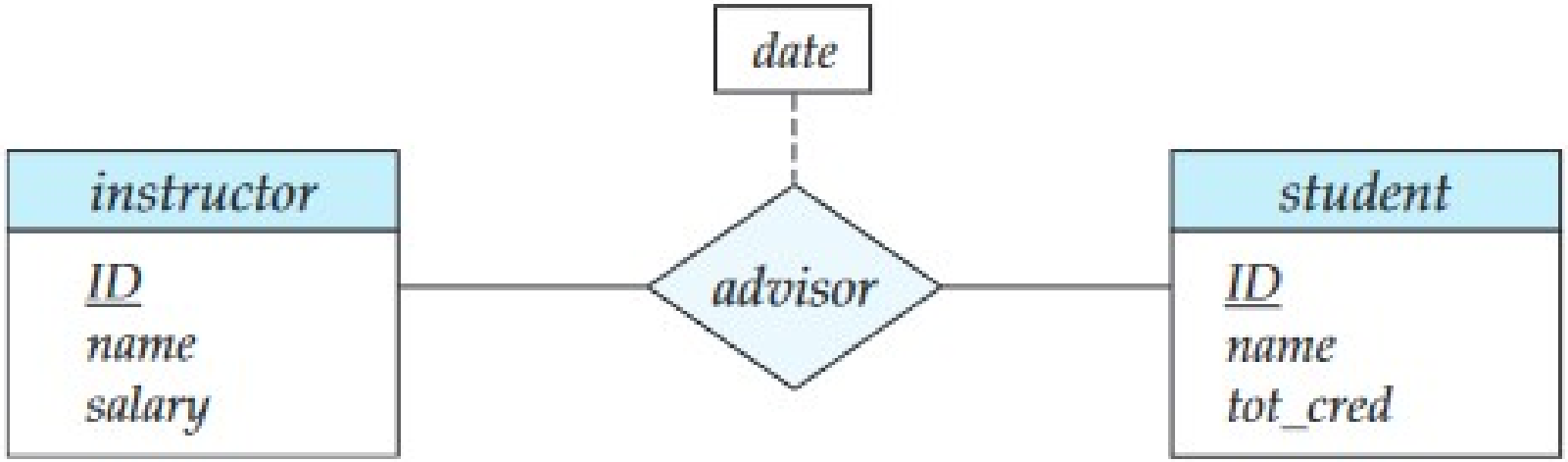


Figure 7.8 E-R diagram with an attribute attached to a relationship set.


instructor
ID
name
salary
advisor
student
ID
name
tot_cred

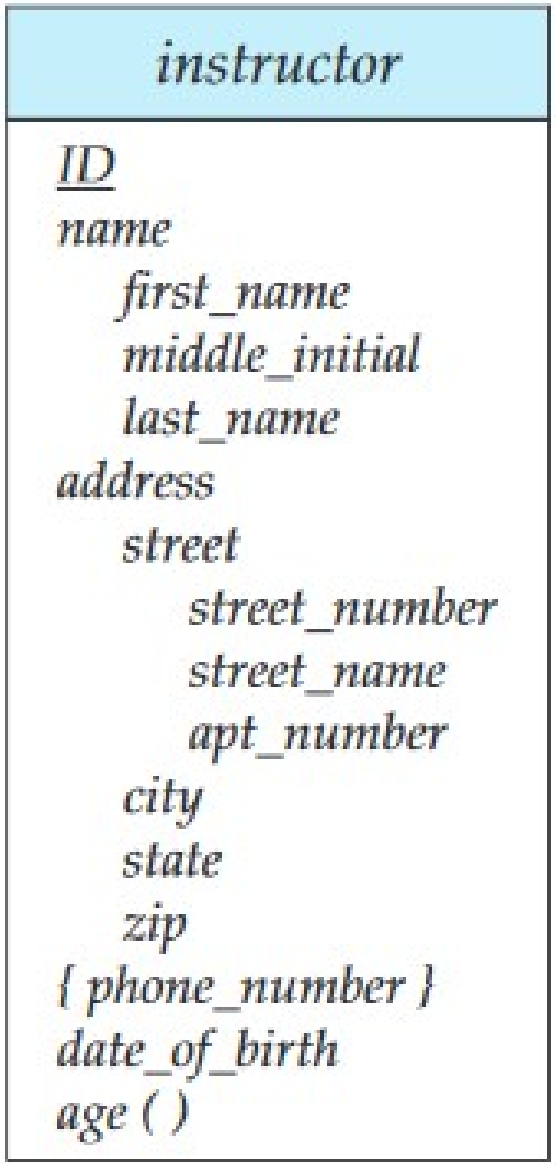
(a)


instructor
ID
name
salary
advisor
student
ID
name
tot_cred

(b)


instructor
ID
name
salary
advisor
student
ID
name
tot_cred

(c)



E-R diagram with composite, multivalued, and derived attributes.

Roles

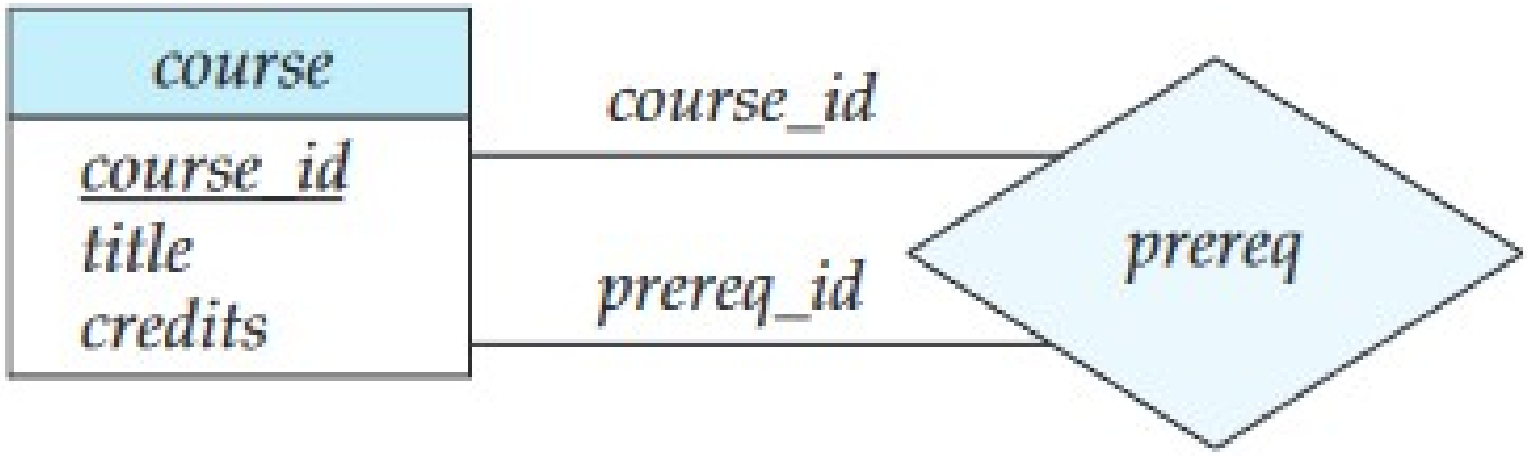


Figure 7.12 E-R diagram with role indicators.

Weak Entity Sets

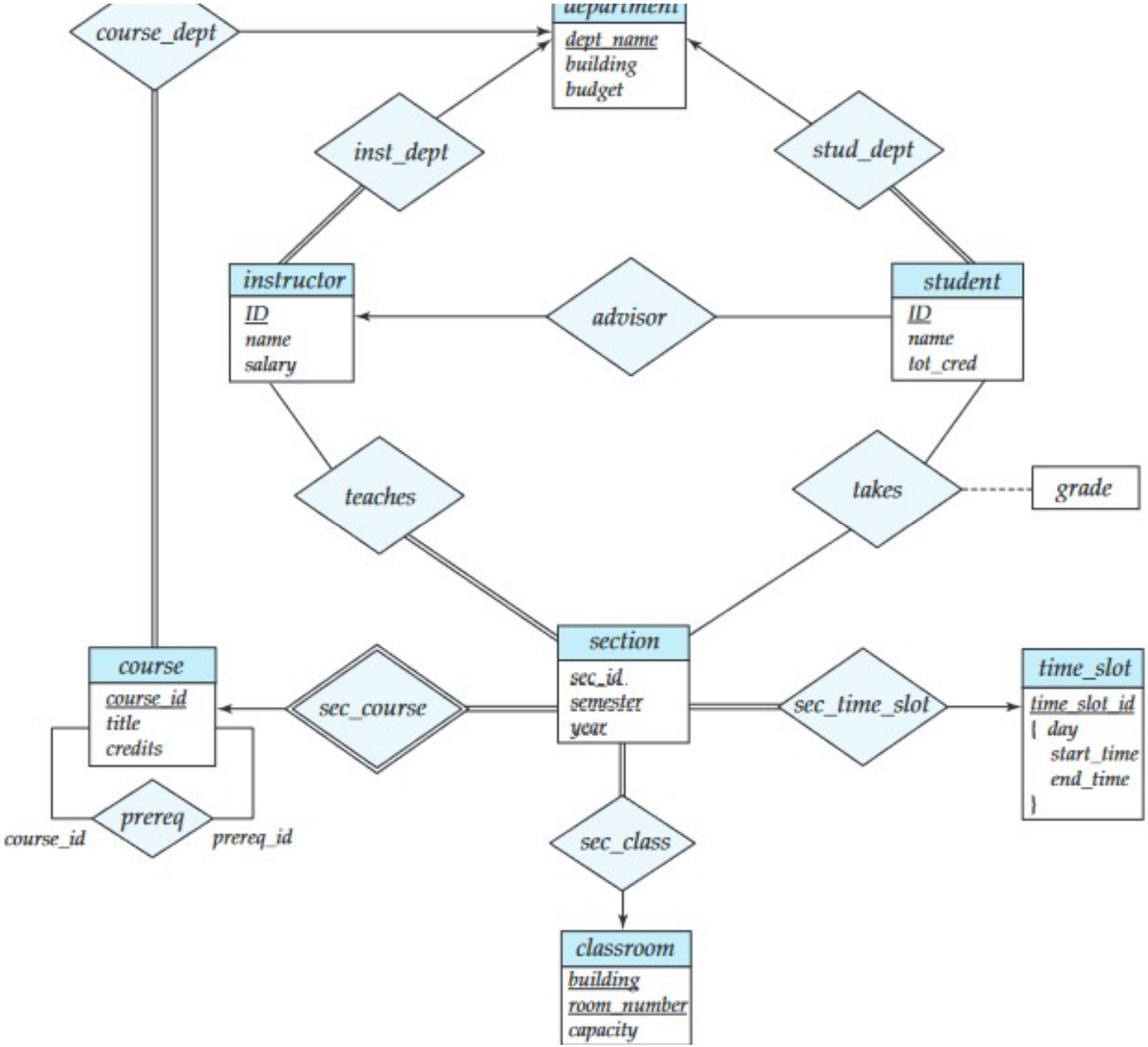
- An entity set that does **not have sufficient attributes to form a primary key** is termed a **weak entity set**.
- An entity set that has a primary key is termed a strong entity set.
- For a weak entity set to be meaningful, it must be associated with another entity set, called the **identifying or owner entity set**.

- Every weak entity must be associated with an identifying entity; that is, the weak entity set is said to be existence dependent on the identifying entity set.
- The identifying entity set is said to own the weak entity set that it identifies.
- The relationship associating the weak entity set with the identifying entity set is called the **identifying relationship**

- The **identifying relationship is many-to-one** from the weak entity set to the identifying entity set, and the **participation of the weak entity set in the relationship is total**.
- The identifying relationship set should not have any descriptive attributes, since any such attributes can instead be associated with the weak entity set.
- The discriminator of a weak entity set is a set of attributes that allows this distinction to be made.

- The primary key of a weak entity set is formed by the primary key of the identifying entity set, plus the weak entity set's discriminator.
- In E-R diagrams, a weak entity set is depicted via a rectangle, like a strong entity set, but there are two main differences:
- The **discriminator of a weak entity is underlined with a dashed**, rather than a solid, line.
- The relationship set connecting the weak entity set to the identifying strong entity set is depicted by a **double diamond.**

Figure 7.14 E-R diagram with a weak entity set.


course_dept
department
dept_name
building
budget
inst_dept
stud_dept
instructor
ID
name
salary
advisor
student
ID
name
tot_cred
teaches
takes
grade
course
course_id
title
credits
sec_course
section
sec_id
semester
year
sec_time_slot
time_slot
time_slot_id
{ day
start_time
end_time
}
prereq
course_id
prereq_id
sec_class
classroom
building
room_number
capacity

Problem

- A company database needs to store information about employees (identified by *ssn*, *with salary and phone as attributes), departments (identified by dno*, with *dname and budget as attributes), and children of employees (with name and age* as attributes).

Problem

- Employees *work in departments; each department is managed by an* employee; a child must be identified uniquely by *name when the parent (who is an* employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.
- Draw an ER diagram that captures this information.