Lecture 8: The E/R Model

جلسه هشتم: مدل موجودیت–رابطه

Today's Lecture

1. Advanced E/R Concepts (مفاهیم پیشرفته‌ی موجودیت–رابطه)
   - ACTIVITY: E/R Translation

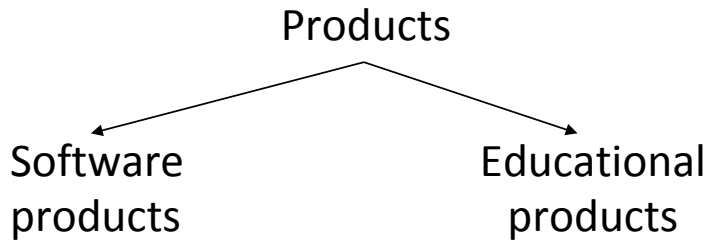
1. Advanced E/R Concepts

What you will learn about in this section

1. Subclasses & connection to OO
2. Constraints
3. Weak entity sets
4. ACTIVITY: Crayon Time! Drawing E/R diagrams Pt. III

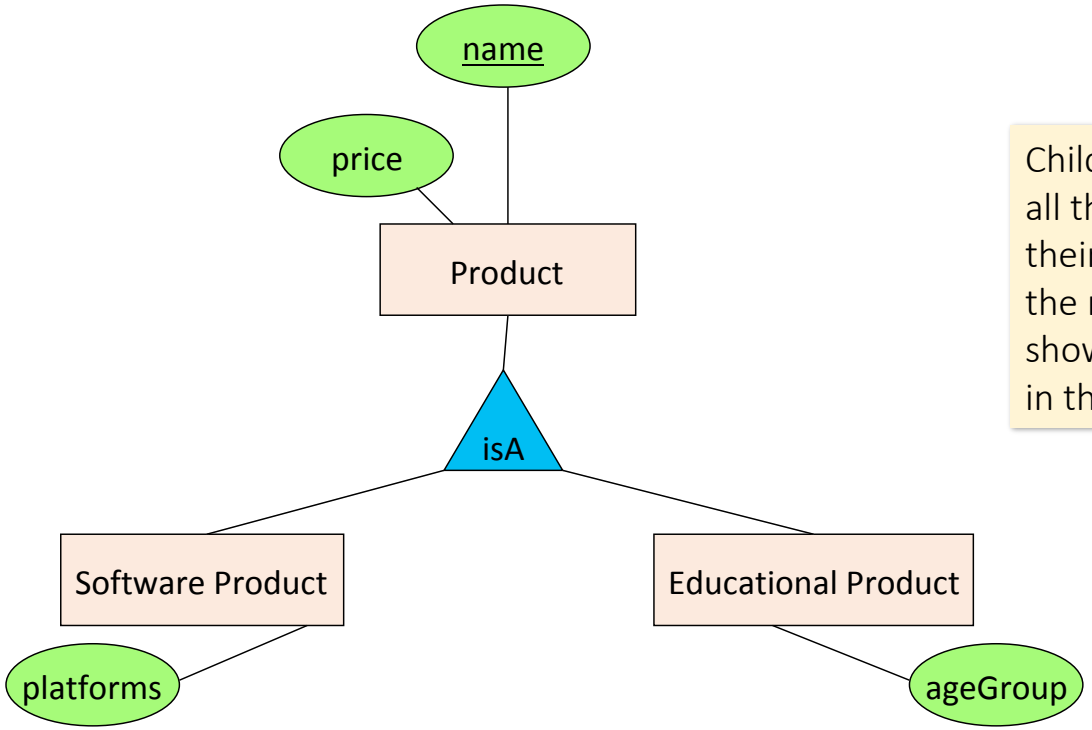
Modeling Subclasses

- Some objects in a class may be special, i.e. worthy of their own class
  - Define a new class?
    - *But what if we want to maintain connection to current class?*
  - Better: define a *subclass*
    - *Ex:*



We can define **subclasses** in E/R!

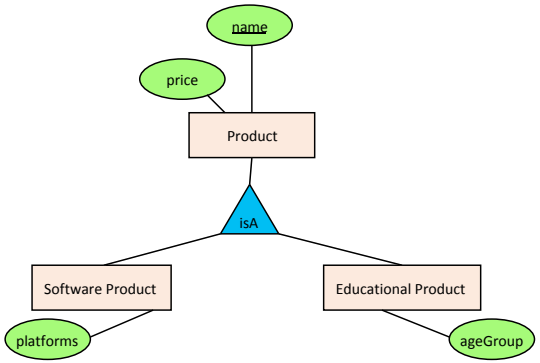
Modeling Subclasses



Child subclasses contain all the attributes of *all* of their parent classes **plus** the new attributes shown attached to them in the E/R diagram

Understanding Subclasses

- Think in terms of records; ex:



- Product

name
price

- SoftwareProduct

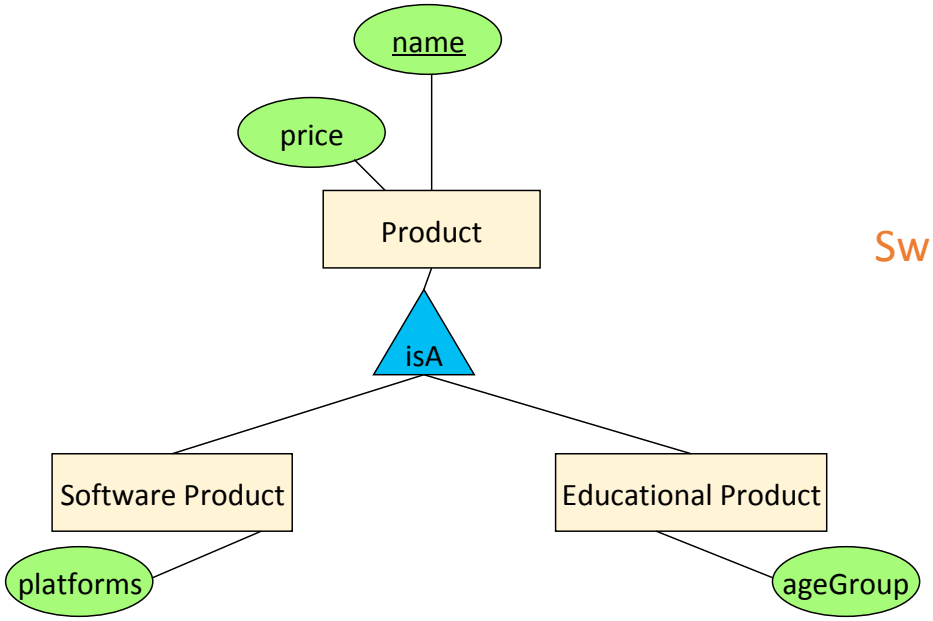
name
price
platforms

- EducationalProduct

name
price
ageGroup

Child subclasses contain all the attributes of *all* of their parent classes **plus** the new attributes shown attached to them in the E/R diagram

Think like tables…



Product

name	price	category
Gizmo	99	gadget
Camera	49	photo
Toy	39	gadget

Sw.Product

name	platforms
Gizmo	unix

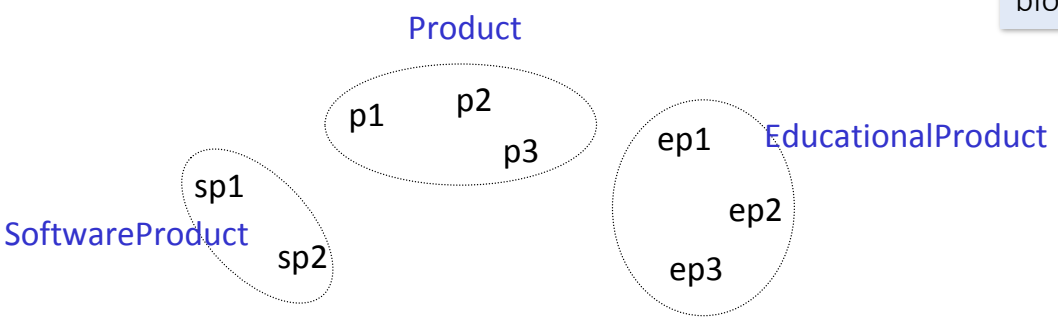
Ed.Product

name	ageGroup
Gizmo	toddler
Toy	retired

Difference between OO and E/R inheritance

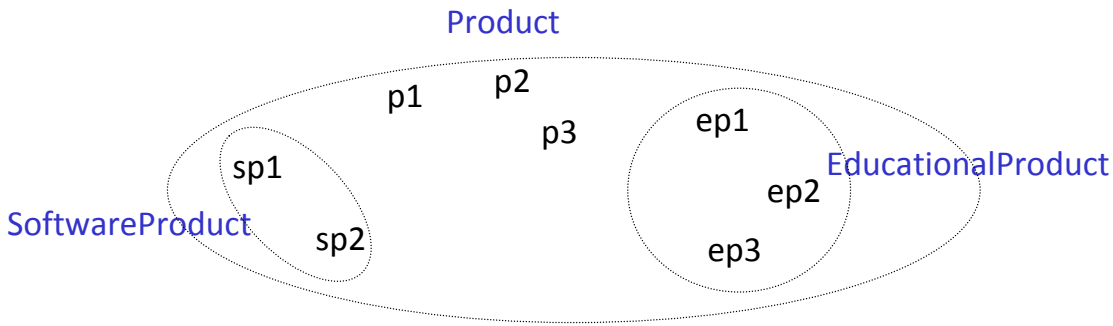
- OO: Classes are disjoint (same for Java, C++)

OO = Object Oriented. E.g. classes as fundamental building block, etc…



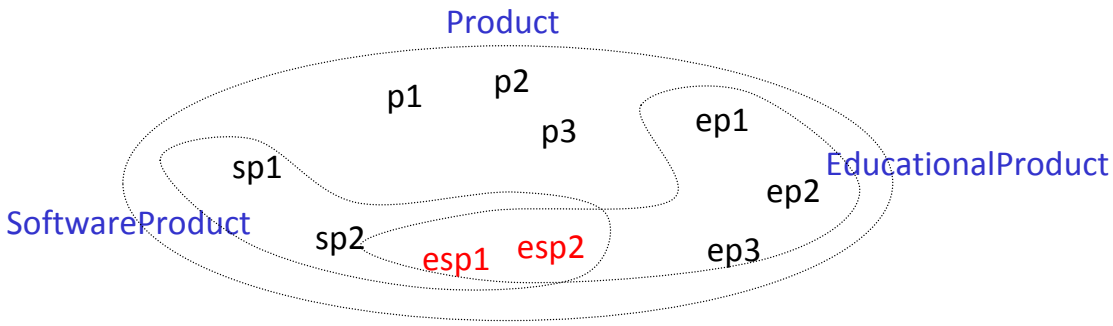
Difference between OO and E/R inheritance

- E/R: entity sets overlap



Difference between OO and E/R inheritance

We have three entity sets, but four different kinds of objects



No need for multiple inheritance in E/R

IsA Review

- If we declare ***A IsA B*** then every **A** is a **B**
- We use IsA to
  - Add descriptive attributes to a subclass
  - To identify entities that participate in a relationship
- **No need for multiple inheritance**

Modeling UnionTypes With Subclasses

Person

FurniturePiece

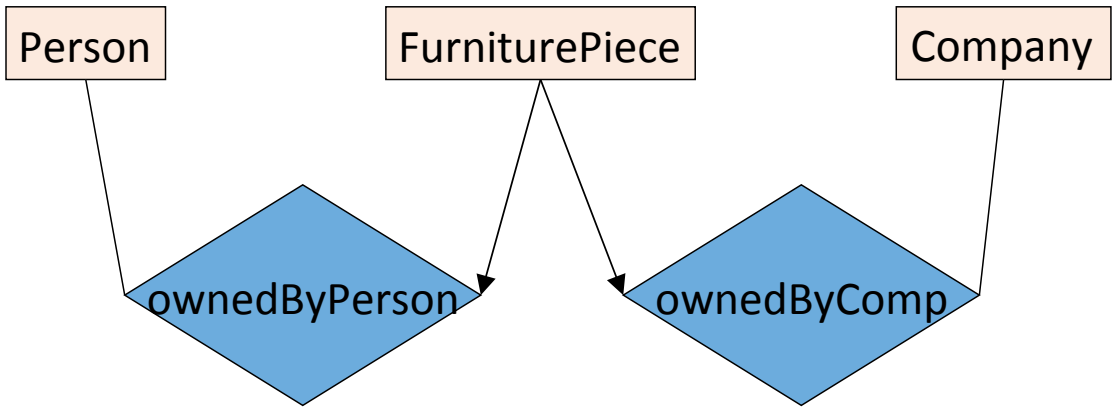
Company

Suppose each piece of furniture is owned either by a person, or by a company. *How do we represent this?*

Modeling Union Types with Subclasses

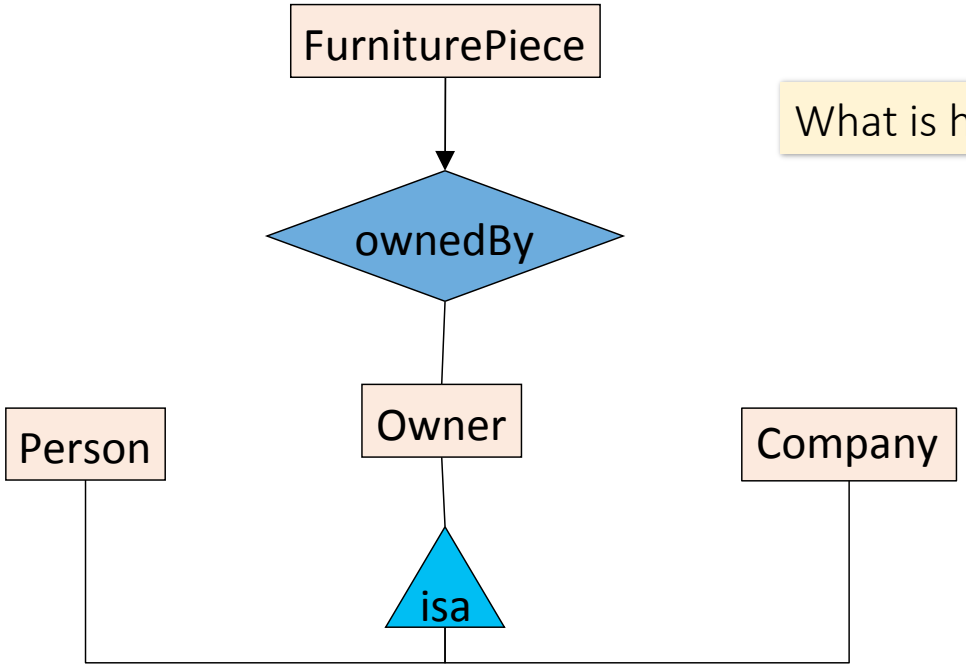
Say: each piece of furniture is owned either by a person, or by a company

<u>Solution 1.</u> Acceptable, but imperfect (What's wrong ?)



Modeling Union Types with Subclasses

Solution 2: better (though more laborious)



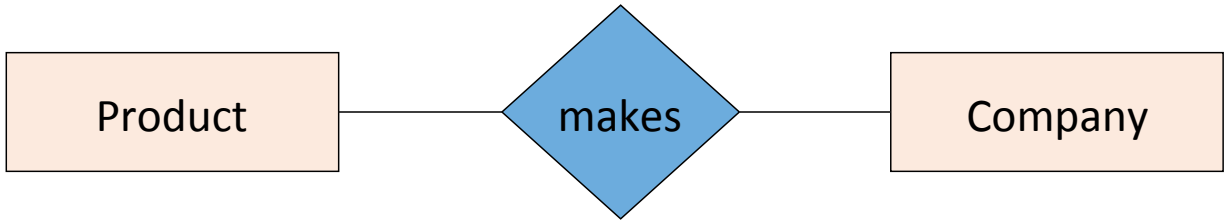
What is happening here?

Constraints in E/R Diagrams

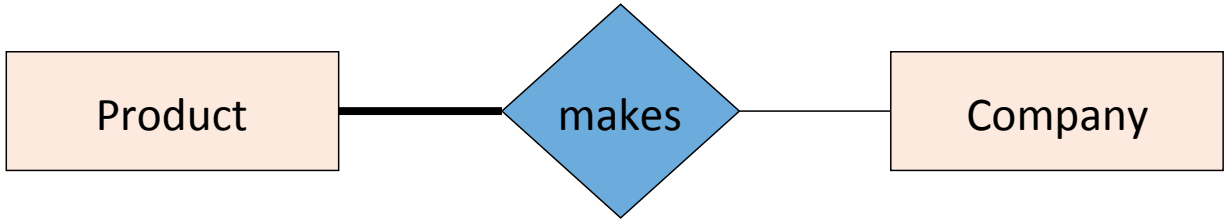
- Finding constraints is part of the E/R modeling process. Commonly used constraints are:
  - Keys: Implicit constraints on uniqueness of entities
    - *Ex: An SSN (کد ملی) uniquely identifies a person*
  - Single-value constraints:
    - *Ex: a person can have only one father*
  - Referential integrity constraints: Referenced entities must exist
    - *Ex: if you work for a company, it must exist in the database*
  - Other constraints:
    - *Ex: peoples' ages are between 0 and 150*

Recall FOREIGN KEYs!

Participation Constraints: Partial v. Total



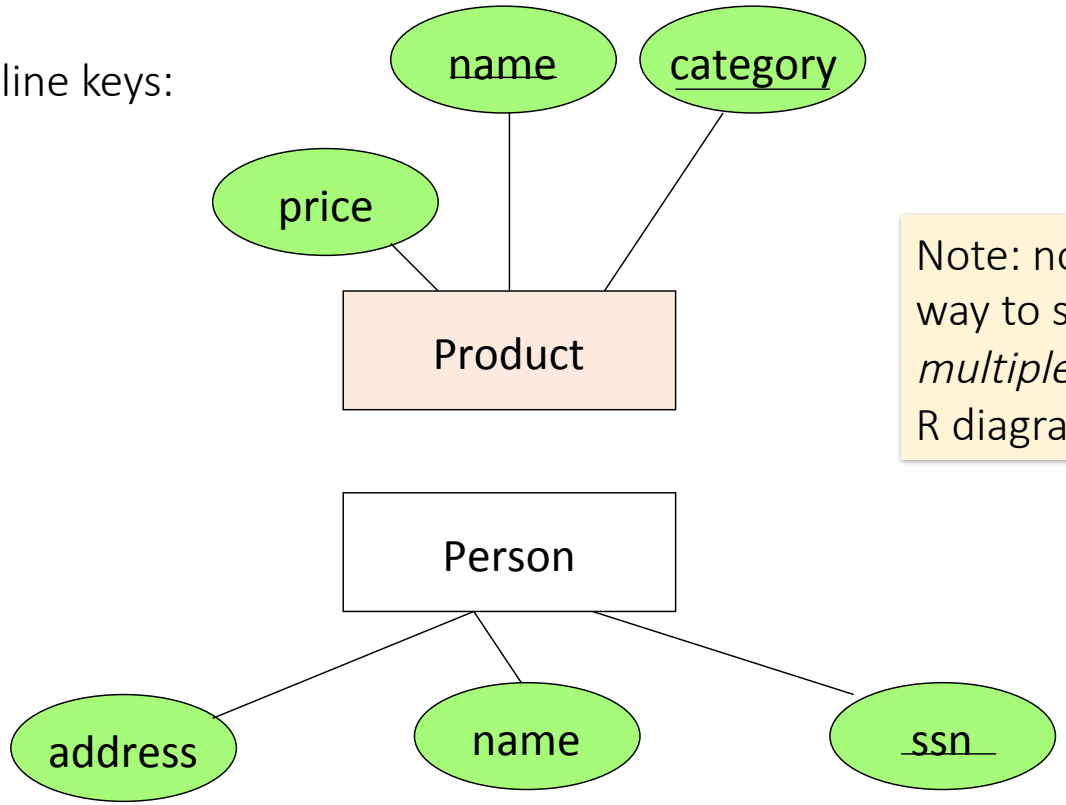
Are there products made by no company?
Companies that don't make a product?



Bold line indicates *total participation* (i.e. here: all products are made by a company)

Keys in E/R Diagrams

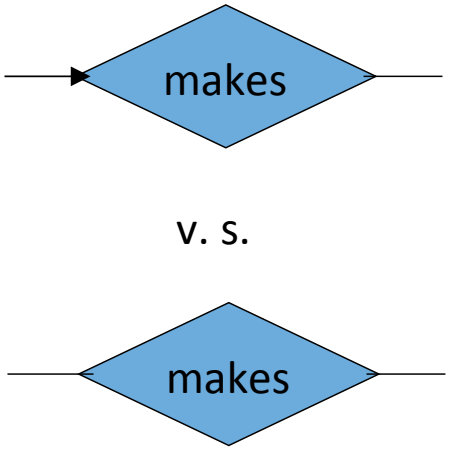
Underline keys:



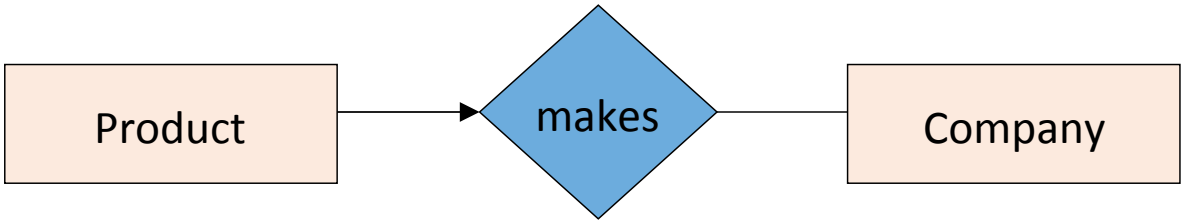
Note: no formal way to specify *multiple* keys in E/R diagrams…

Single Value Constraints

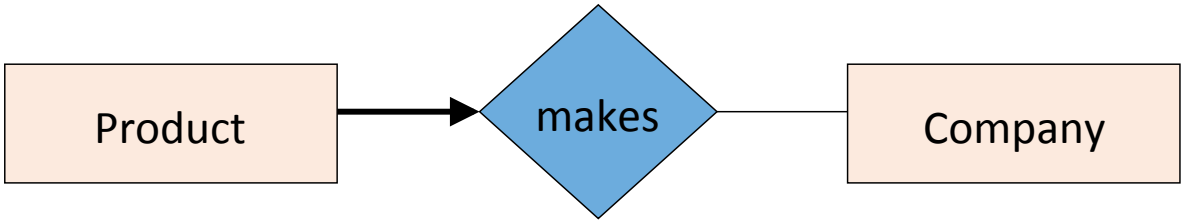
See previous section!



Referential Integrity Constraints



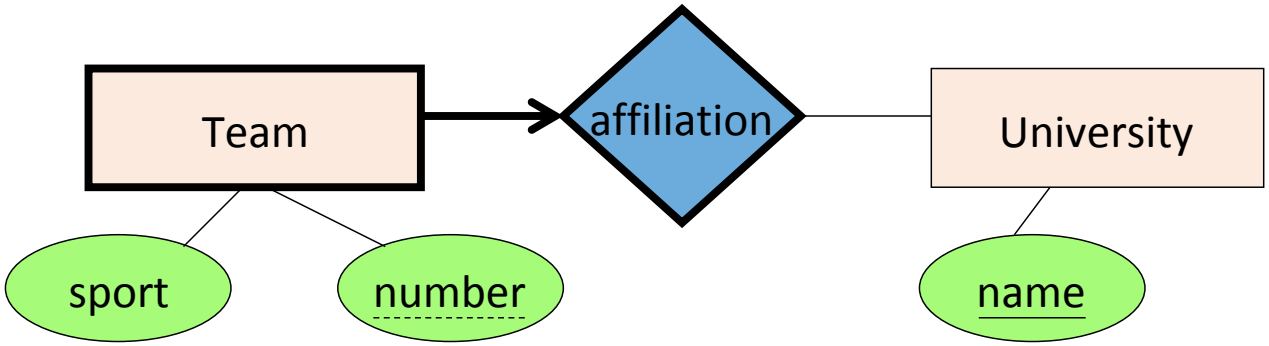
Each product made by at most one company.
Some products made by no company?



Each product made by *exactly* one company.

Weak Entity Sets

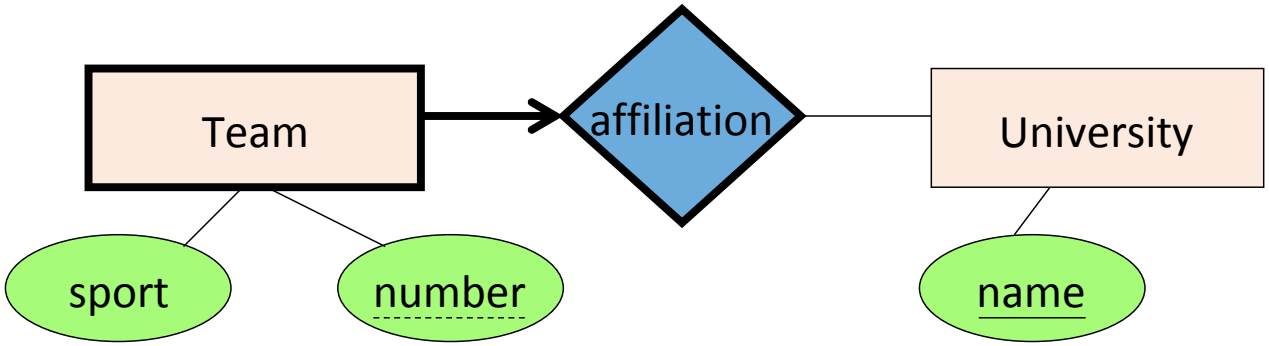
Entity sets are *weak* when their key comes from other entity sets to which they are related.



"Football team" v. "*The Yazd Uni* Football team" *(e.g., Tehran Uni has a football team too)*

Weak Entity Sets

Entity sets are *weak* when their key comes from other classes to which they are related.



- number is a *partial key*. (denote with dashed underline).
- University is called the _____.
- Participation in affiliation must be total. Why?

E/R Summary

- E/R diagrams are a visual syntax that allows technical and non-technical people to talk
  - For conceptual design
- Basic constructs: **entity**, **relationship**, and **attributes**
- A good design is faithful to the constraints of the application, but not overzealous