CS 320

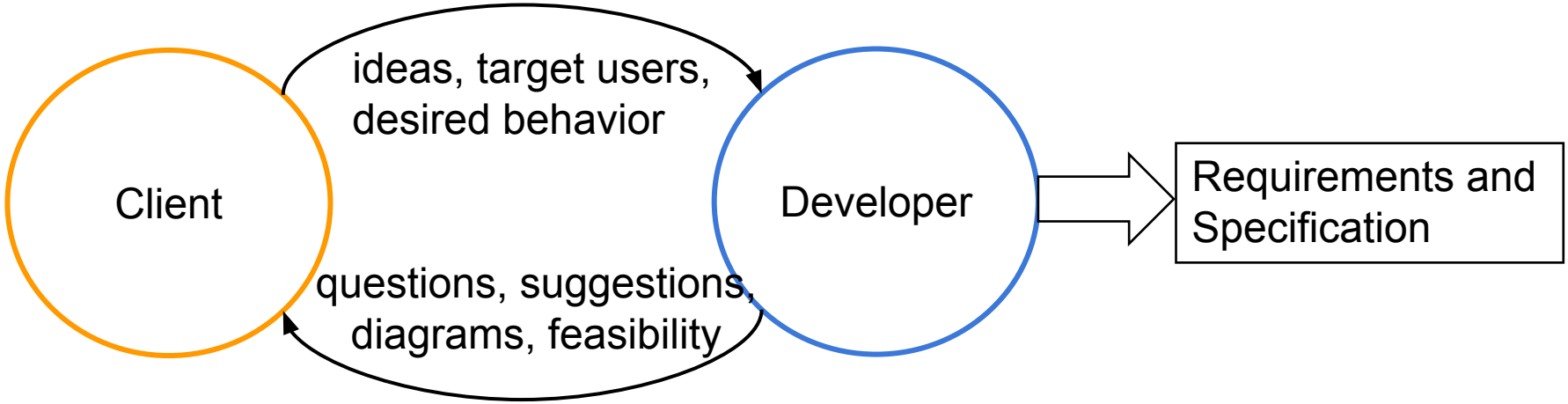
Introduction to Software Engineering
Spring 2017

February 15, 2017

Recap: the analysis phase

- It is the process of formally specifying exactly **what** is to be built based on the client's ideas and needs.
- Obtain a **clear understanding** of the **client's needs** (clear means unambiguous in this context).
- **Software engineer** is an **active participant**. Client may not understand the potential/feasibility of a system.
- Analysis **may uncover** unknown potential/**pitfalls**.

Recap: the analysis phase



The high-level questions to answer

1. **What is the purpose** of the system?
2. **Who uses the system** (can be human and non-human)?
3. **What functionality**/benefits must it provide
   (what's the desired behavior)?
4. **Is it feasible** to build the system with the given expectations?

Today

Post-mortem of discussion session

- What analysis techniques did you use?
- How useful/informative was the client interview?
- What are the lessons learned?
- How will you proceed?

Modelling techniques

- Entity-Relationship (ER) diagrams

Open discussion

Post-mortem of discussion session

- What analysis techniques did you use?
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The high-level questions

- What's the purpose of the system?
- Who uses the system?
- What functionality must it provide?
- Is it feasible to build the system?

Common analysis techniques

- Meetings, questionnaires, interviews.
- Prototyping.
- User stories, use cases.
- Modeling (Diagramming).

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.

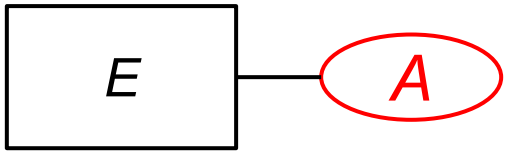
ER diagrams: graphical syntax

- An entity *E*

ER diagrams: graphical syntax

- An entity *E*

- An attribute *A* of entity *E*



ER diagrams: graphical syntax

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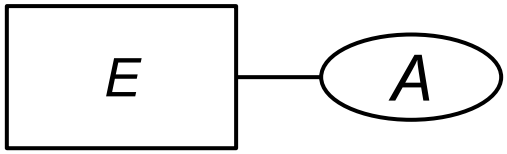
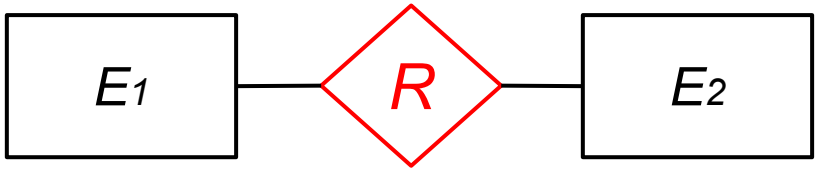


- A relationship *R* between two entities E_1 and E_2



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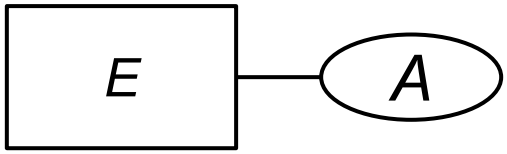

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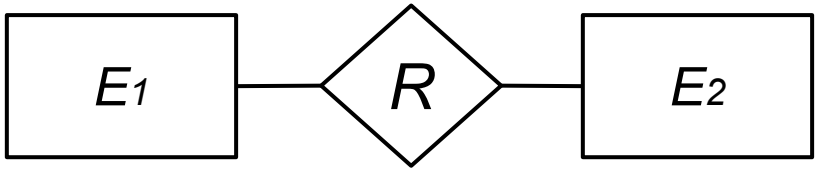
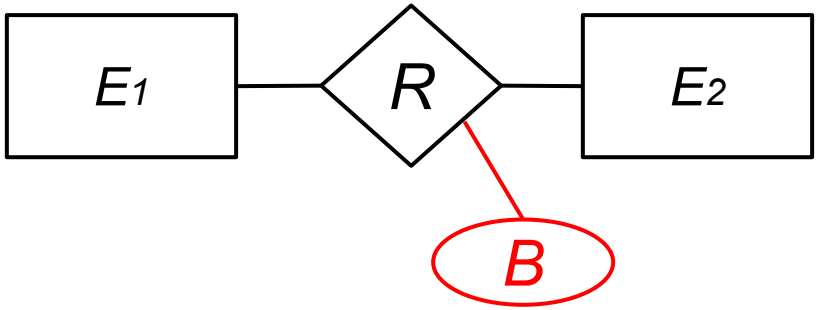
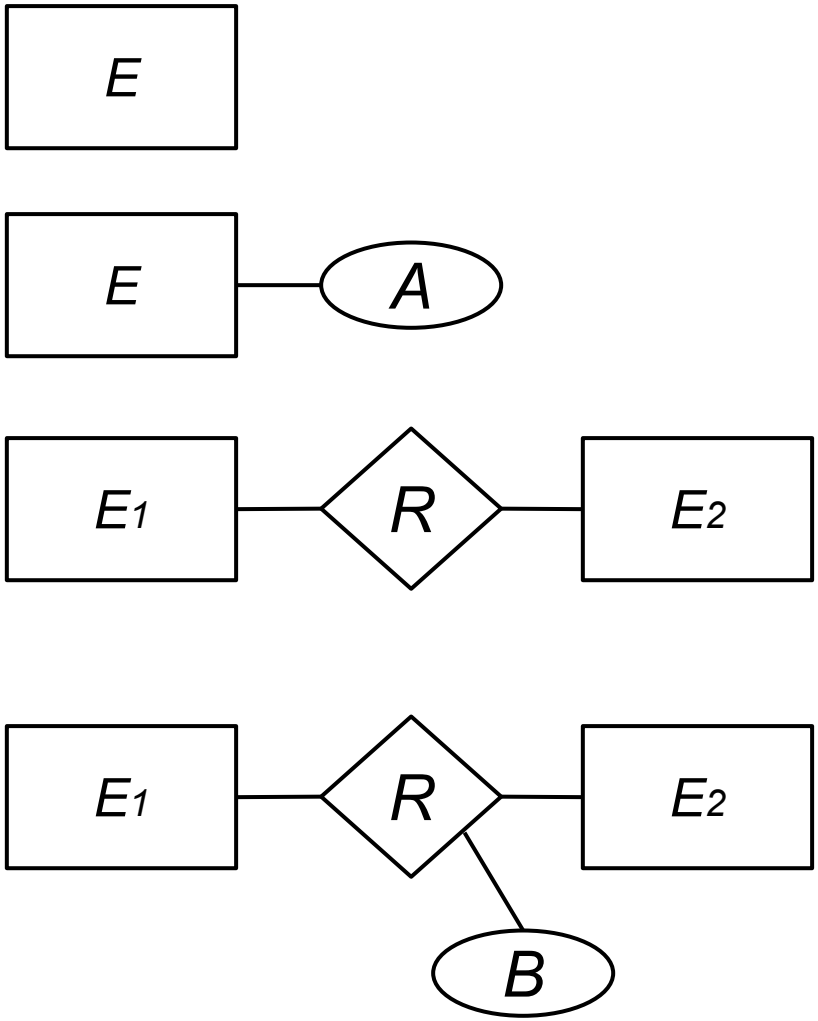


- An attribute *B* of relationship *R*



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.

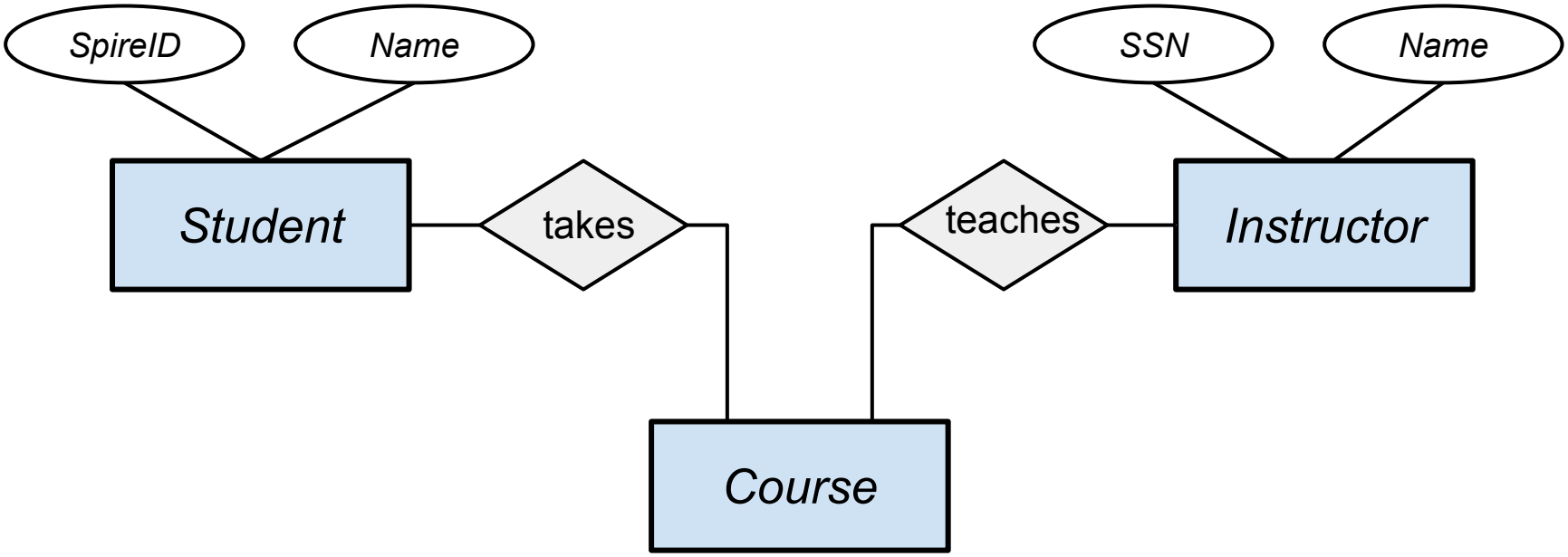


ER diagrams: example

Let’s model the following entities and their relationships in the context of a simple course registration system at UMass:

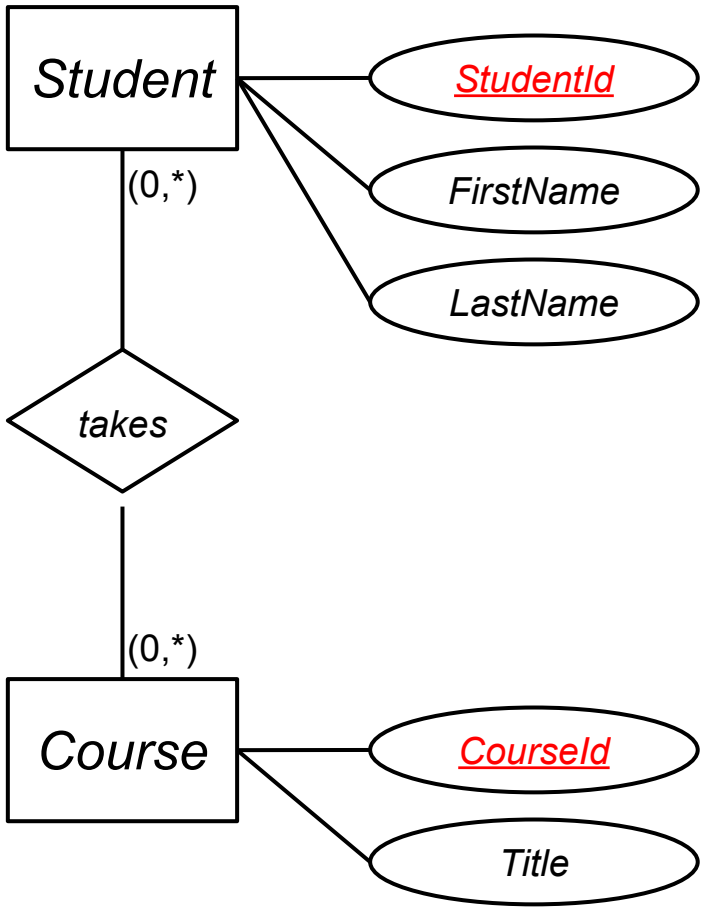
- **Students**
- **Instructors**
- **Courses**

ER diagrams: example



ER diagrams: keys and cardinalities

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



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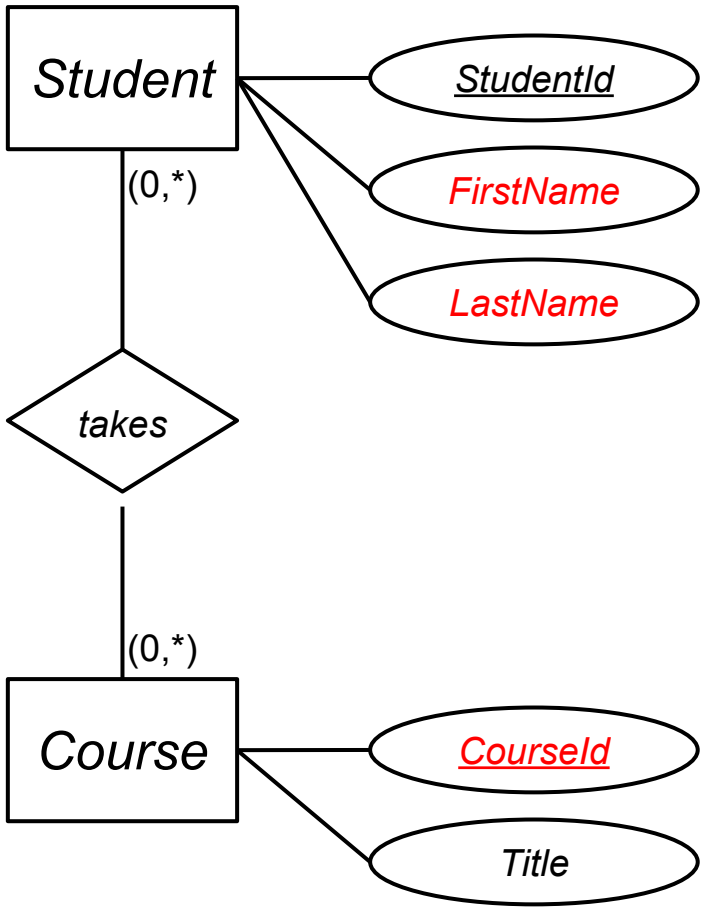
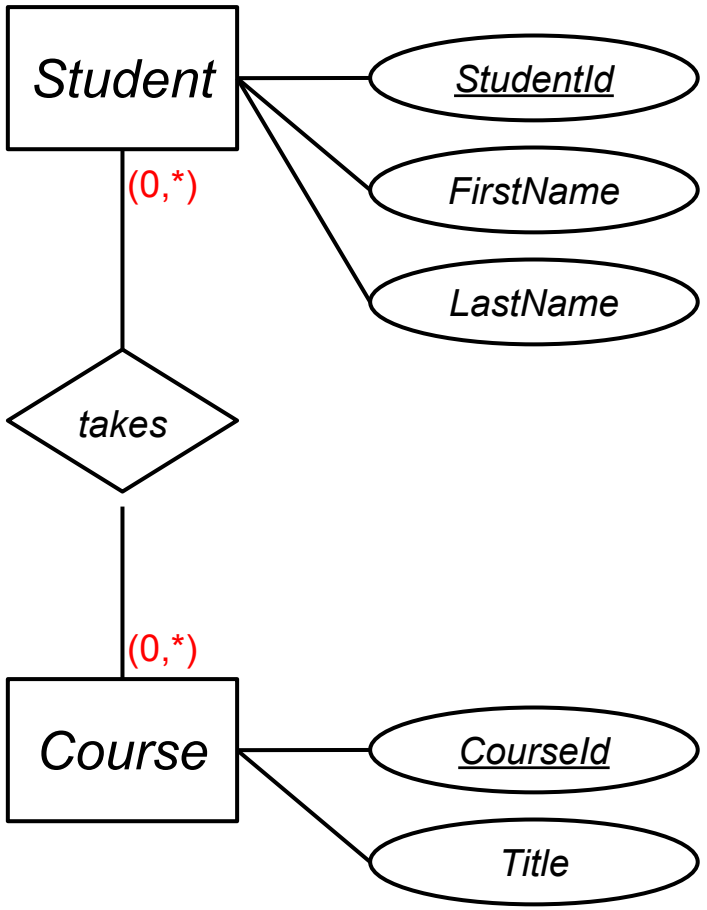


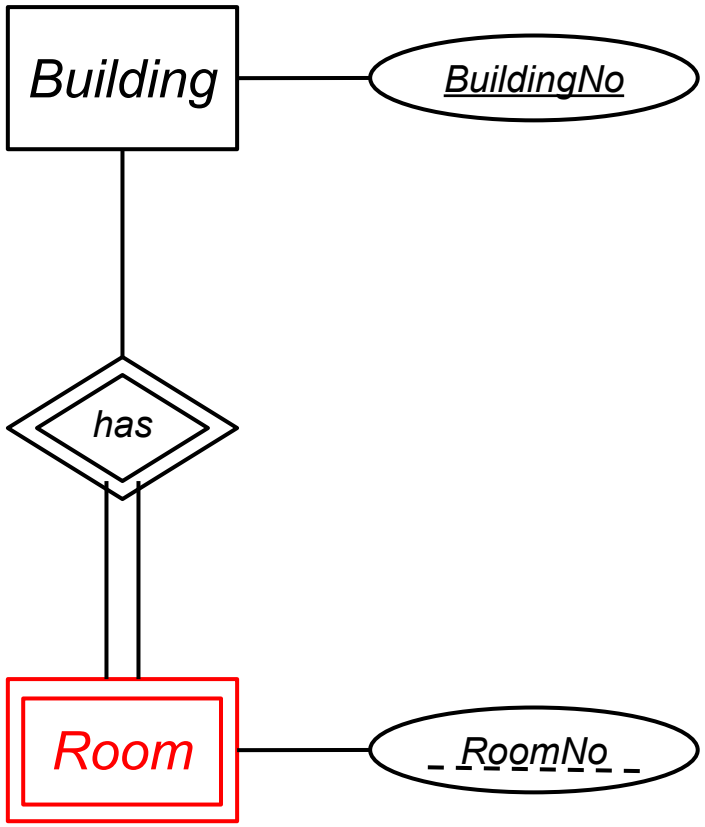
ER diagrams: keys and cardinalities

- 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,*)



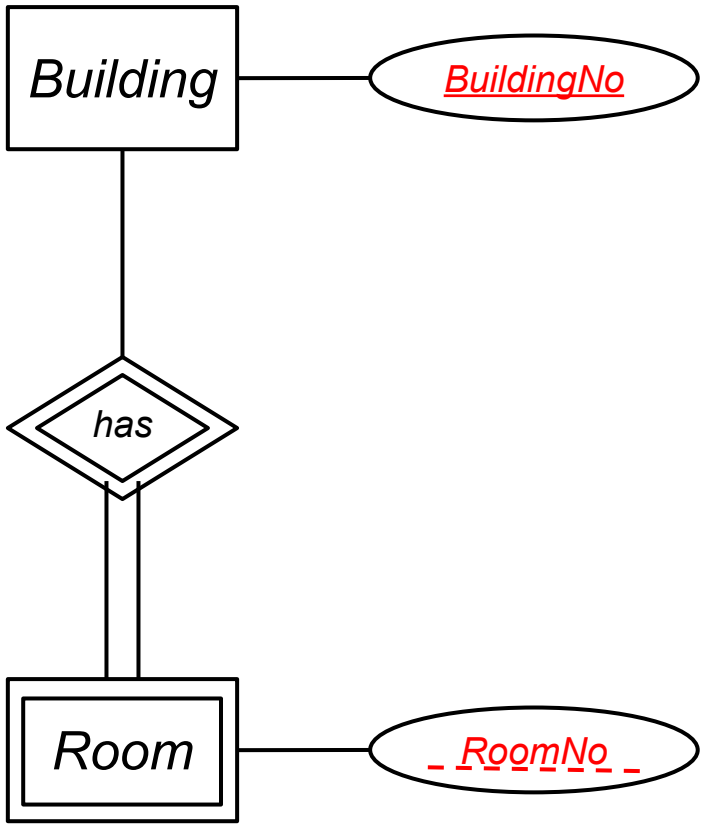
ER diagrams: weak entities

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



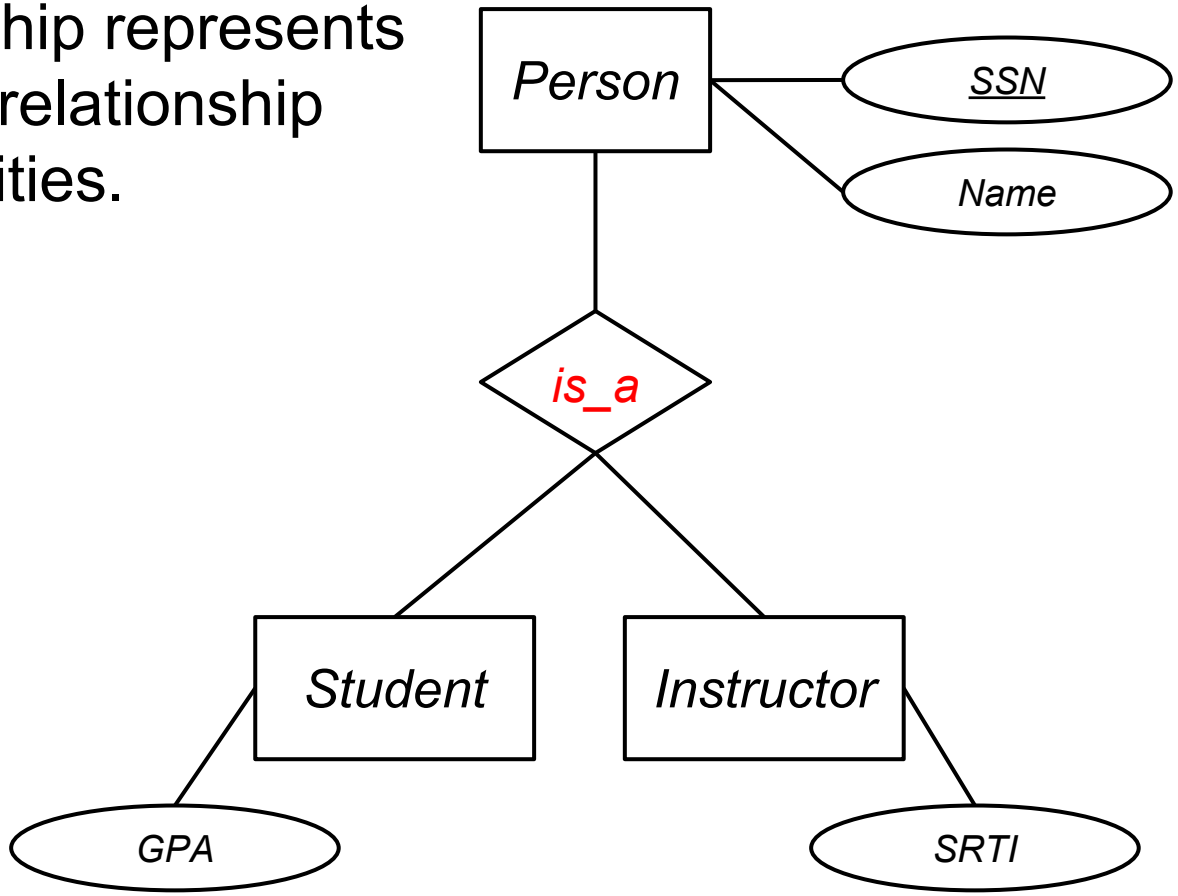
ER diagrams: weak entities

- 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.



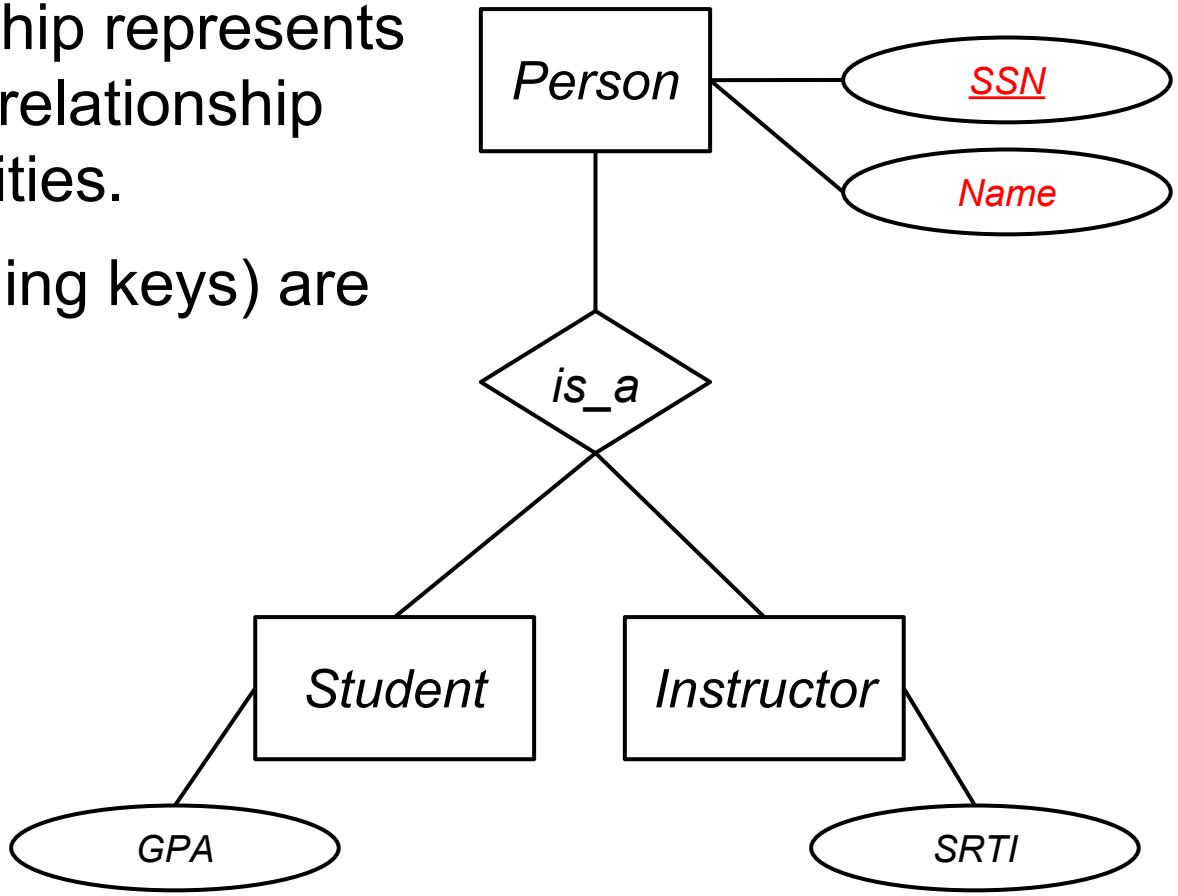
ER diagrams: generalization

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



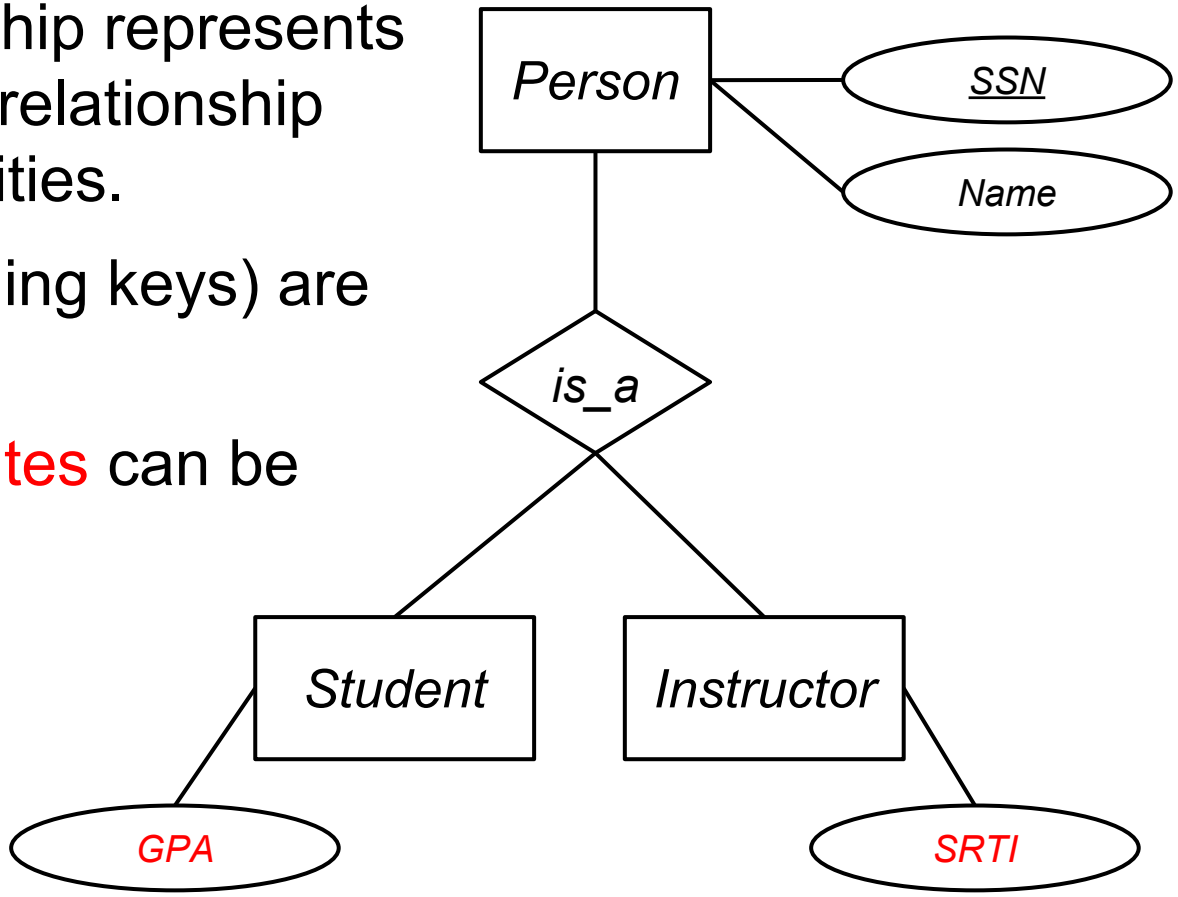
ER diagrams: generalization

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



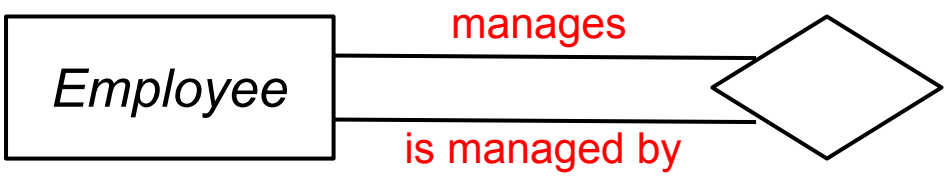
ER diagrams: generalization

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

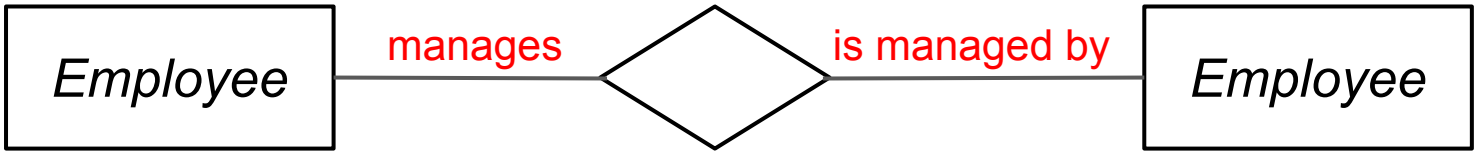


ER diagrams: self references and roles

- 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:



ER diagrams: example

Let’s improve our initial model of a simple course registration system at UMass:

- Students
- Instructors
- Courses
- **Sections**
- **Prerequisites**
- **Assignments**
- **Points/grades**

ER diagrams: example