Database Systems Concepts and Design

CSC201S2/G2

Database Design Using the E-R Model

Outline

- The Entity-Relationship Model
- Complex Attributes
- Mapping Cardinalities
- Primary Key
- Removing Redundant Attributes in Entity Sets
- Reducing ER Diagrams to Relational Schemas
- Extended E-R Features
- Entity-Relationship Design Issues
- Alternative Notations for Modeling Data

Overview

Entity Relationship Model

- Models an enterprise as a collection of *entities* and *relationships*
  - Entity: a “thing” or “object” in the enterprise that is distinguishable from other objects. Described by a set of *attributes*
  - Relationship: an association among several entities
- Represented diagrammatically by an *entity-relationship diagram*

▪Normalization Theory

- Formalize what designs are bad, and test for them

ER model: Database Modeling

- Facilitate database design by allowing specification of an enterprise schema
- Represents the overall logical structure of a database.
- The ER data model employs three basic concepts:

  entity sets, relationship sets, and attributes.
- Express the overall logical structure of a database graphically

Entity Sets

- An entity: object that exists and is distinguishable from other objects.

  Eg: specific person, company, event, plant

- An entity set: set of entities of the same type that share the same properties.

  Eg: set of all persons, companies, trees, holidays

- An entity is represented by a set of attributes

  Eg: instructor = (ID, name, salary), course= (course_id, title, credits)

- A subset of the attributes form a primary key: uniquely identifying each member of the set.

Entity Sets: Instructor and Student

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

instructor

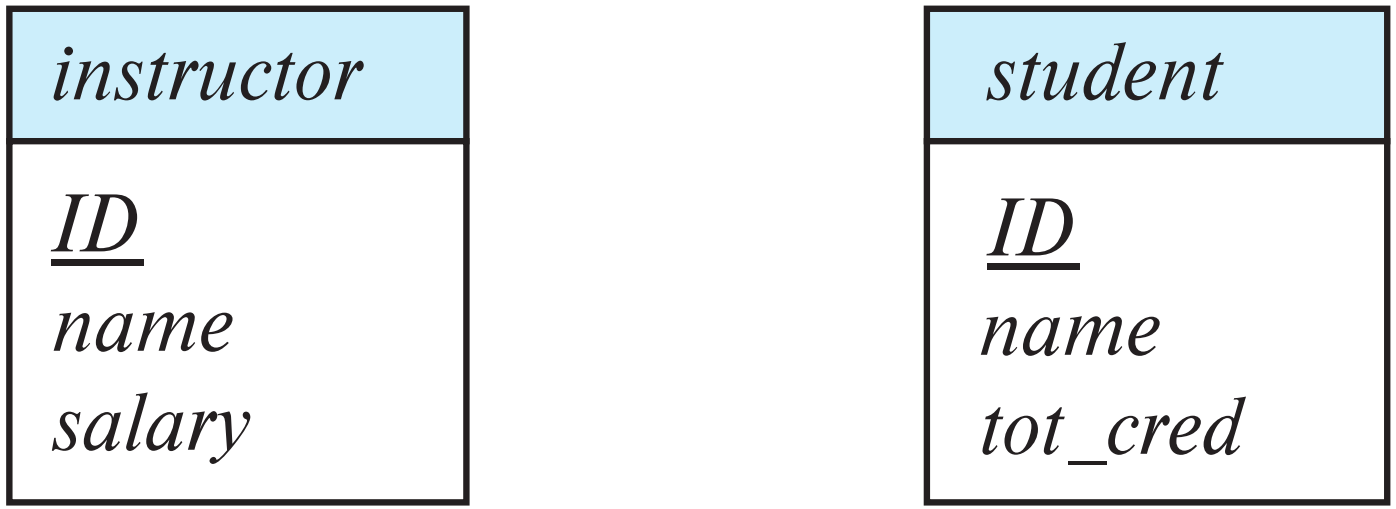
98988	Tanaka
12345	Shankar
00128	Zhang
76543	Brown
76653	Aoi
23121	Chavez
44553	Peltier

student

Representing Entity sets in ER Diagram

Entity sets can be represented graphically as follows:

- Rectangles represent entity sets.
- Attributes listed inside entity rectangle
- Underline indicates primary key attributes



Relationship Sets

Eg: 44553 (Peltier) advisor 22222 (Einstein)

student entity relationship set instructor entity

A relationship set is a mathematical relation among n ≥ 2 entities, each taken from entity sets

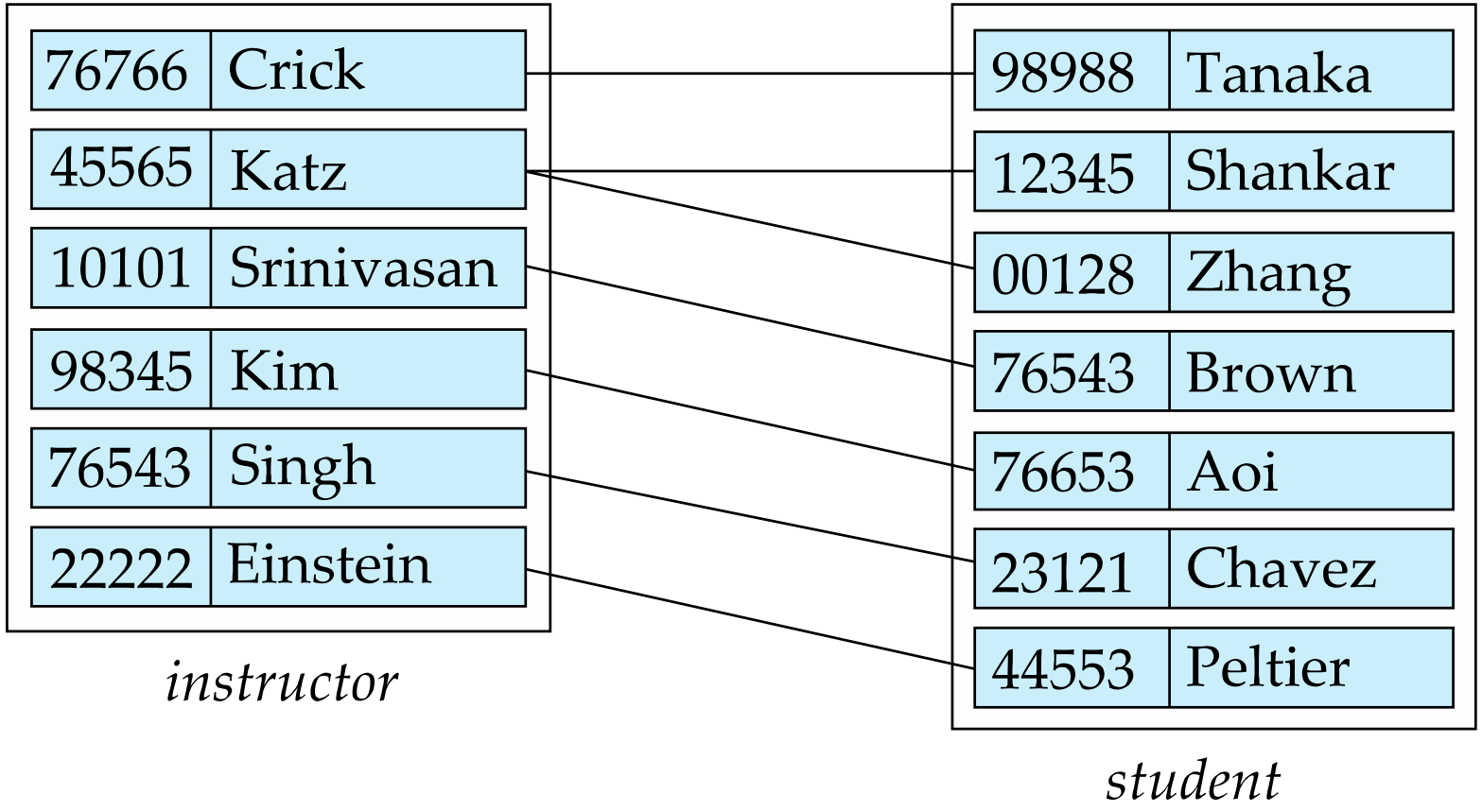
$$\{(e_1, e_2, \ldots e_n) \mid e_1 \in E_1, e_2 \in E_2, \ldots, e_n \in E_n\}$$

where $(e_1, e_2, \ldots, e_n)$ is a relationship

Eg: (44553,22222) ∈ advisor

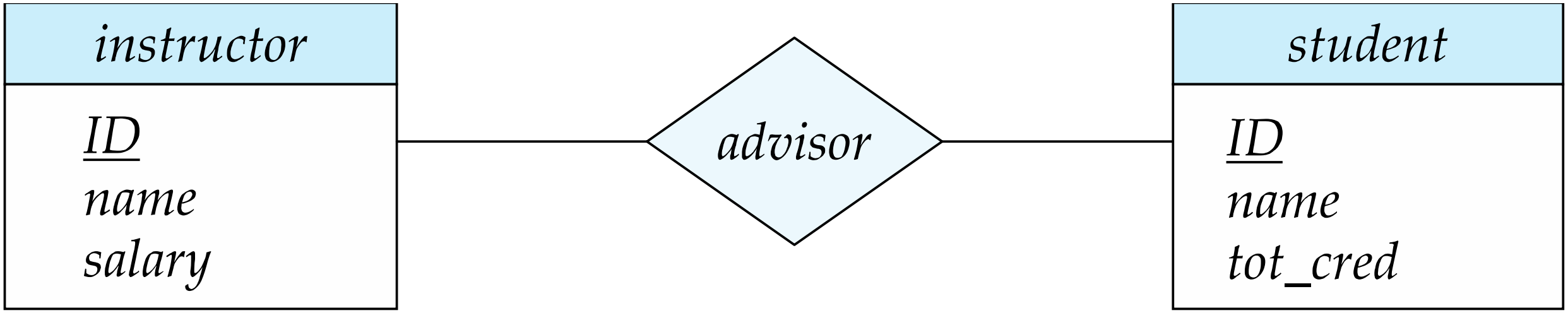
Relationship Sets

- Example: we define the relationship set *advisor* to denote the associations between students and the instructors who act as their advisors.



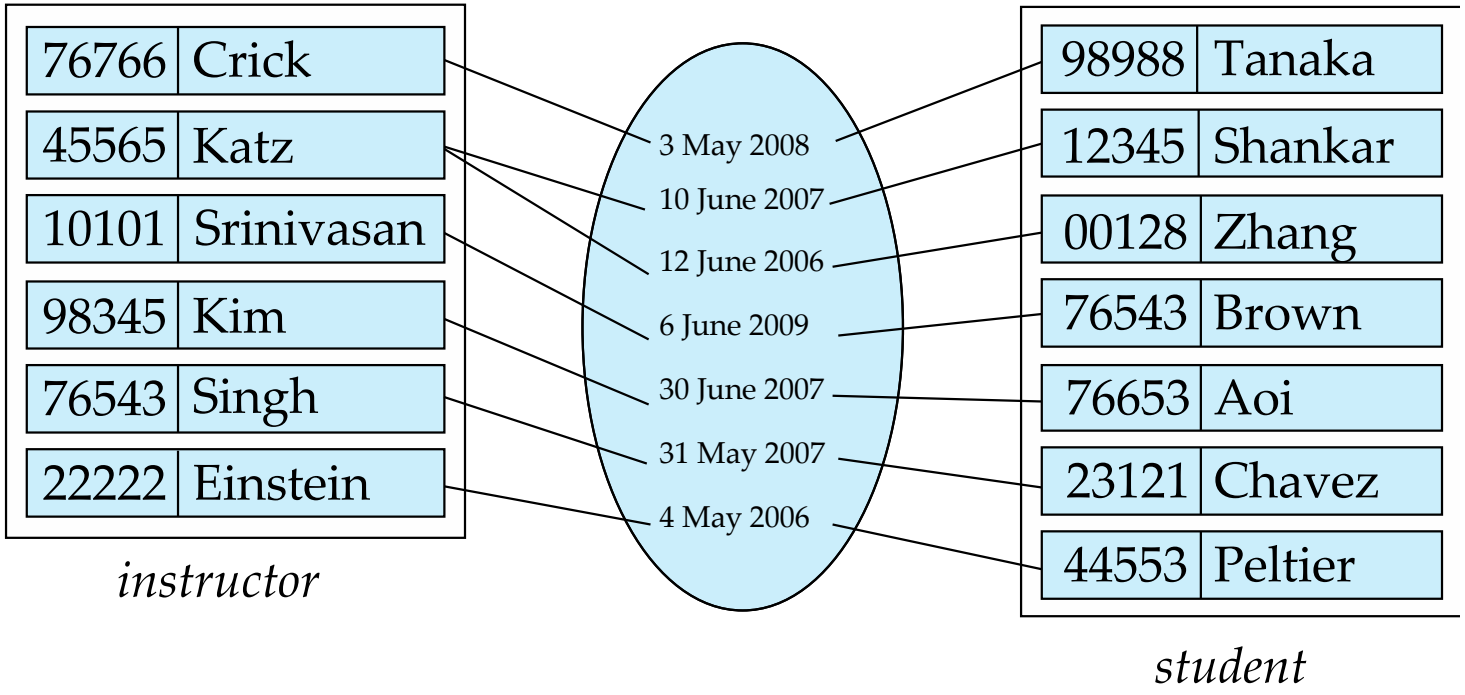
Representing Relationship Sets via ER Diagrams

- Diamonds represent relationship sets.



Relationship Sets

- An attribute can also be associated with a relationship set.
- Eg: advisor relationship set between entity sets instructor and student may have the attribute date which tracks when the student started being associated with the advisor

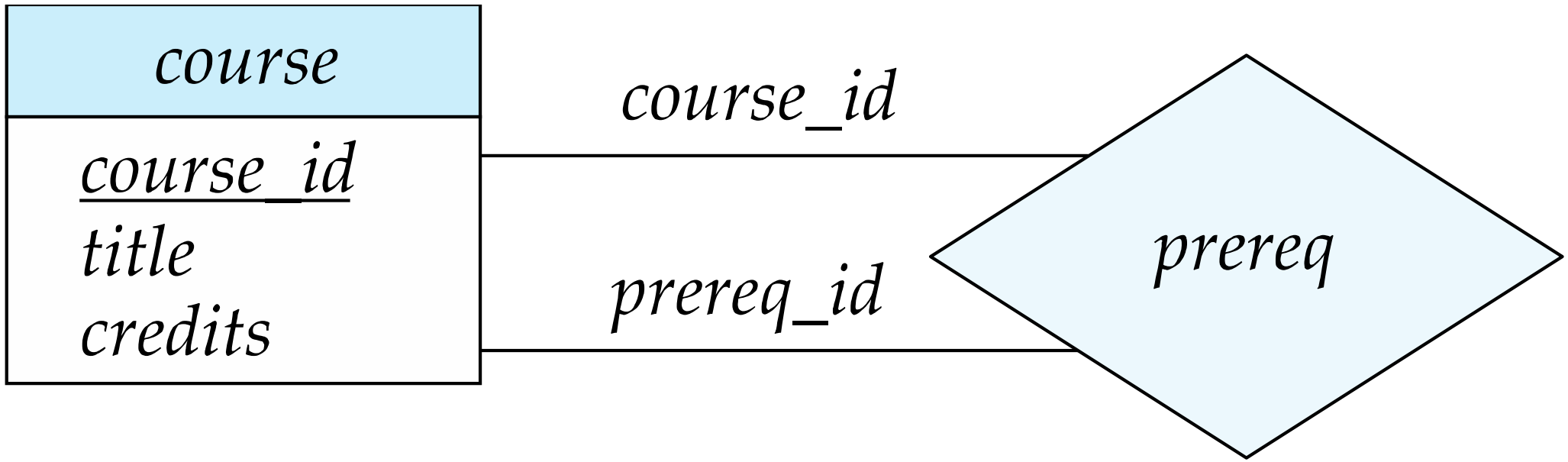


Roles

- Entity sets of a relationship need not be distinct

  Each occurrence of an entity set plays a “role” in the relationship

Eg: The labels “*course_id*” and “*prereq_id*” are called **roles**.

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