

Data Modeling: ER Modeling

How to Organize Data: ER Model

- ❖ Conceptual Design
 - ❖ Determine the *entities* and *relationships*
 - ❖ What attributes should be kept for them
 - ❖ Constraints on these
 - ❖ Create a schema, say an ER diagram
 - ❖ Map it into a relational schema

Entities (Entity Set)

- ❖ **Entity** - a distinguishable object
 - ❖ may have **attributes**
- ❖ Entity Set - each member of the set is distinct
 - ❖ a “key” is a minimum set of attributes that uniquely identify a member of the entity set
 - ❖ each attribute has a domain (usually a *type*)

University Database - Entities

- ❖ Students

- ❖ student id, last name, first name, matriculation date
- ❖ standing, major(s)

- ❖ Faculty

- ❖ last name, first name, department


- ❖ Courses

- ❖ department, number, cross listing, description

- ❖ Classrooms

- ❖ building, room number, capacity

Relationships (Relationship Set)

- ❖ How different entities (2 or more) relate to another
 - ❖ students taking courses
 - ❖ teachers teaching course: (Prof Shatdal, CS564)
 - ❖ course's schedule and location:
 - ❖ (CS564, 3:30-4:45PM, Edu Sci 204, Monday)
 - ❖ (CS564, 3:30-4:45PM, Edu Sci 204, Wednesday)
- ❖ Relationship Set - a set of  relationships like above
- ❖ Same entities can participate in many relationships

Kinds of Relationships

- ❖ 1 to 1 (1:1) : ssn-student_id
- ❖ 1 to many (1:n): (1) department - (n)faculty members
 - ❖ each department has many faculty members
 - ❖ but faculty member belongs to only 1 department
- ❖ many to 1 (n:1) equivalent to (1:n)
- ❖ many to many (n:m): students - courses
 - ❖ a student can take many courses
 - ❖ a course has many students

Key Constraint

- ❖ In a 1:N relationship the “N” part uniquely determines the relationship entry
 - ❖ e.g. each faculty member has only one entry in the relationship set “faculty-department”
- ❖ So the faculty member entity is a “key” for the relationship
- ❖ in some ER diagrams, it is pictured with an arrow (pointed from “key” entity to the relationship)

Participation Constraint

- ❖ Essentially says that all entities participate in the relationship, e.g. every faculty member has a department

Weak Entities

- ❖ Entities that can't (uniquely) stand on their own ...
- ❖ Uniquely identifiable only through a 1:N relationship
- ❖ (Think: dependents before we had SSN for every newborn - A dependent "name" could only be uniquely identified with a parent name association)

Is-A Hierarchy

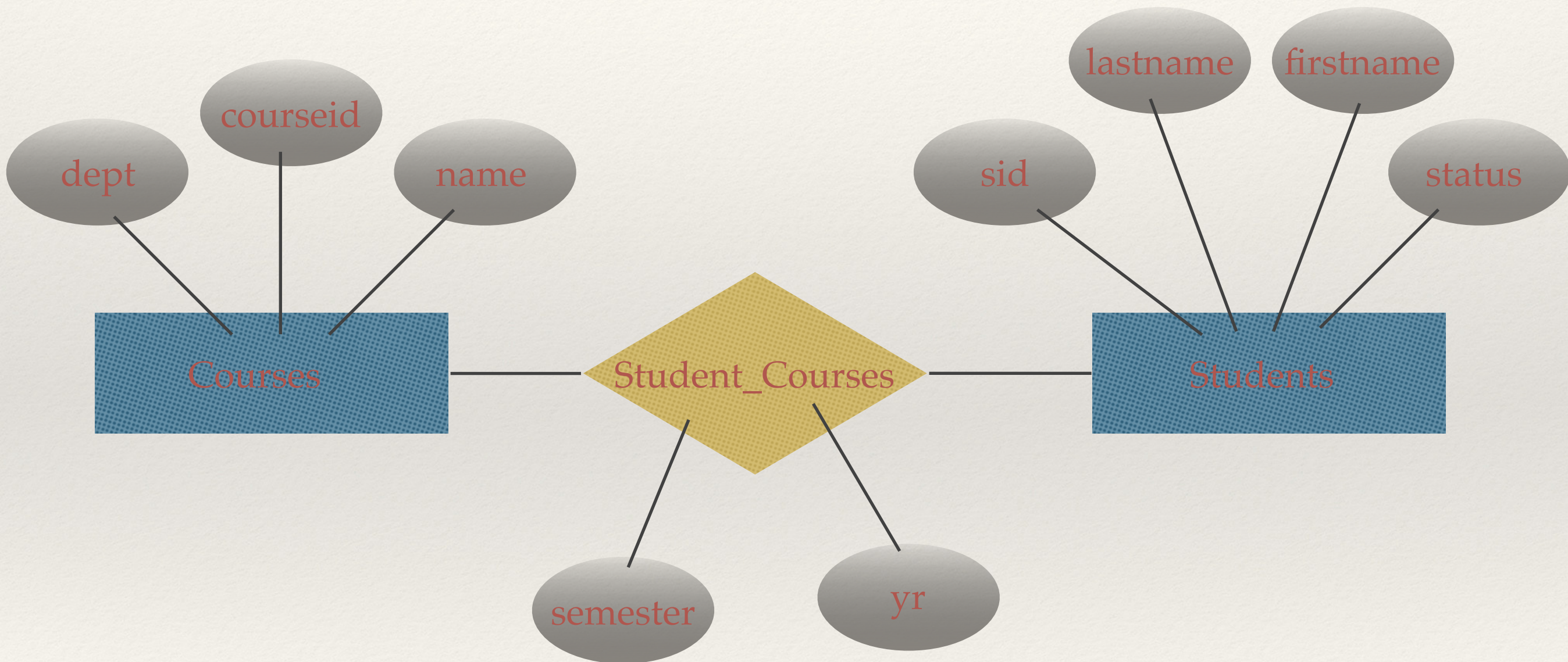
- ❖ Many relationships between entities are hierarchical in nature, so instead of inventing new terms we simply call them “ISA”
- ❖ Dept Chair *ISA* Faculty Member *ISA* Employee
- ❖ The subclasses may have additional attributes

Design with ER Model

- ❖ Identify entities, attributes, relationships
 - ❖ e.g.: attributes vs. relationship with another entity with attributes
- ❖ Kind of relationships
- ❖ Identify domains and constraints (the more the better)

Simple E-R model

2.2-2.3



Simple E-R model using a new entity

