CSE 403

Software Engineering

Spring 2023

#10: Data modelling

Logistics

WEEK 4

04/17	L: Data modeling	
04/18	T:	DUE: GPS!!!
04/19	L: Architecture	Design & Architecture (DnA)
04/20	P:	
04/21	L: Design	

From Requirements to System Design

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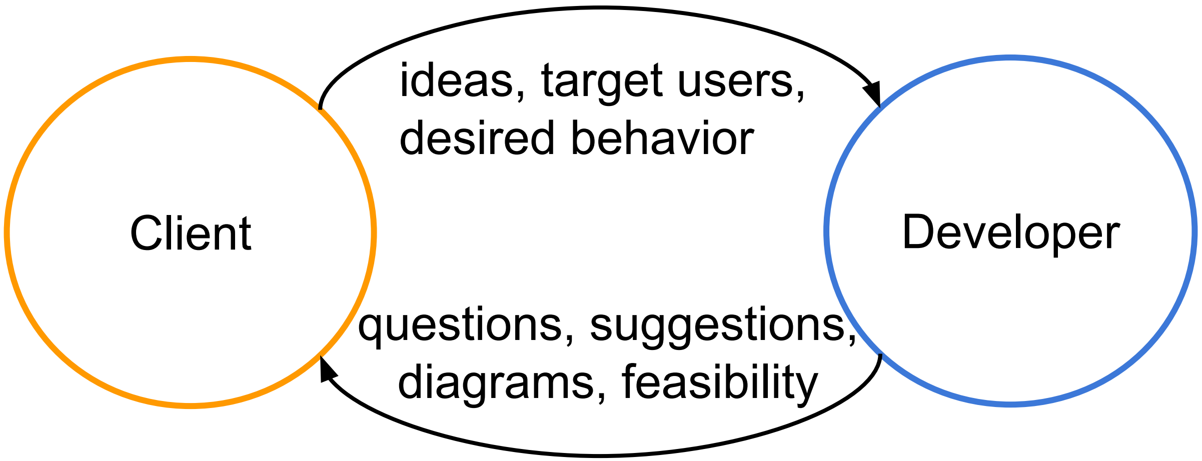
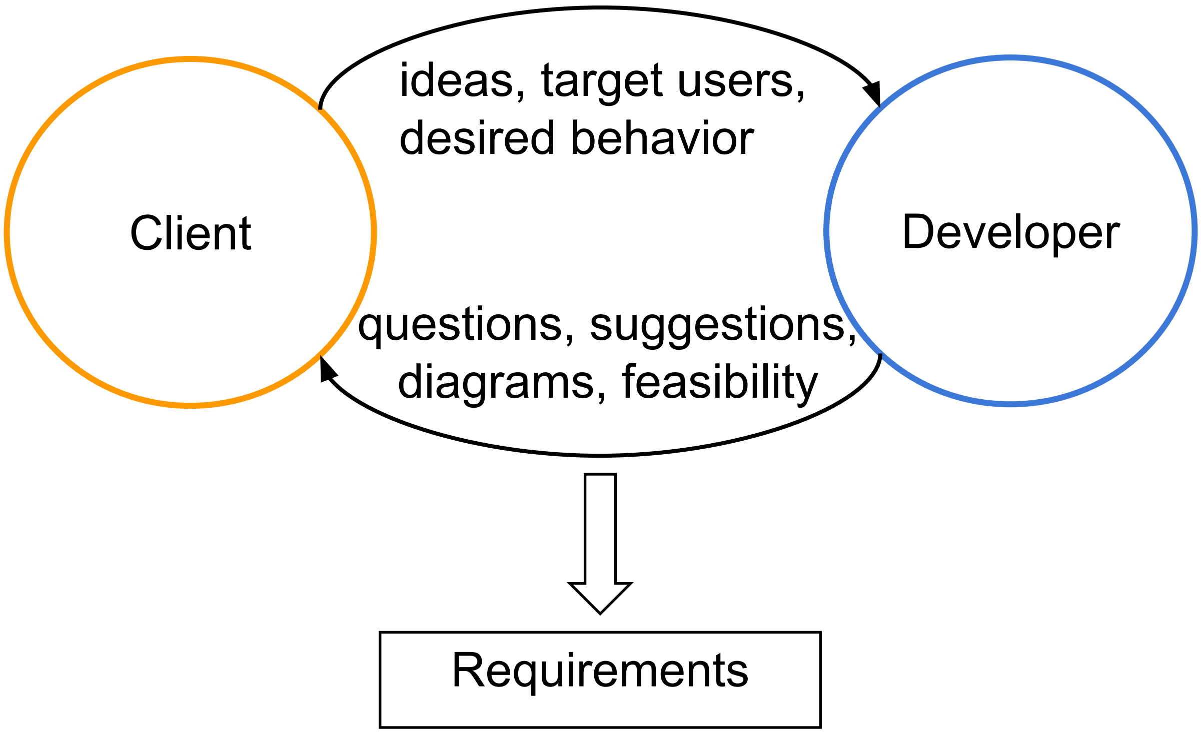
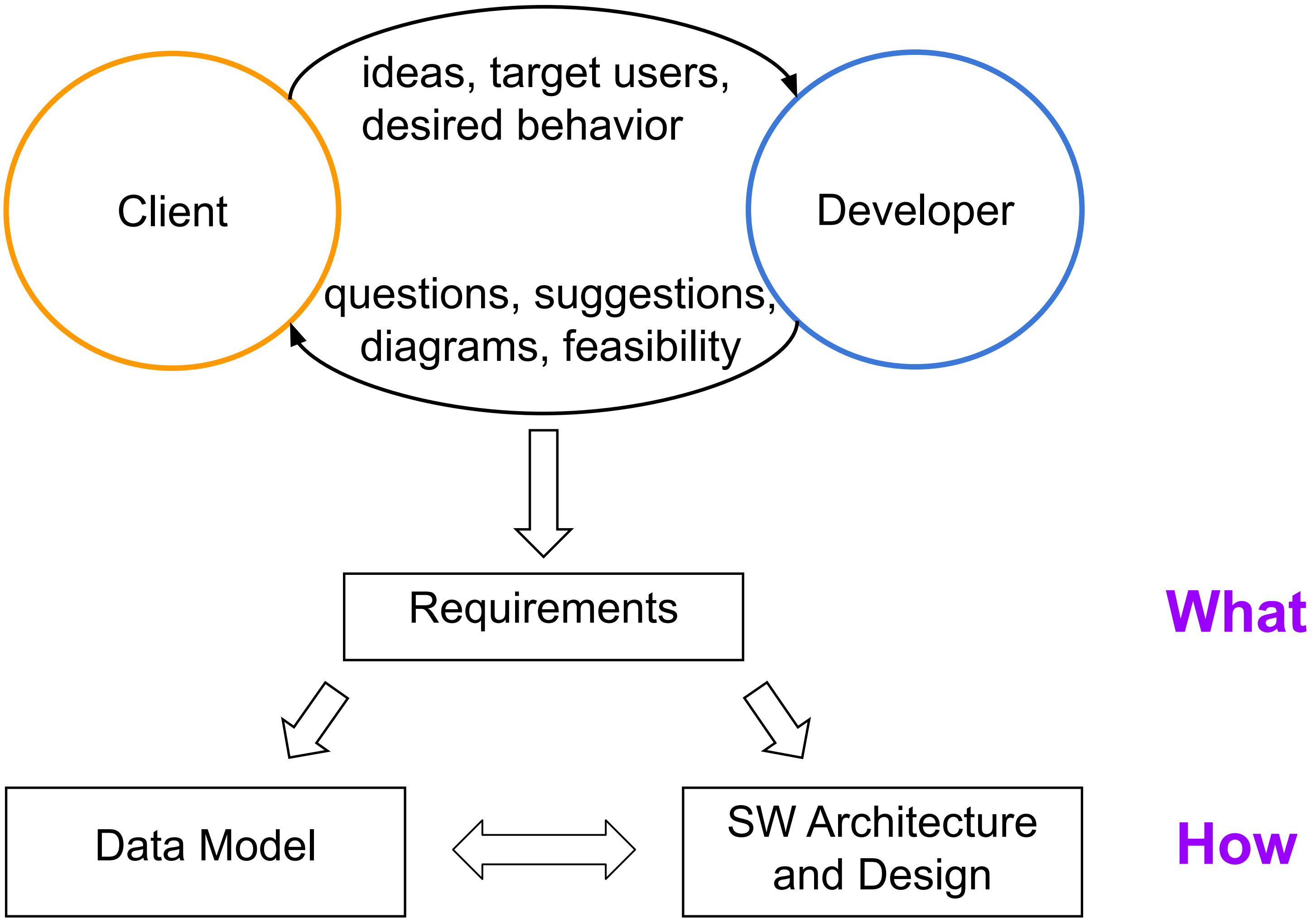


From Requirements to System Design



From Requirements to System Design



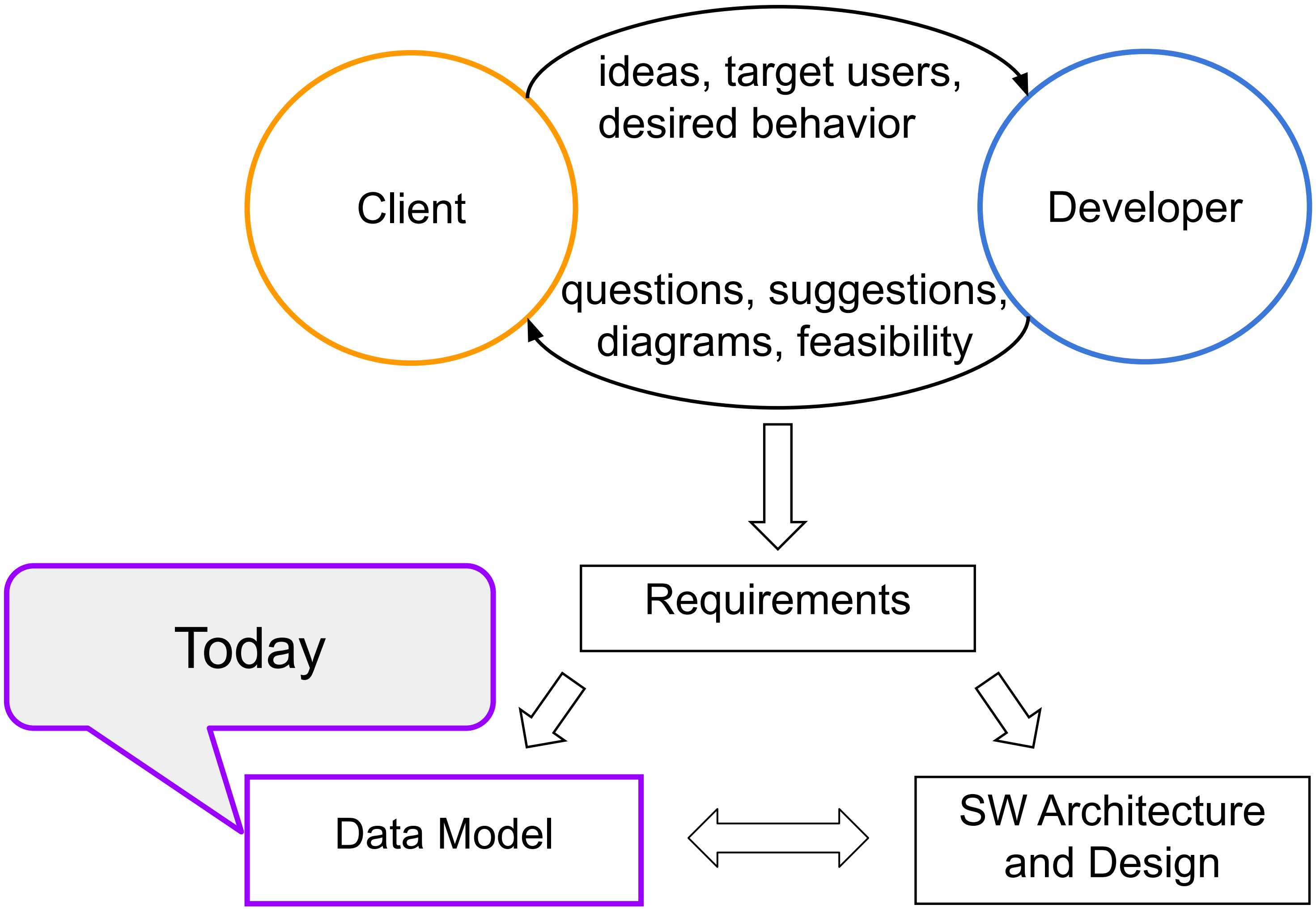
Life-cycle stages

Virtually all SDLC models have the following stages

- Requirements
- Design
- Implementation
- Testing
- Maintenance

Do you remember this?

From Requirements to System Design



Data Modelling

Goals for today

- How to model data?
  - Identify Entities
  - Identify Attributes
  - Identify Relationships
  - Assign Keys
  - ~~*(Normalization to reduce redundancy)*~~
  - ~~*(Denormalization to improve performance)*~~
- Common "language" for data modelling
  - ER (Entity-Relationship) diagrams
  - Just one out of many possibilities (diagrams, tables, text)
- Develop a data model for a course-registration system

ER diagrams: overview

- An Entity Relationship (ER) diagram is a **graphical representation** of a **data model**.
- It shows the **relationship** between **entities** (e.g., people, objects, events, or concepts) within a system.
- It **can be mapped** to a **relational** (database) **schema**.

ER diagrams: graphical syntax

- An entity *E*

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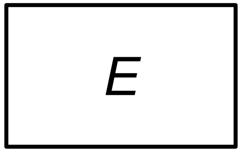
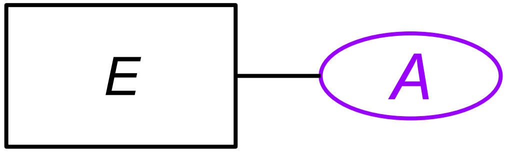


- An attribute *A* of entity *E*



ER diagrams: graphical syntax

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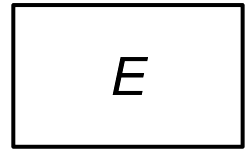

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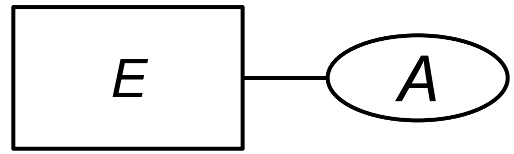
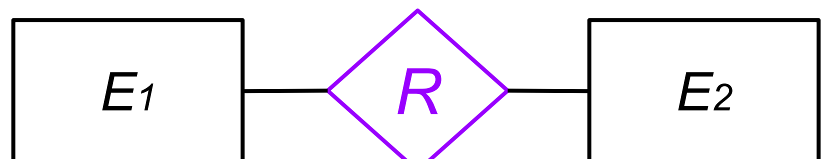


- A relationship *R* between two entities *E1* and *E2*



ER diagrams: graphical syntax

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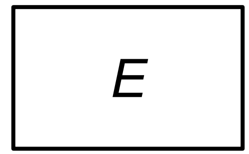

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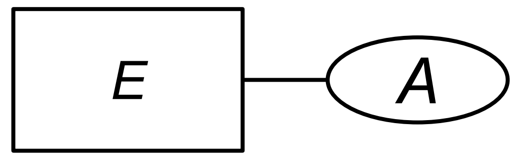

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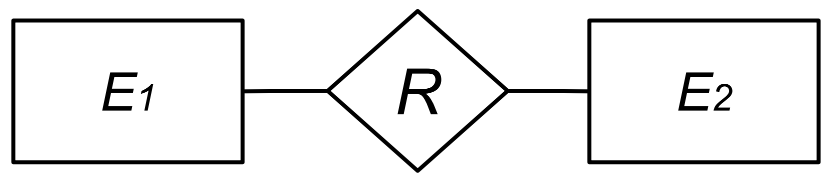
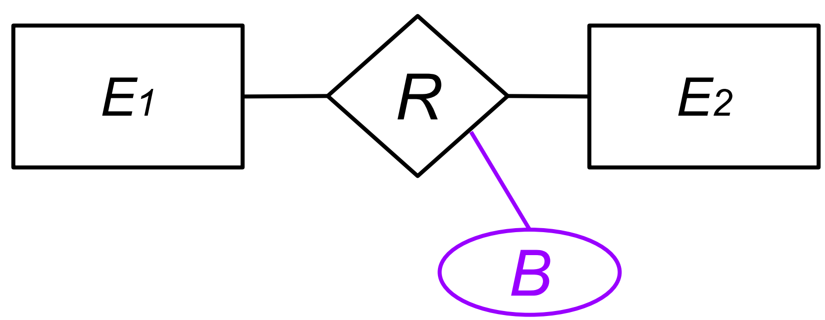
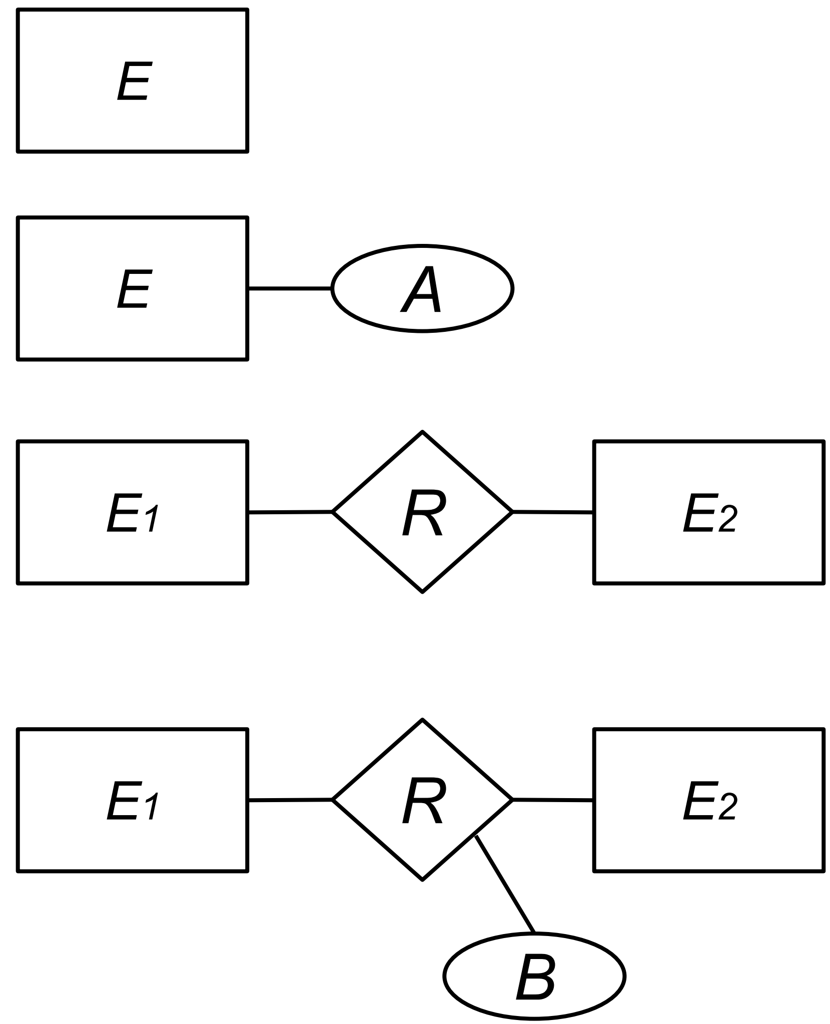


- An attribute *B* of relationship *R*



ER diagrams: rules

- An interconnecting line is only allowed between:
  - a box and a diamond,
  - a box and an oval,
  - a diamond and a oval.
- An oval must have exactly one connecting line.
- Names of boxes must be unique in the diagram.
- Names of ovals must be unique per box/diamond.



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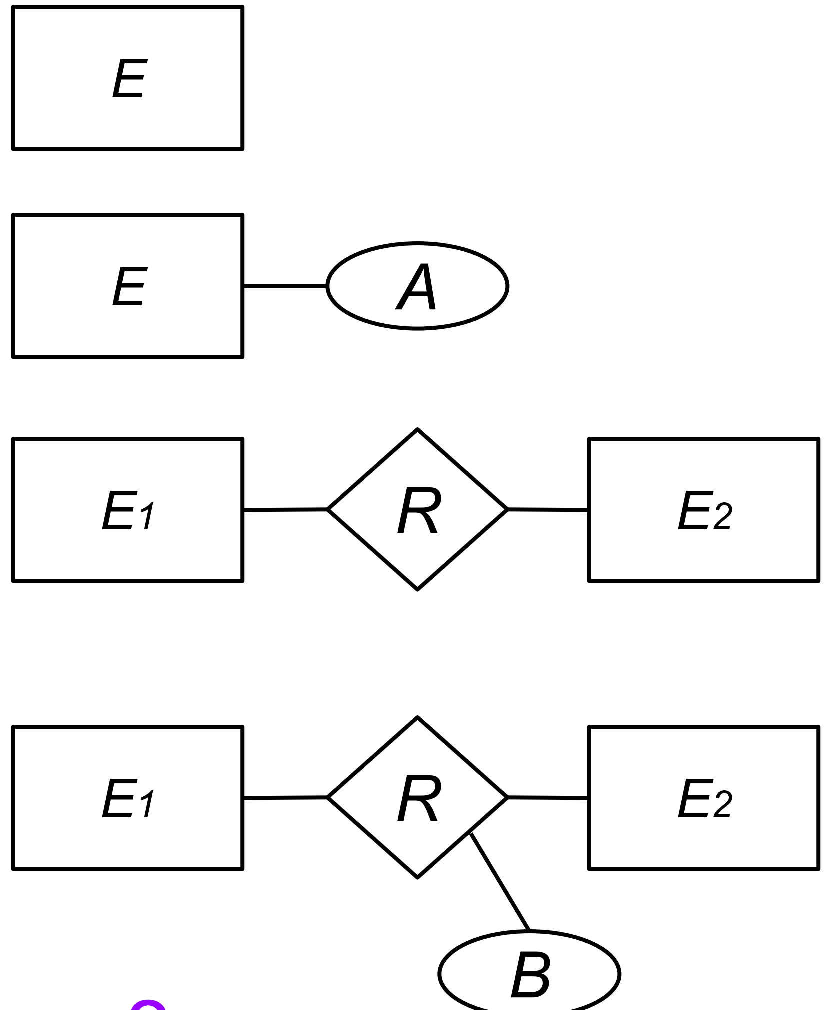


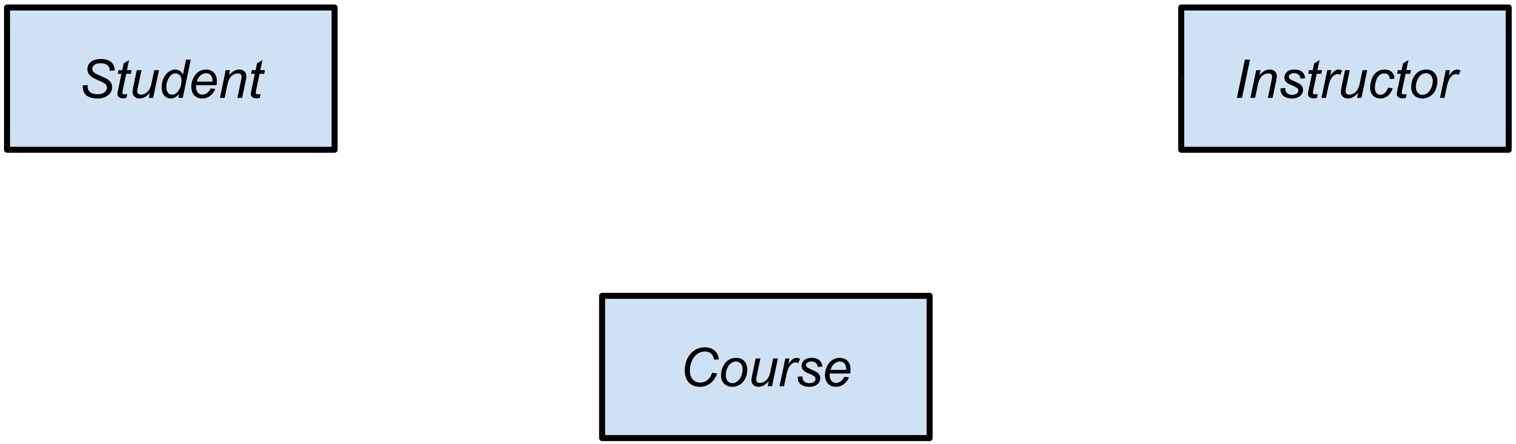
Questions?

A first example

Let’s model a simple course registration system:

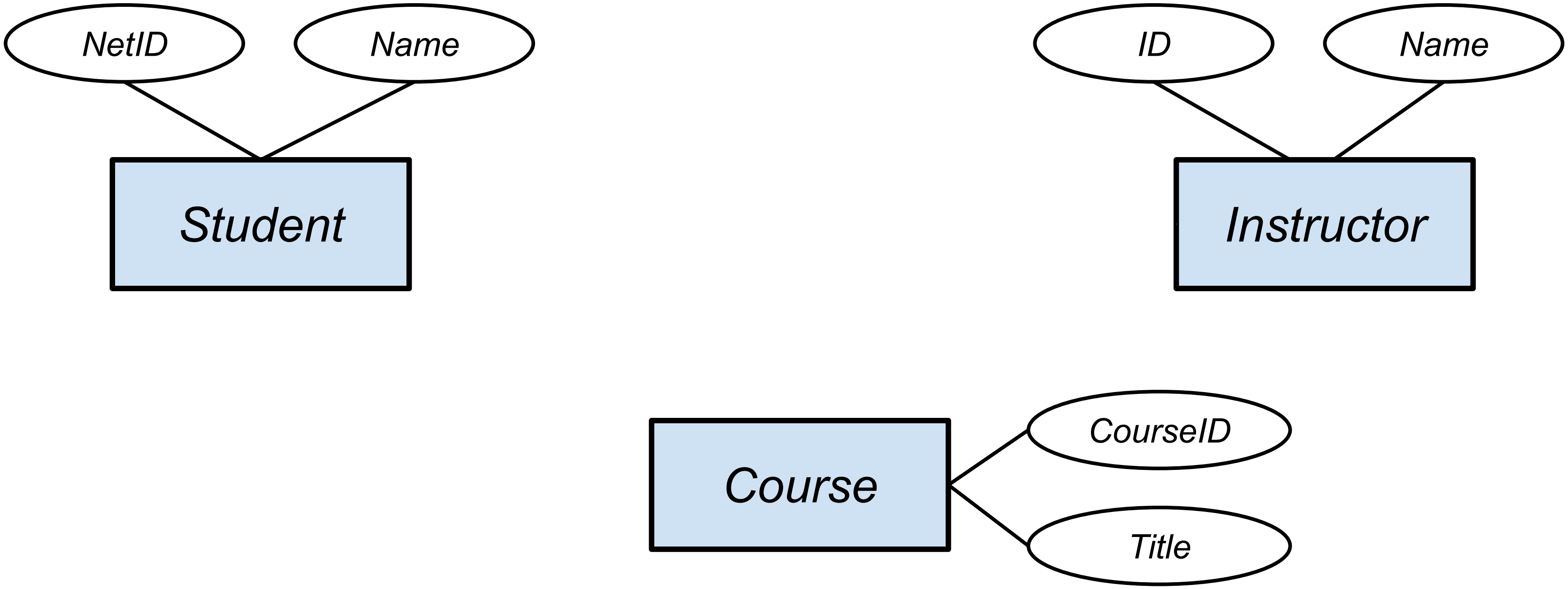
- **Students**
- **Instructors**
- **Courses**

A first example: identify entities



What attributes should we add?

A first example: identify attributes



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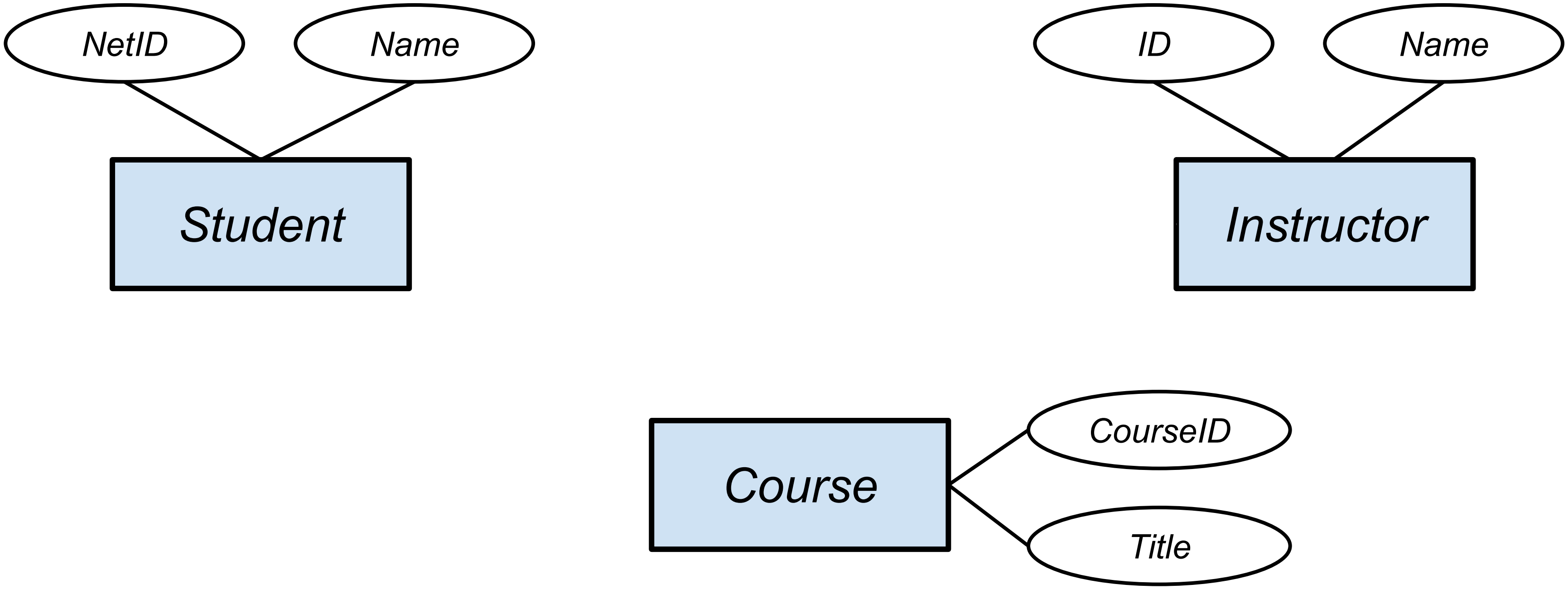
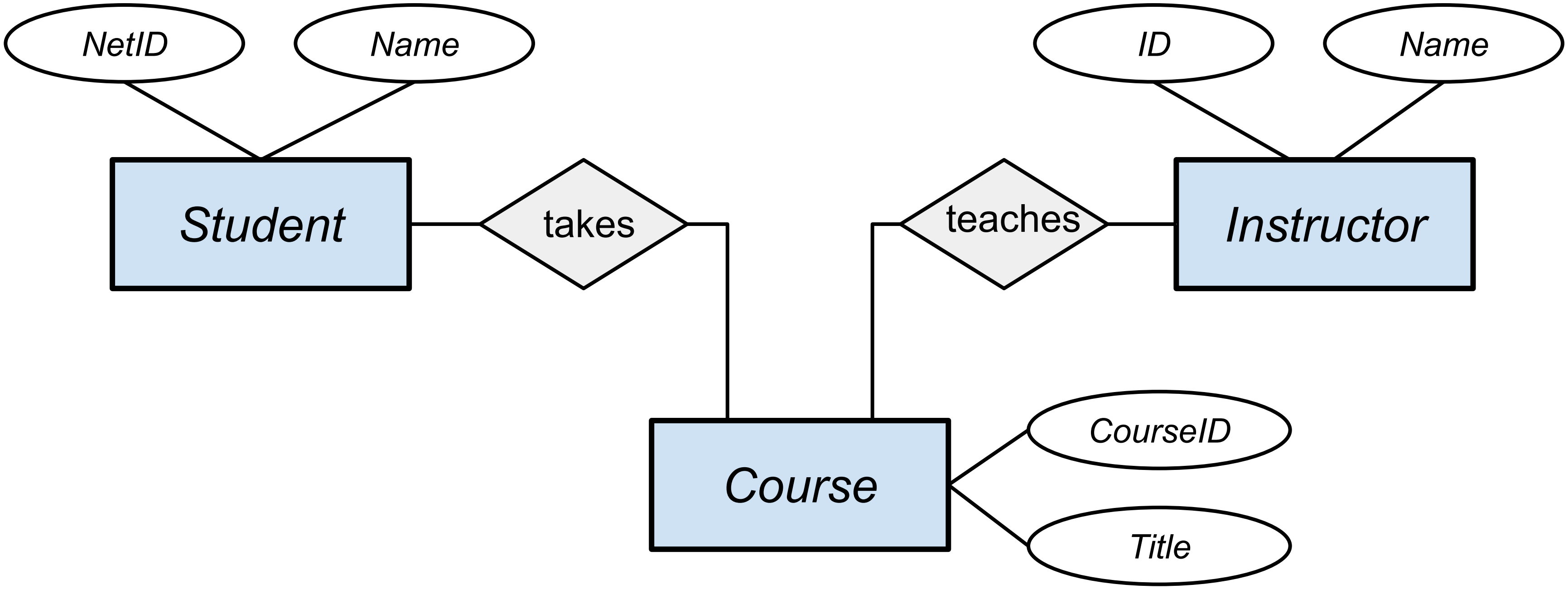


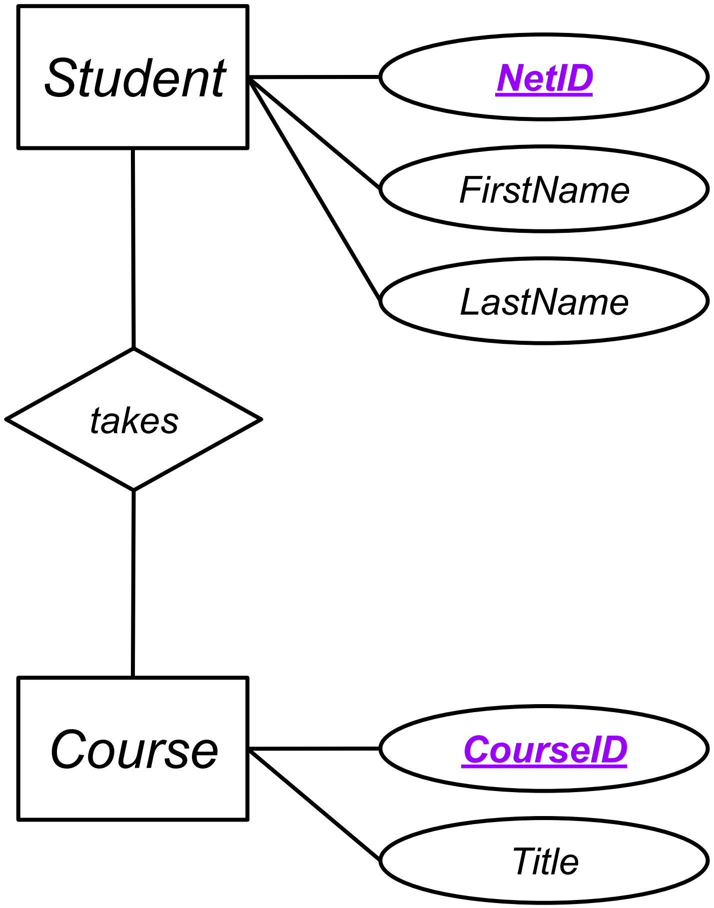
What relationships should we add?

A first example: identify relationships



ER diagrams: keys and cardinalities

- A key is an (underlined) attribute, or a set of attributes, which uniquely identifies an entity.



ER diagrams: keys and cardinalities

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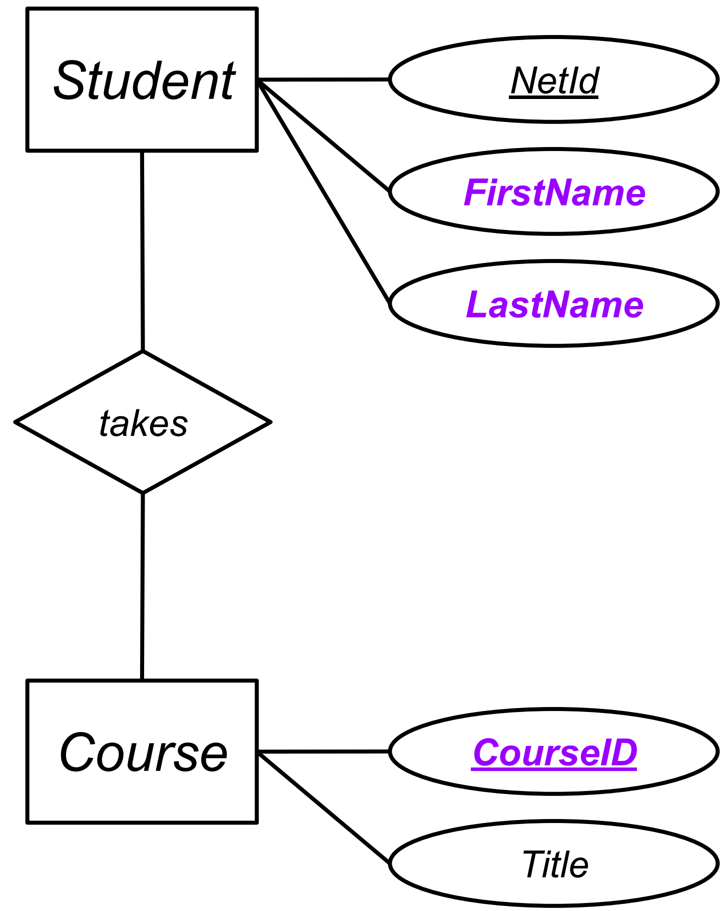
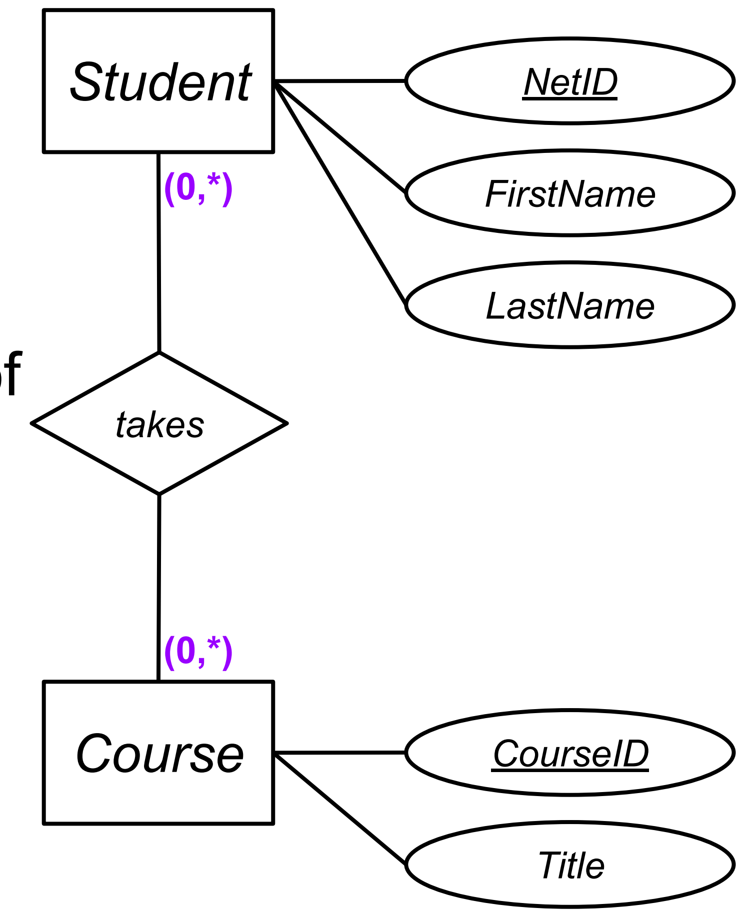
- A key can be artificial or natural.



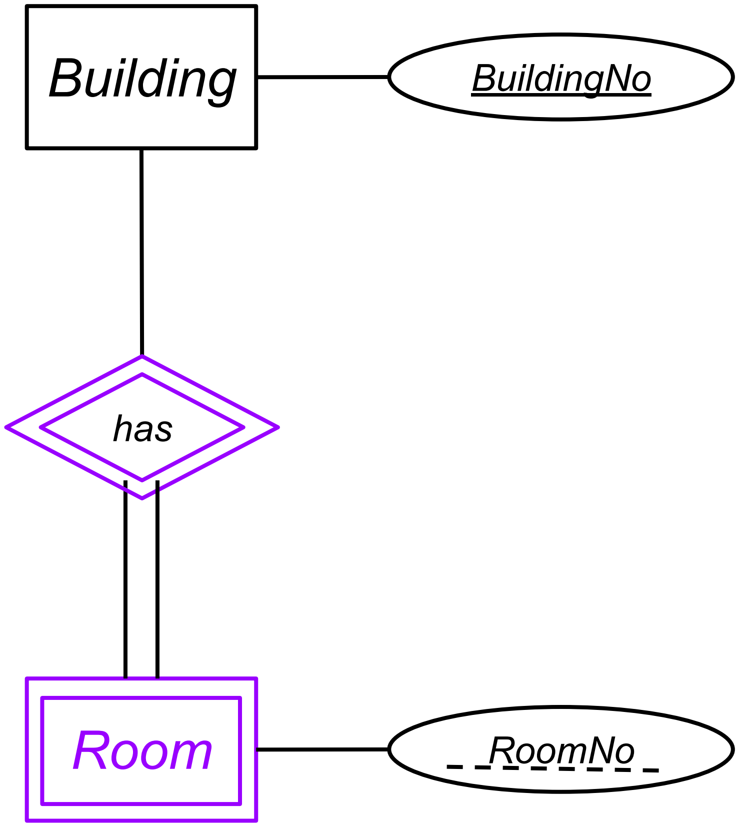
ER diagrams: keys and cardinalities

- A key is an (underlined) attribute, or a set of attributes, which uniquely identifies an entity.
- A key can be artificial or natural.
- The cardinalities define the kind of relationship (one-to-one, one-to-many, or many-to-many).
- There are different notations for cardinalities. For example:
  - 1 = (1,1)
  - c = (0,1)
  - m = (1,*)
  - mc = (0,*)



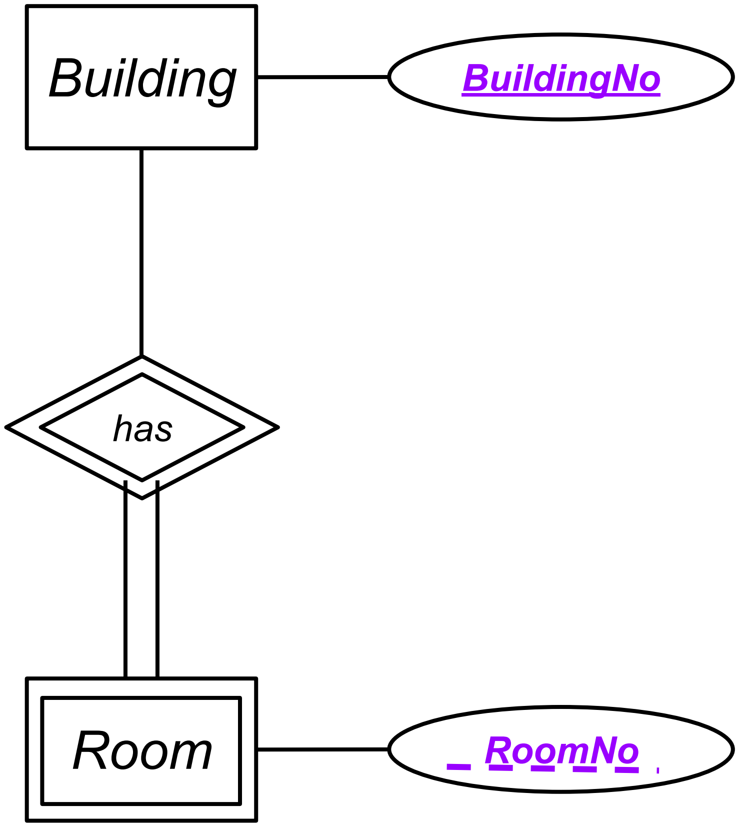
ER diagrams: weak entities

- A weak entity can't exist on its own (if a building is torn down, its rooms disappear).



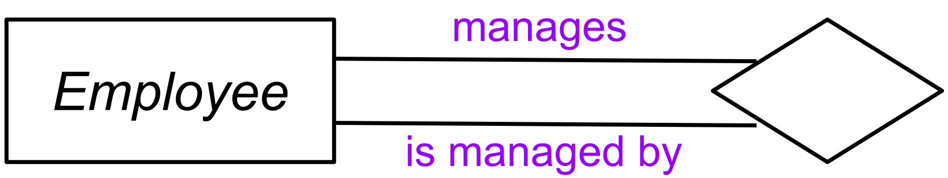
ER diagrams: weak entities

- A weak entity can't exist on its own (if a building is torn down, its rooms disappear).
- A weak entity is only uniquely identifiable in reference to another entity.

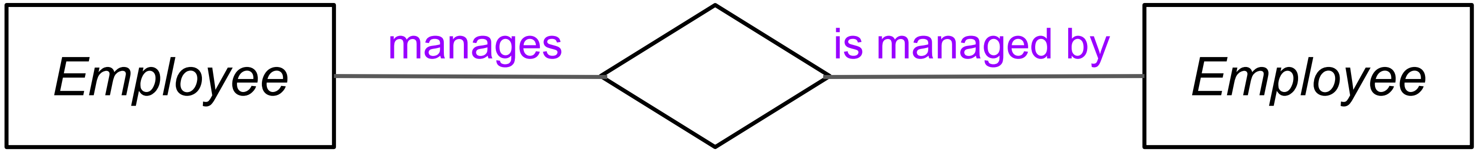


ER diagrams: self references and roles

- A self reference is usually explicitly annotated with roles to clarify the meaning of the self-referencing relationship.



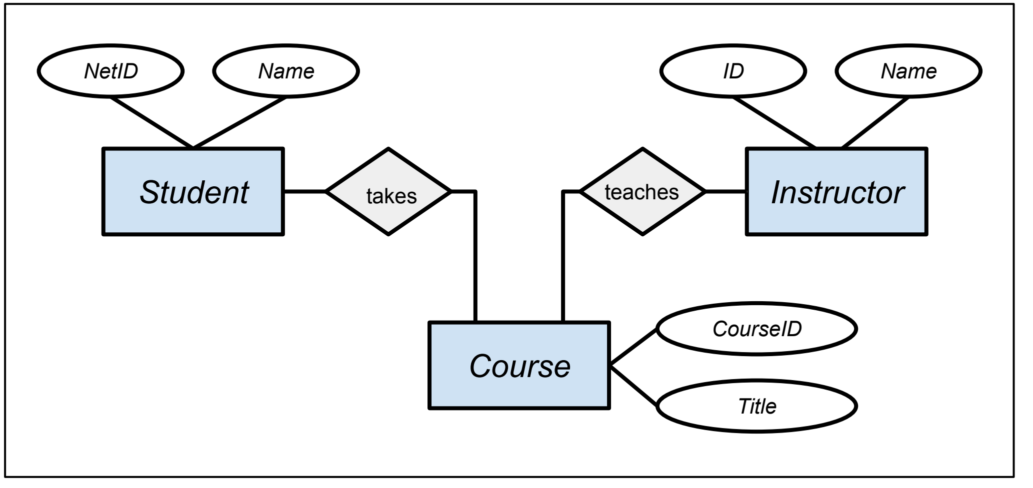
Think about (but never draw) the following:



Putting it all together

Let's **augment** our **model** of a course registration system:

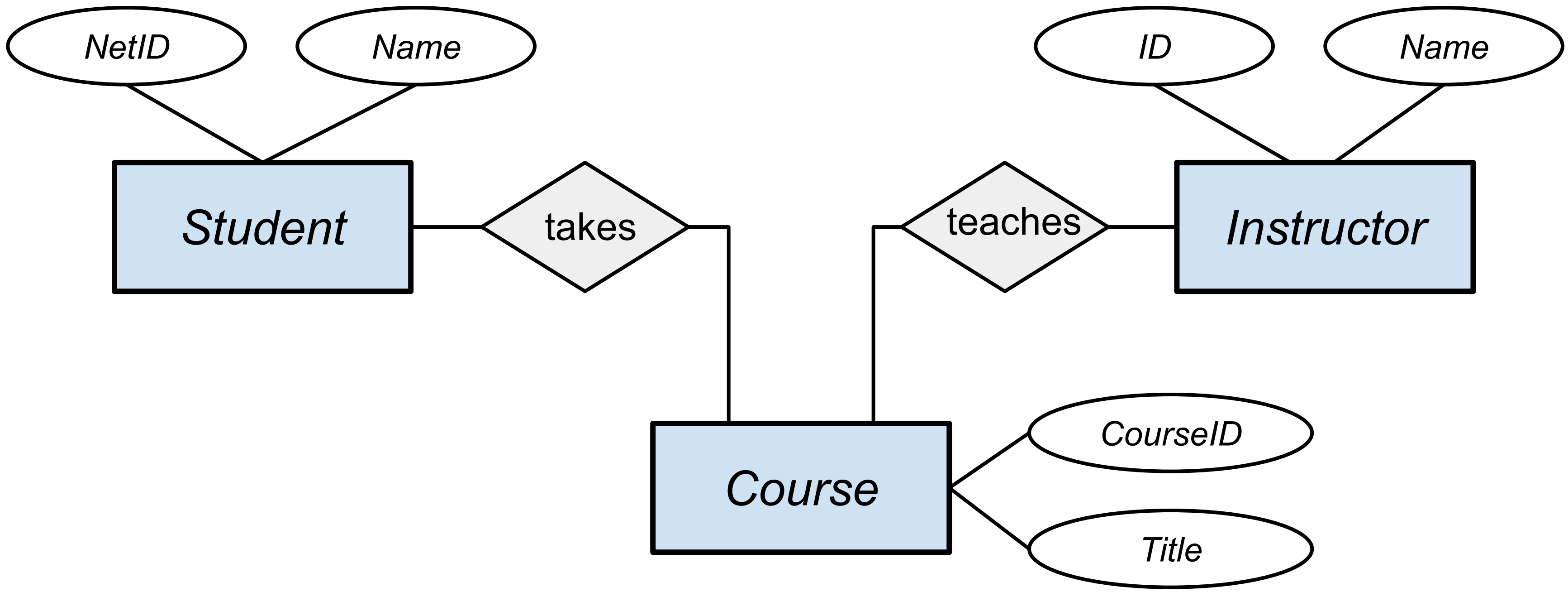
- Prerequisites
- Assignments
- Points/grades



Instructions

https://tinyurl.com/cse403-ER

Putting it all together



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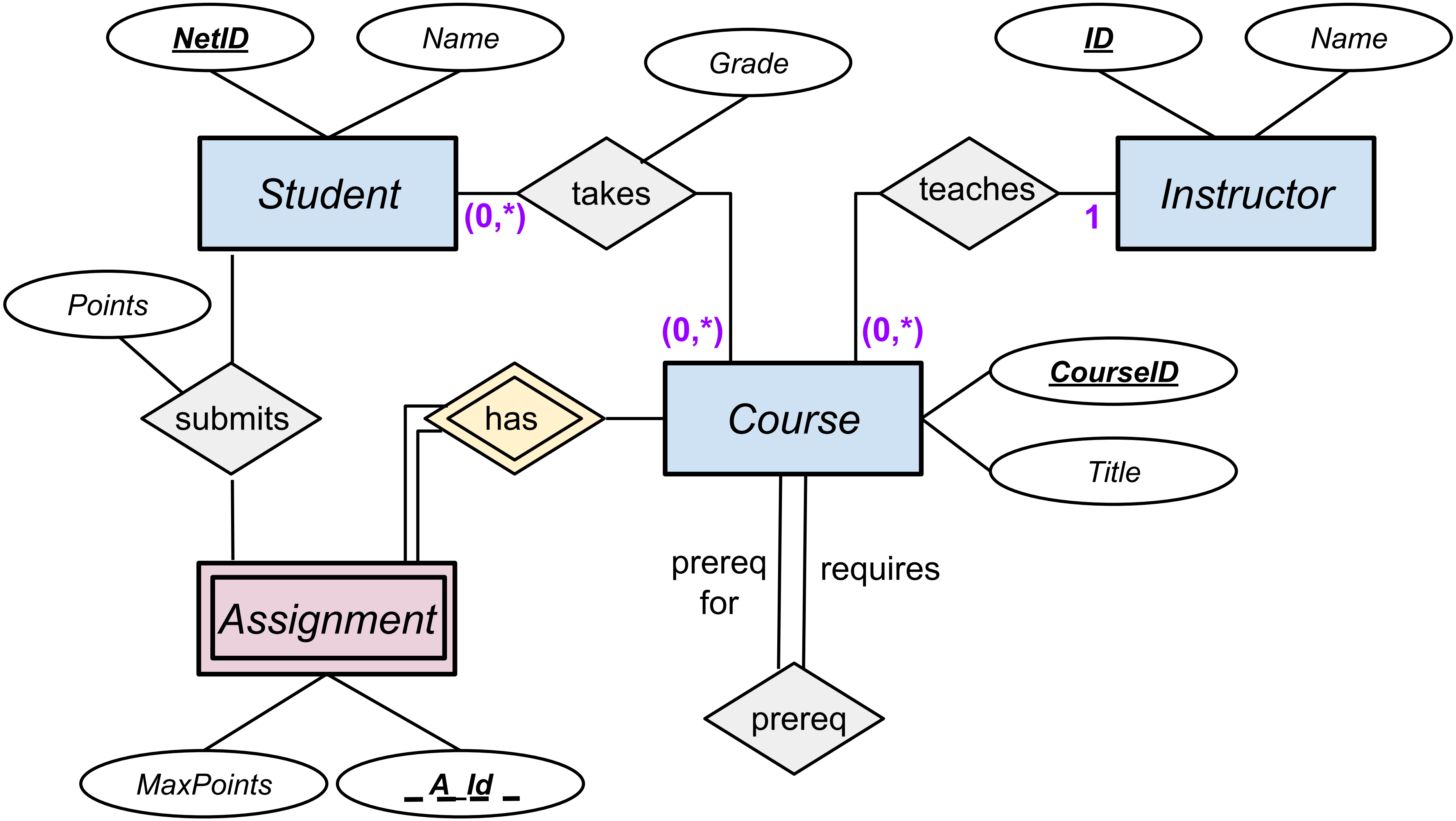
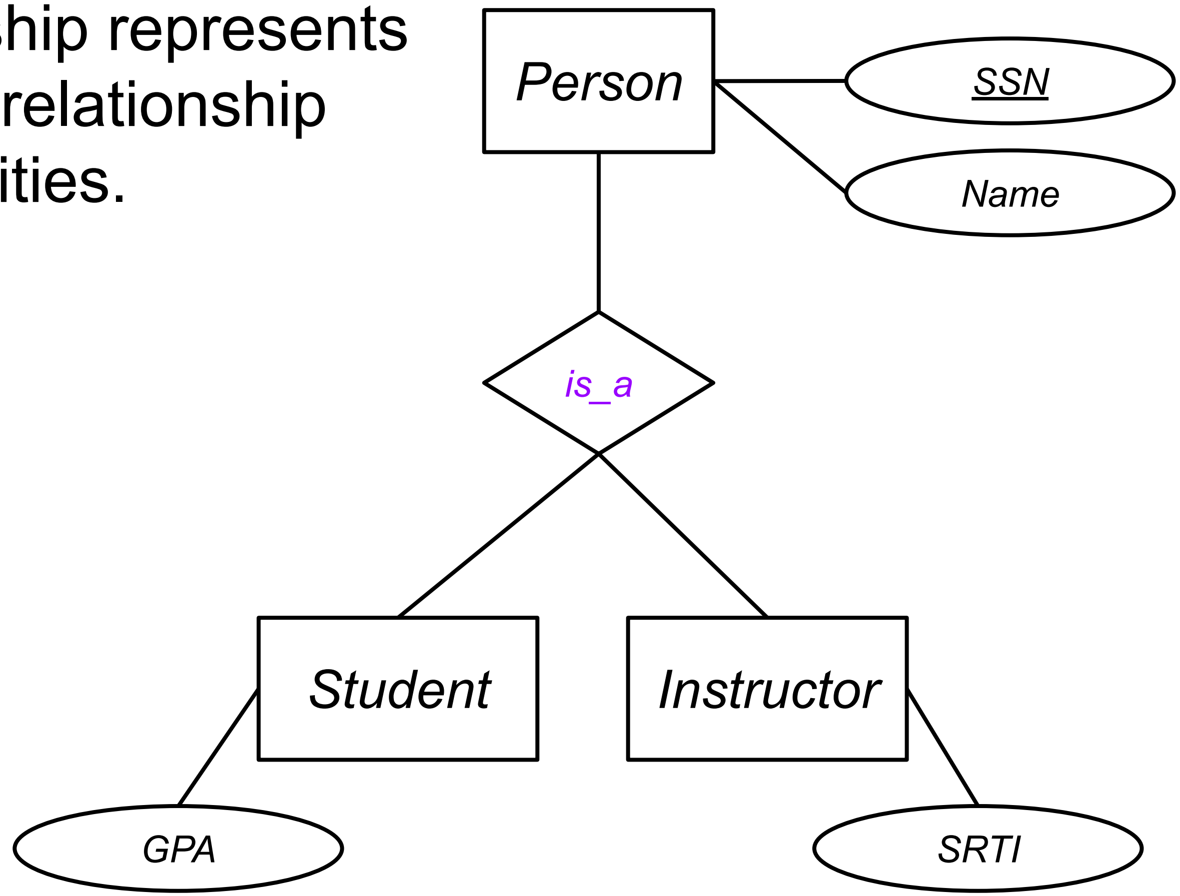


Additional material, not discussed in class

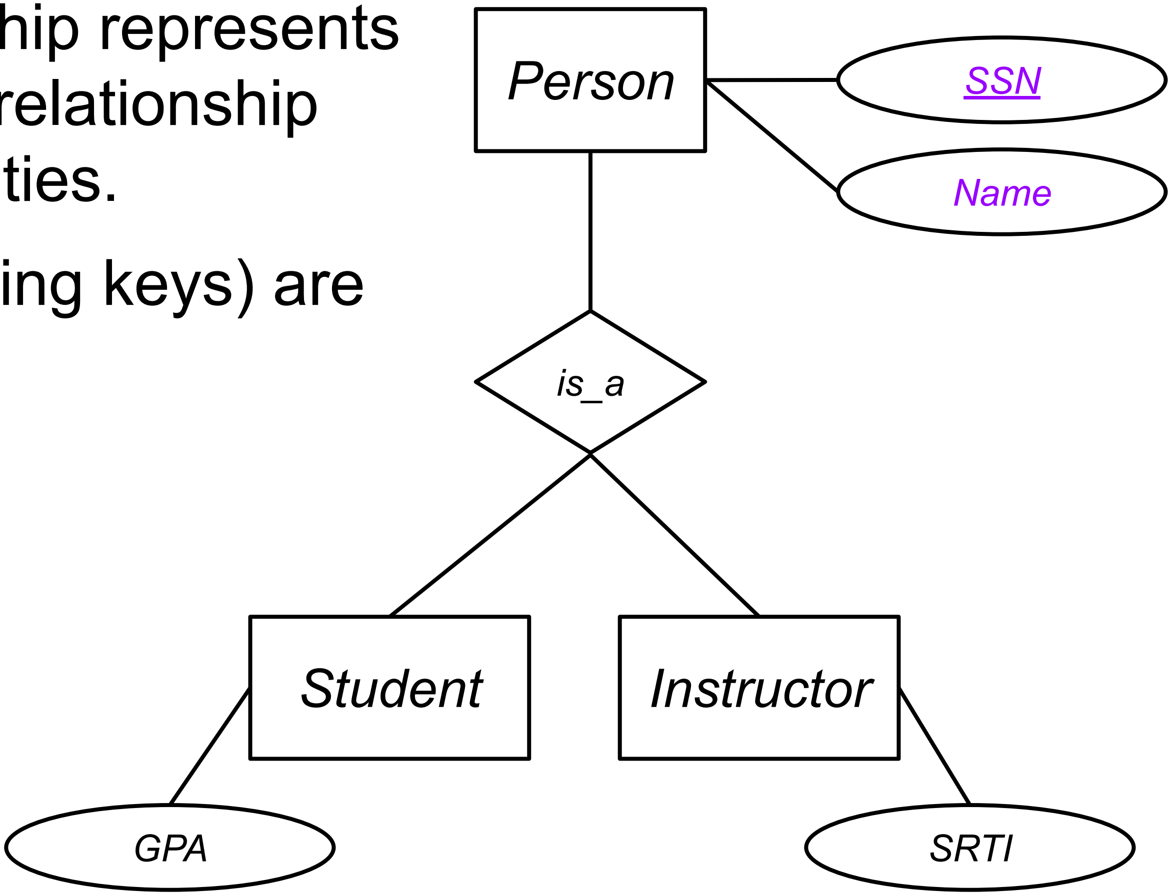
ER diagrams: generalization

- An is_a relationship represents a generalization relationship between two entities.



ER diagrams: generalization

- An is_a relationship represents a generalization relationship between two entities.
- Attributes (including keys) are "inherited".



ER diagrams: generalization

- An is_a relationship represents a generalization relationship between two entities.
- Attributes (including keys) are “inherited”.
- Additional attributes can be defined.