ER MODEL

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ITER,S'O'A(DEEMED TO BE UNIVERSITY)

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Review

- The ER Model

Content

- The ER Model
- The ER Diagram

Entity-Relationship (ER) Data Model

- The ER data model facilitates database design by allowing specification of an enterprise schema that represents the overall logical structure of a database.

- It is very useful in mapping the meanings and interactions of real-world enterprises onto a conceptual schema.

- The ER data model employs three basic concepts:

  - Entity Sets,

  - Relationship Sets,

  - Attributes.

- The ER model also has an associated diagrammatic representation, the ER diagram, which can express the overall logical structure of a database graphically.

ER Data Model - II

- This data model uses a collection of
  - basic objects, called *entities,*
  - and *relationships among these objects.*
- An entity is a "thing" or "object" in the real world that is distinguishable from other objects.
  - Ex: employee, student, account
- An entity has a set of properties that uniquely identifies an entity called attributes.
  - Ex: Employee (emp_no, emp_name, …)
  - Student (stu_no, stu_name, branch, …)

ER Model: Entity Set

■ **Entity Set** : is a set of entities of the same type that share the same attributes.

● Ex: The set of all people who are instructors at a given university, can be defined as the entity set instructor.

76766	Crick
45565	Katz
10101	Srinivasan
98345	Kim
76543	Singh
22222	Einstein

instructor

98988	Tanaka
12345	Shankar
00128	Zhang
76543	Brown
76653	Aoi
23121	Chavez
44553	Peltier

student

● Ex: The set of all students at a given university, can be defined as the entity set student.

ER Diagram: Entity Set

- Entities are represented graphically as follows:
  - Rectangles represent entity sets.
    - Part I: entity set name
    - Part II: Attributes listed inside entity rectangle
 - Underline indicates primary key attributes

instructor
<u>ID</u>
name
salary

student
<u>ID</u>
name
tot_cred
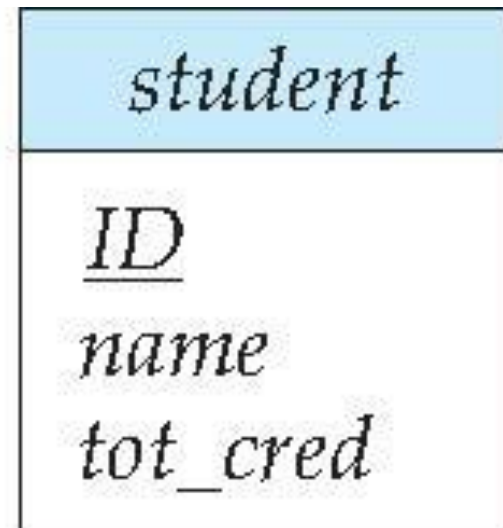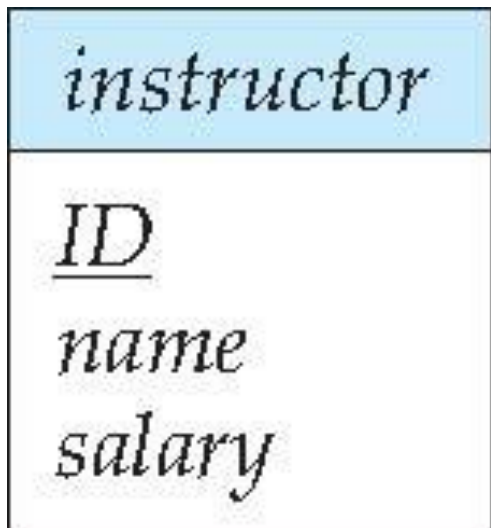
ER Model: Relationship - I

■ **Relationship**: A relationship is an *association* among several entities.

- Ex: Let's define a relationship *advisor that associates instructor Katz with student Shankar.*

■ **Relationship set**: is a set of relationships of same type between two or more entity sets.
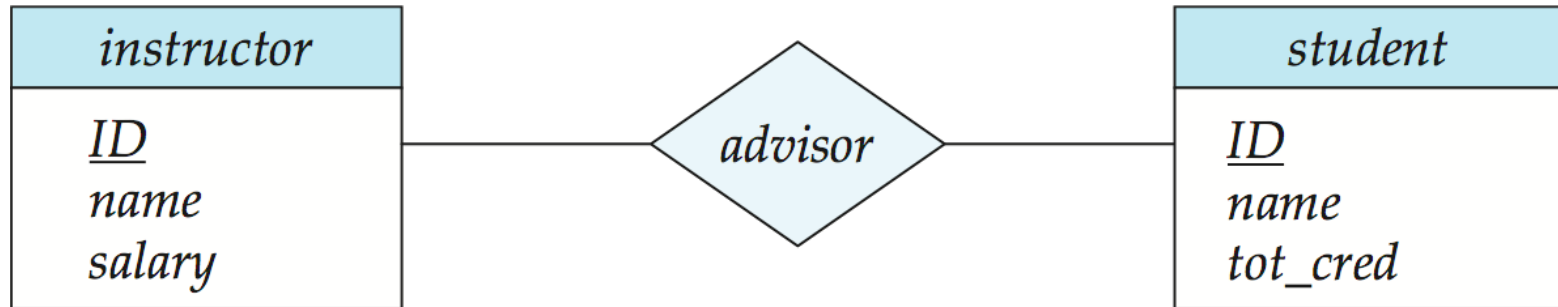

Relationship set
advisor
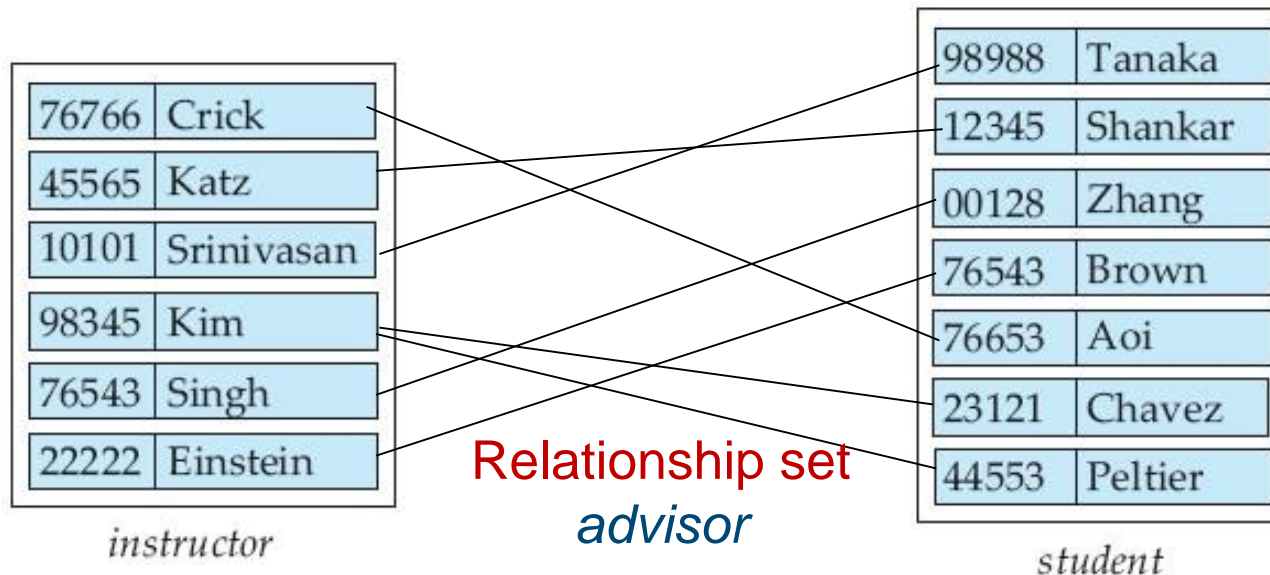
ER Model: Relationship Set - II

- The association between entity sets is referred to as *participation*.

  - Ex: Katz and Shankar participate in relationship instance of advisor

  - i.e. This relationship instance represents that in the university, instructor Katz is advising student Shankar.

- Relationship may also have attributes called *descriptive attributes.*.

instructor
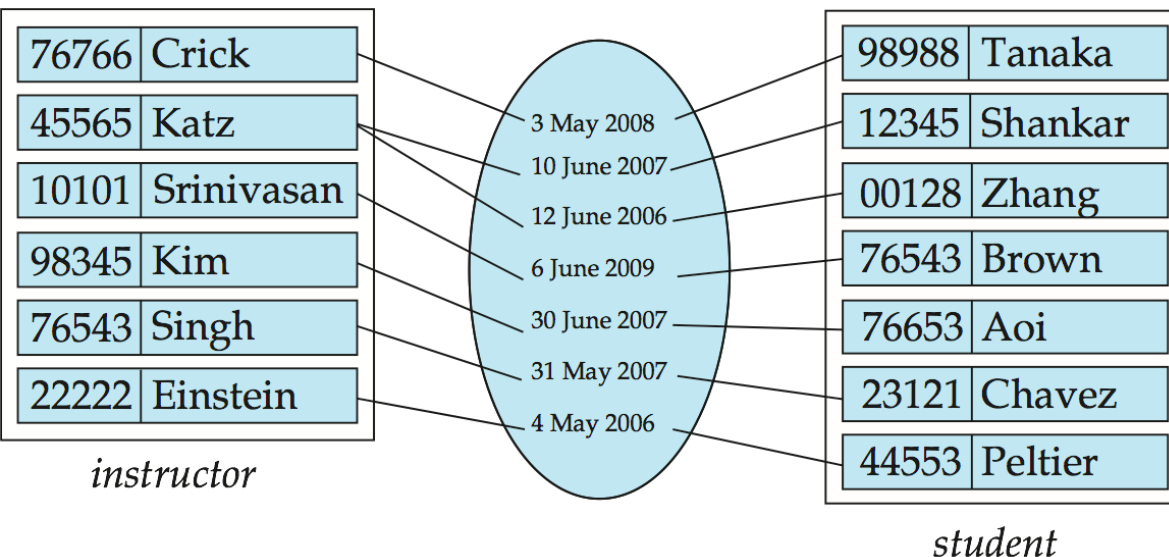
student

Ex. the *advisor* relationship set between entity sets *instructor* and *student* have the attribute *date* which tracks when the student started being associated with the advisor

ER Diagram: Relationship sets

- ■ Diamonds represent relationship sets
  - ● Solid lines link entity set to relationship sets

- ■ Relationship sets with attributes
  - ■ Undivided rectangles represent attributes of relationship set
  - ■ Dashed line link relationship set to attributes
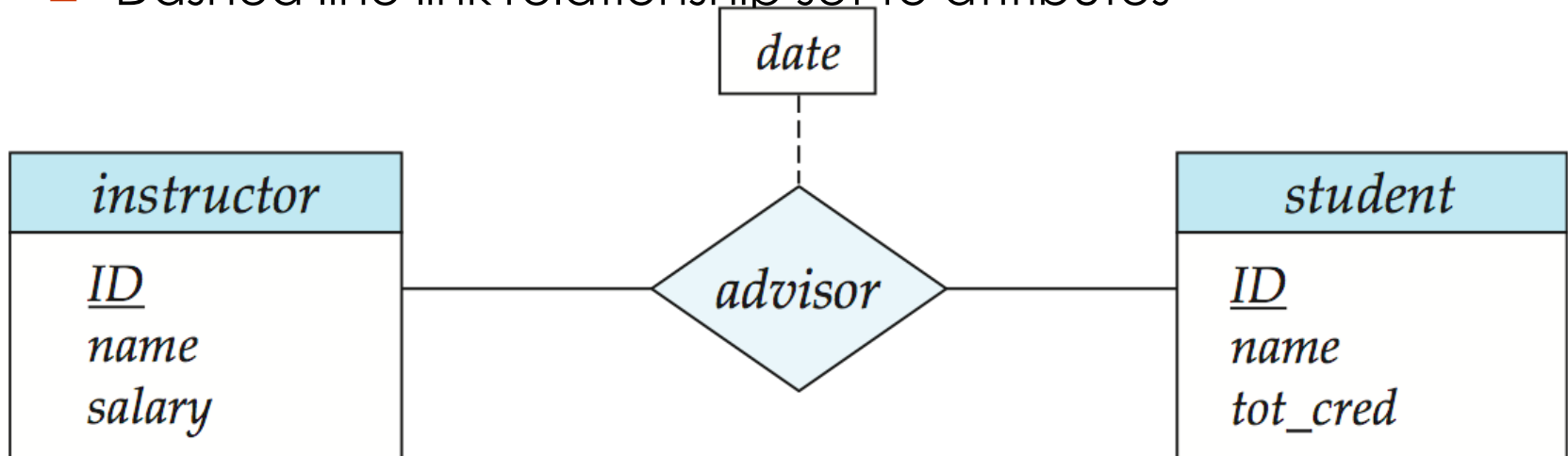
Project-I – Step I

- Entity set Customer with attributes
  - cust_num, Name , Address, Phone_num
- Entity set Account with attributes
  - Acc_num, balance
- Entity set Loan with attributes
  - loan_num, Loan_amt
- Entity set Branch with attributes
  - branch_id, branch_name, branch_address
- Relationship set Deposits between Customer & Account
- Relationship set Borrows between Customer & Loan
- Relationship set Loan_branch between Loan & Branch
- Relationship set Account_with between Account & Branch

ER Model: Relationship Set - III

- The function that an entity plays in a relationship is called that entity's *role*
  - Katz's role is *'instructor'*, Shankar's is *'student'* in the relationship of *'advisor'*

- The same entity set participates in a relationship set more than once, in different roles is called *recursive relationship set*

- Also known as unary relationship

MTH 1001: Calculus I
MTH 2001: Calculus II
CSE1002: Discrete Maths
CSE2011: COA
MTH2002: Probability & Statistics

prerequisite
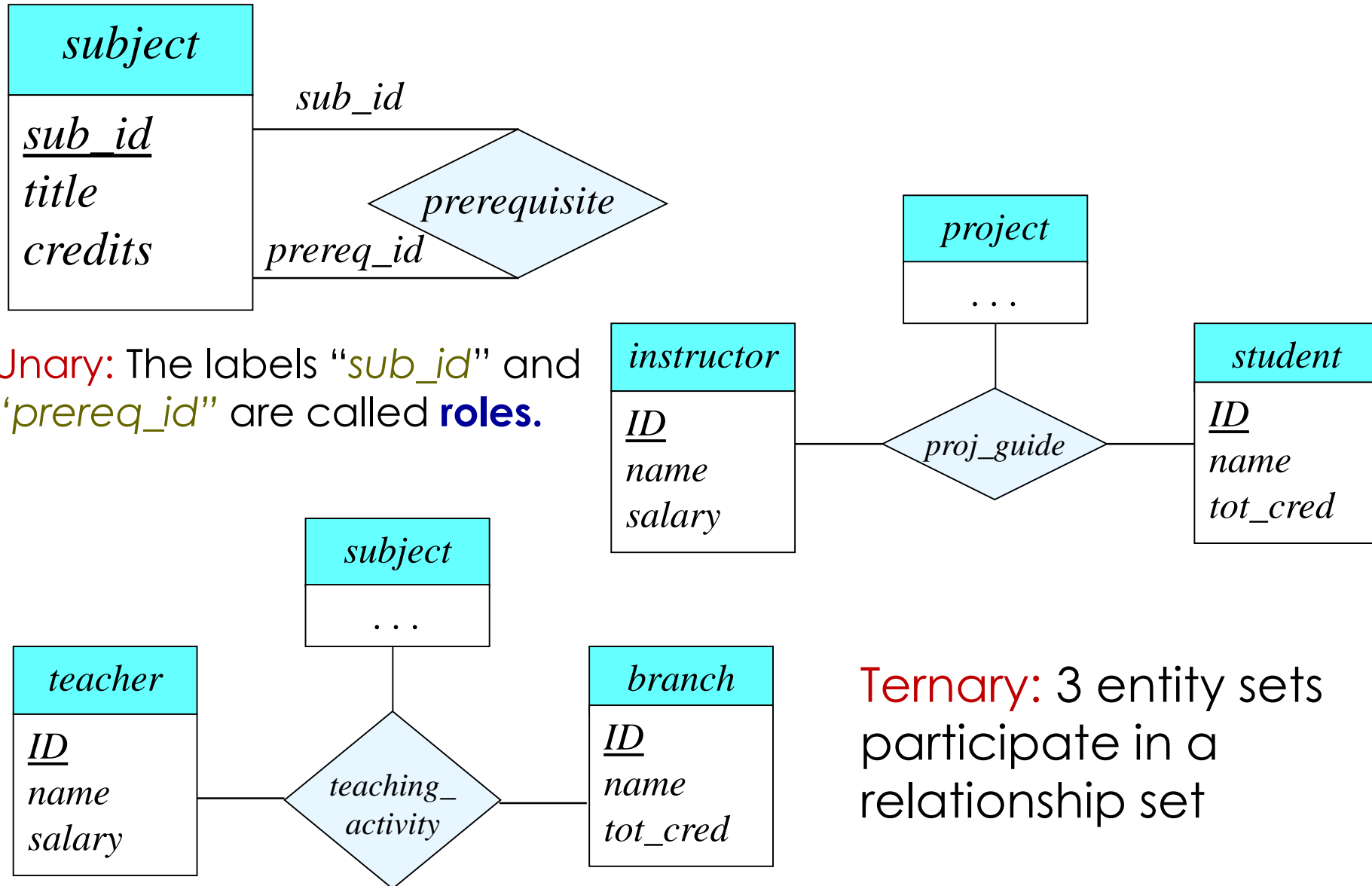
recursive relationship set
Role of MTH2001: course
Role of MTH1001: prerequisite course

ER Model: Degree of Relationship

■ The *degree* of a relationship set is the number of entity sets participate in the relationship.

■ The three most common relationship sets categorised according to the degree in ER models are

■ *Binary: When two entity sets participates.*

- *Ex: Teacher teaches some Students*

■ *Unary:* when both participants are the same entity

- *Ex: Subject prerequisite of another Subject*
- Also known as *recursive relation*

■ *Ternary:* when three entities participate in the relationship.

- *Ex1: Instructor becomes project_guide to students and develops projects*
- *Ex2: Teacher teaching_activity with Branch and Subject*

ER Diagram: Degree of Relationship

subject

subject
<u>sub_id</u>
title
credits

sub_id

prereq_id

prerequisite

project

project
. . .

instructor

instructor
<u>ID</u>
name
salary

proj_guide

student

student
<u>ID</u>
name
tot_cred

Unary: The labels "*sub_id*" and "*prereq_id*" are called **roles.**

subject

subject
. . .

teacher

teacher
<u>ID</u>
name
salary

teaching_activity

branch

branch
<u>ID</u>
name
tot_cred

**Ternary:** 3 entity sets participate in a relationship set

ER Model: Attributes

- Attributes are the properties of an entity set that are relevant to the database and about which the data values need to be stored.

- For each attribute, there is a set of permitted values, called domain or value set

- An attribute of an entity set is a function that maps from the entity set in to a domain.

- Each entity can be described by a set of (attribute, value) pair.

  - Ex. A particular instructor entity may be represented as

  {(ID, 76766), (name, Crick), (dept, CSIT), (salary, 50000)}

  - Similarly a particular student entity

  {(ID, 34721),(name, Sid),(DoB, 30-12-1997),(branch, CSIT)}

ER Model: Category of Attributes- I

- ## Simple and Composite

  - Simple attributes are atomic and cannot be divided further.

  - Ex. (regNo)

  - Composite attributes are sub-divided further.

  - Ex. (name{*first_name, middle_name, last_name*})

  - Composite attributes may be represented in a hierarchy.
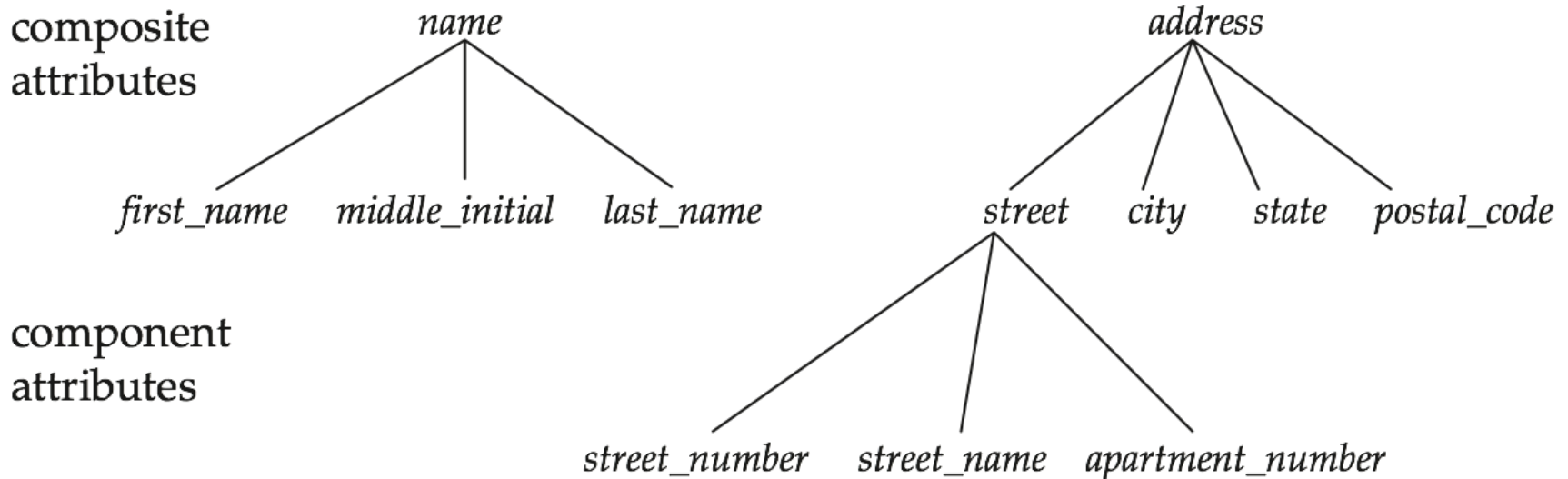
Composite attributes are useful when it is needed to use either whole or part of the information of an attribute
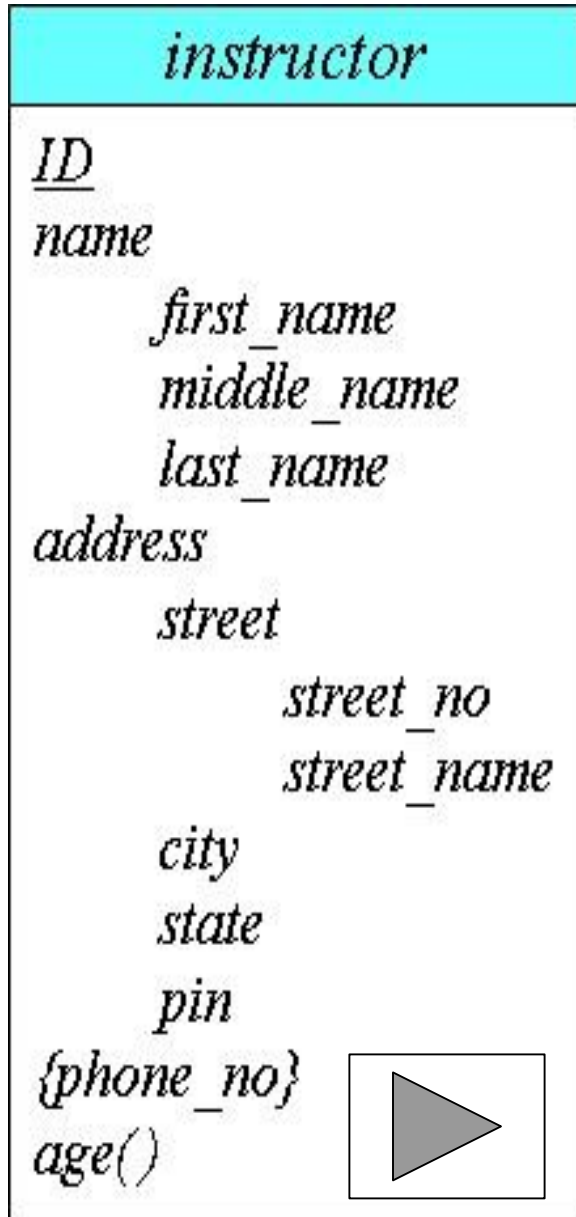
ER Model: Category of Attributes- II

- ## Single Valued and Multivalued

  - Attribute that maps to only one value in a domain are called single valued attribute

  - Ex. DoB, reg_no

  - Attribute that maps to more than one values in a domain are called multivalued attribute.

  - Ex. phone_no, email_id

- ## Derived

  - If the value for an attribute can be computed from the values of other related attributes then is called derived attribute

  - Ex. age, net_salary, can be calculated from DoB and other salary components respectively.

ER Diagram: Attributes

instructor
ID
name
first_name
middle_name
last_name
address
street
street_no
street_name
city
state
pin
{phone_no}
age( )

- Composite attribute: represented in indentation.

- Ex. *name* with component attributes *first_name,…, last_name*

- Ex. *address* with *, city, state, and zip.*

- Ex. *street* with *street_no, street name and apt_number*

- Multivalued attribute: represented using curly braces.

- Ex. *{phone_number}* of *instructor*

- Derived attribute: represented using parenthesis. Ex. *age( )*

Thank You