# CSCI4333 Database Design & Implement

## Lecture Five – E-R Model 3

Instructor: Dr. Yifeng Gao

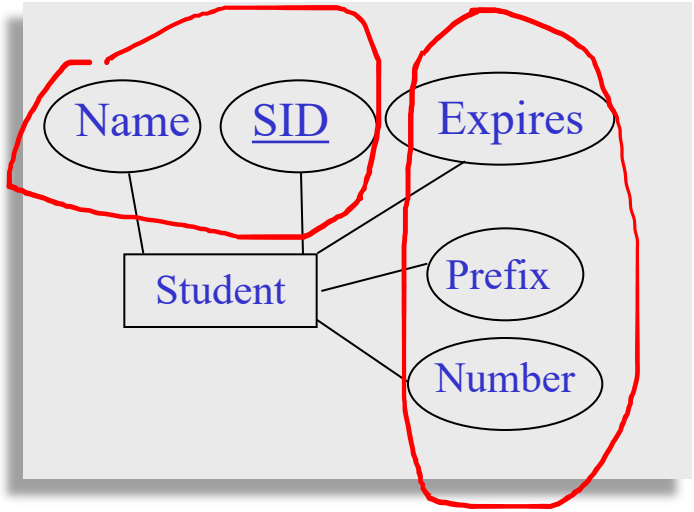
# Quick Question

- In University Database:
  - Each student is asked to report their name and the phone number to the university.
  - Each student is associated with a student ID
  - Starting from 2020, university start to ask students to report expired date for the phone
  - What the database want to store pre-fix and number

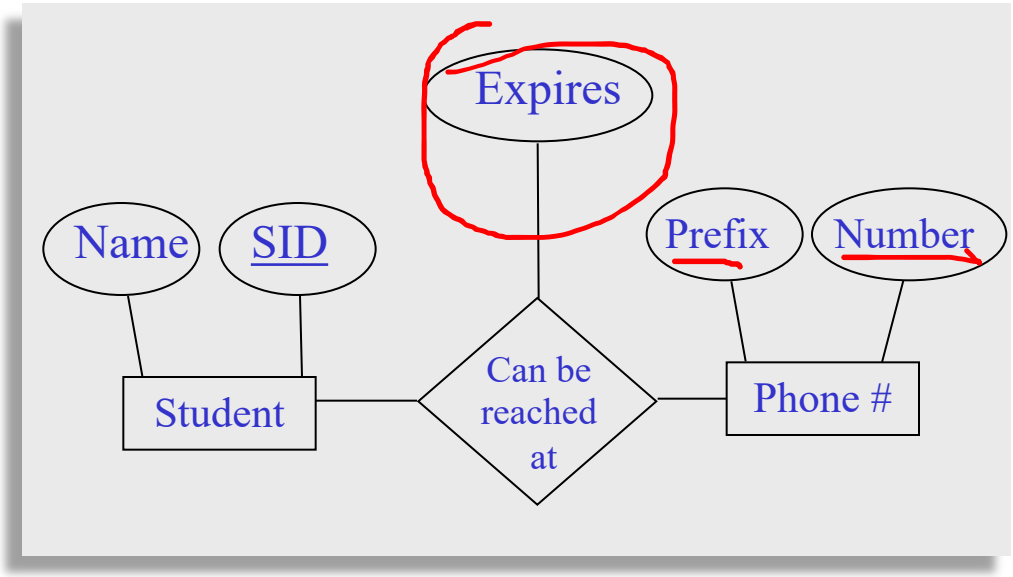
- Let's draw E-R diagram!

# Entity versus Attribute

Sometimes we have to decide whether a property of the world we want to model should be an attribute of an entity, or an entity set which is related to the attribute by a relationship set.



# How about this design?



# Entity versus Attribute

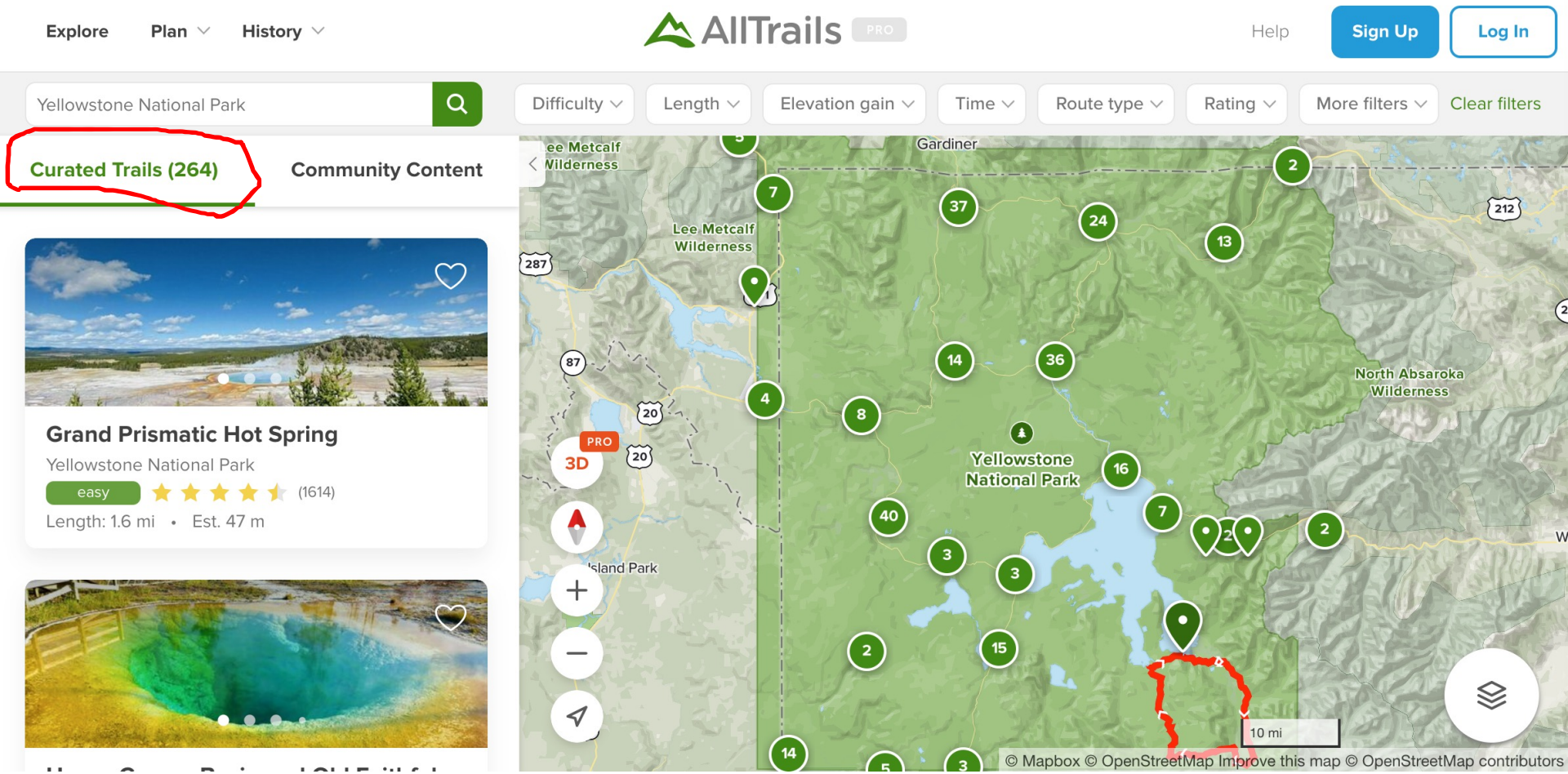
Sometimes we have to decide whether a property of the world we want to model should be an attribute of an entity, or an entity set which is related to the attribute by a relationship set.

Advantage vs. Disadvantage?

# Revisited: National Park Table

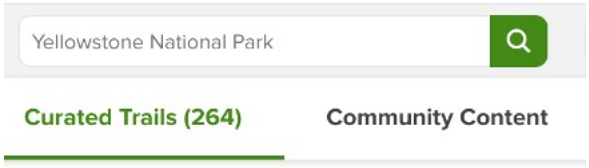
| Name | State | Established |
|---|---|---|
| Yellow Stone | WY | 1872 |
| Great Smoky Mountain | TN | 1934 |
| Acadia | ME | 1916 |
| Mount Rainer | WA | 1899 |

# Revisited: National Park Table



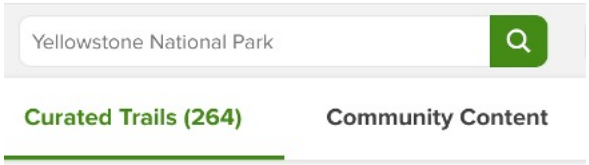
# Revisited: National Park Table

| Name | State | Established | Trail Name | Length | Rating |
|---|---|---|---|---|---|
| Yellow Stone | WY | 1872 | … | … | … |
| Great Smoky Mountain | TN | 1934 | … | … | … |
| Acadia | ME | 1916 | … | … | … |
| Mount Rainer | WA | 1899 | … | … | … |



# Revisited: National Park Table

| Name | State | Established | Trail Name | Length | Rating |
|---|---|---|---|---|---|
| Yellow Stone | WY | 1872 | … | … | … |
| Great Smoky Mountain | TN | 1934 | … | … | … |
| Acadia | ME | 1916 | … | … | … |
| Mount Rainer | WA | 1899 | … | … | … |




How many Entities in National Park Entity Set after adding attribute trail name?

# Revisited: National Park Table

**Mammoth Hot Springs Day Hikes ›**

The trails around Mammoth Hot Springs have a full range of difficultly and environments to explore.

**Old Faithful Day Hikes ›**

Hydrothermal features abound in the Upper Geyser Basin, and many trails in the area lead to some quieter views.

Suppose we only have two trails  in Yellow Stone…

# Revisited: National Park Table

| Name | State | Established | Trail Name | Length | Rating |
|---|---|---|---|---|---|
| Yellow Stone | WY | 1872 | Mammoth Hot Spring | 2 mile | 4.8 |
| Yellow Stone | WY | 1872 | Old Faithful | 5 mile | 4.9 |
| Great Smoky Mountain | TN | 1934 | … | … | … |
| Acadia | ME | 1916 | … | … | … |
| Mount Rainer | WA | 1899 | … | … | … |

Suppose we only have two trails in Yellow Stone…

# Revisited: National Park Table

| Name | State | Established | Trail Name | Length | Rating |
|---|---|---|---|---|---|
| Yellow Stone | WY | 1872 | Mammoth Hot Spring | 2 mile | 4.8 |
| Yellow Stone | WY | 1872 | Old Faithful | 5 mile | 4.9 |
| Great Smoky Mountain | TN | 1934 | … | … | … |
| Acadia | ME | 1916 | … | … | … |
| Mount Rainer | WA | 1899 | … | … | … |

We have **Redundancy!**

**Canyon Day Hikes ›**

Mountains and canyons highlight some of the stunning hikes in the center of the park.

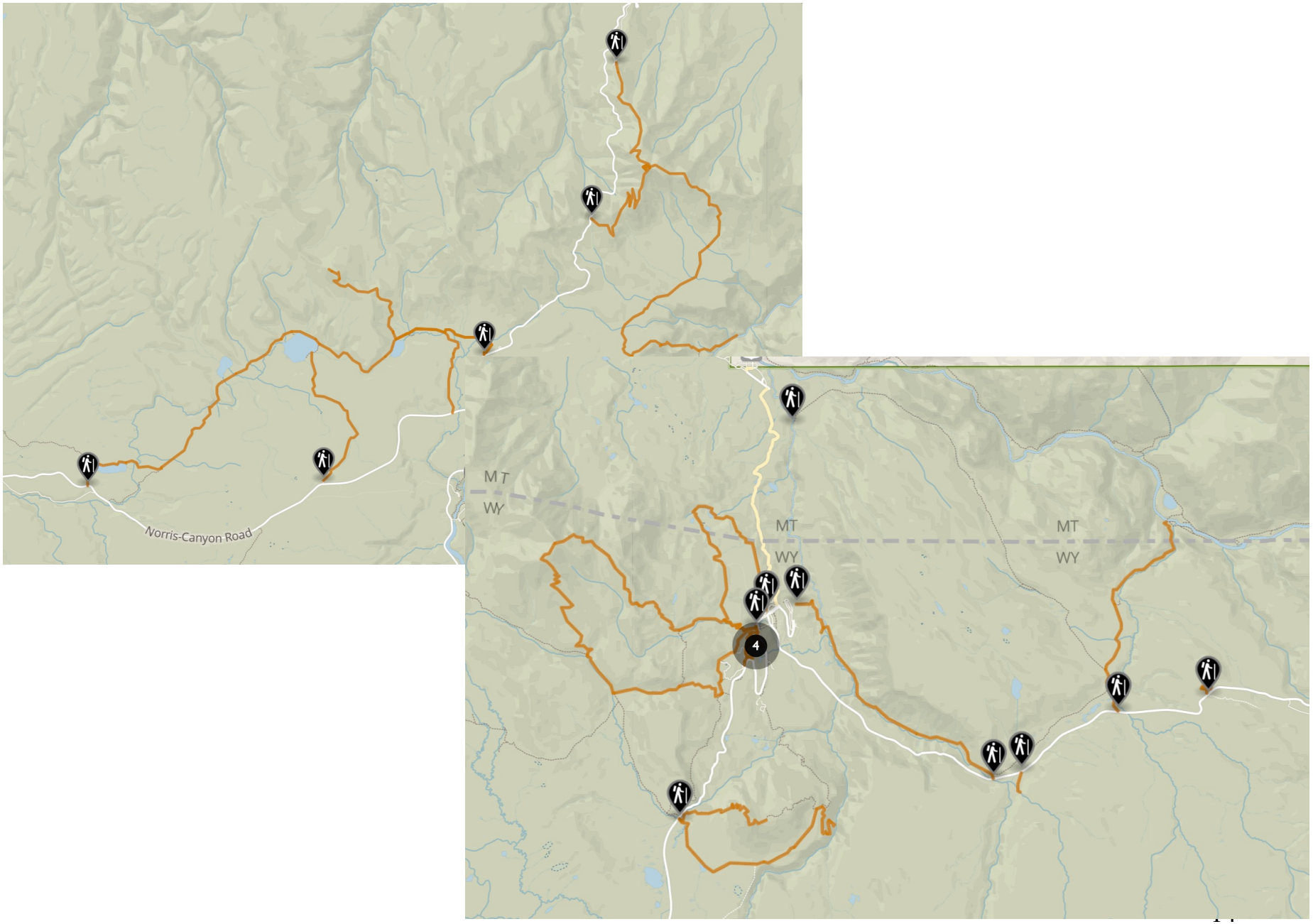
**Lake & Fishing Bridge Day Hikes ›**

Hikes in this area provide views of Yellowstone Lake and the surrounding mountains.

**Madison Day Hikes ›**

**Mammoth Hot Springs Day Hikes ›**

**Old Faithful Day Hikes ›**

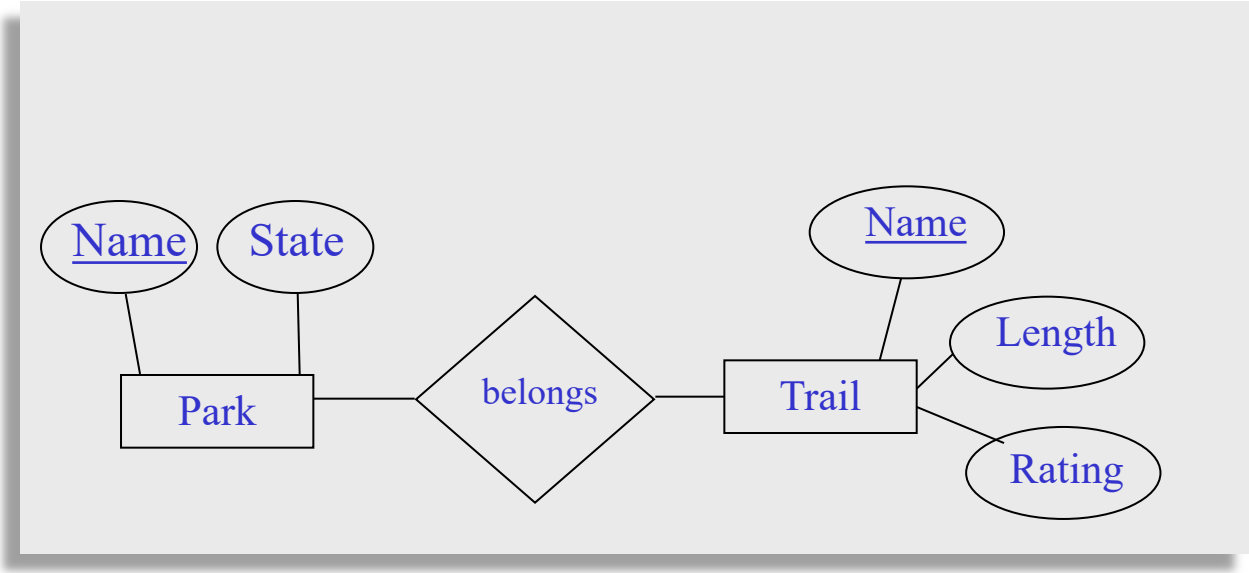

Norris-Canyon Road
MT
WY
MT
WY
MT
WY
4

# Revisited: National Park Table

| Name | State | Established | Trail Name |
|---|---|---|---|
| Yellow Stone | WY | 1872 | Trail 1 |
| .. | … | … | Trail 2 |
| Yellow Stone | WY | 1872 | Trail 264 |
| Great Smoky Mountain | TN | 1934 | |
| Acadia | ME | 1916 | |
| Mount Rainer | WA | 1899 | |

A Big Table contains 267 entities!

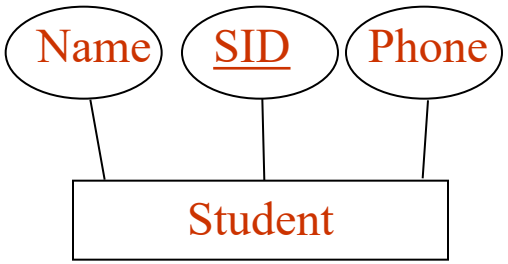
# What if our design is this?

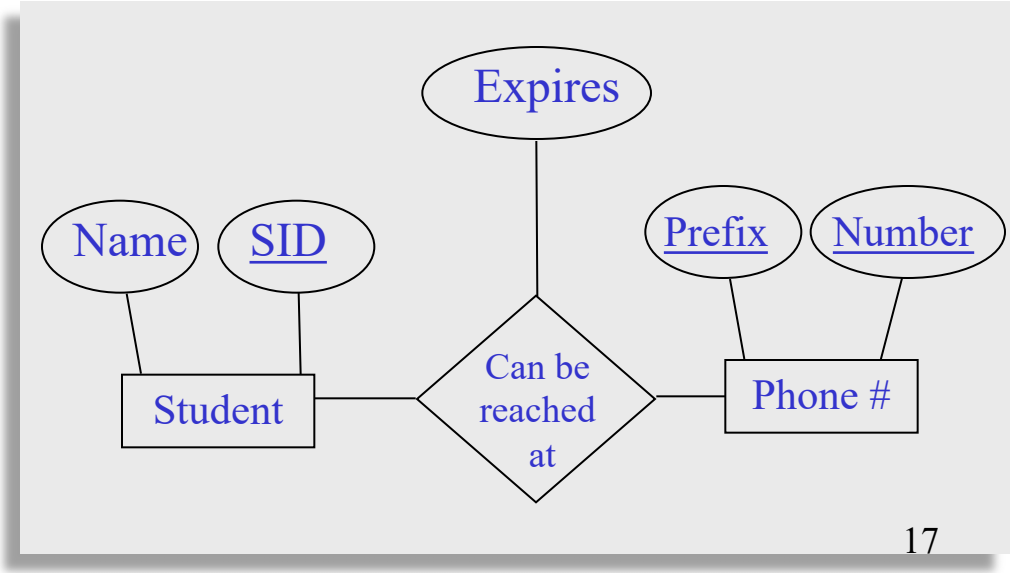


# Entity versus Attribute

Sometimes we have to decide whether a property of the world we want to model should be an attribute of an entity, or an entity set which is related to the attribute by a relationship set.

A major advantage of the latter approach is that we can easily model the fact that a person can have multiple phones, or that a phone might be shared by several students. (attributes can not be set-valued)



# Entity versus Attribute Cont.

A classic example of a feature that is best modeled as an entity set which is related to the attribute by a relationship set is an *address*.

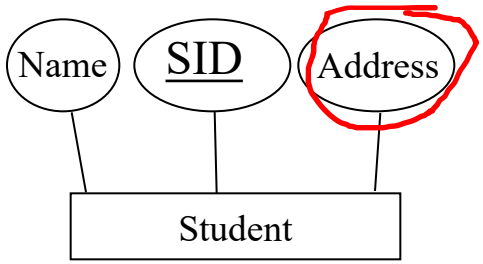
# Entity versus Attribute Cont.

A classic example of a feature that is best modeled as an entity set which is related to the attribute by a relationship set is an *address*.

Very bad choice for most applications.

it would make it difficult to test validity of the data,

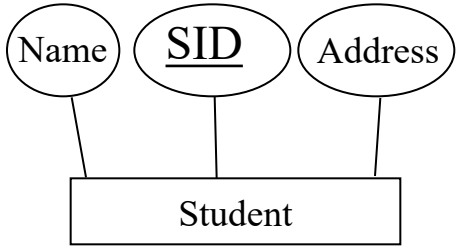
it would make it difficult/impossible to do queries such as "how many students live in Edinburg, TX?"



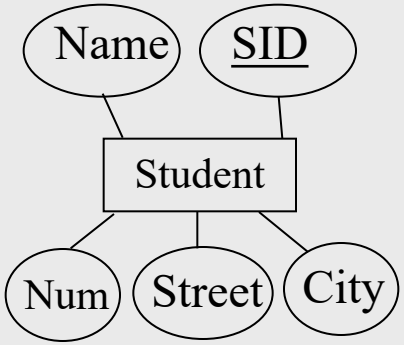
# Entity versus Attribute Cont.

A classic example of a feature that is best modeled as a an entity set which is related to the attribute by a relationship set is an *address*.

Very bad choice for most applications.



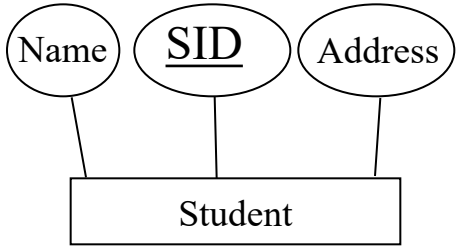

A better choose.



# Entity versus Attribute Cont.

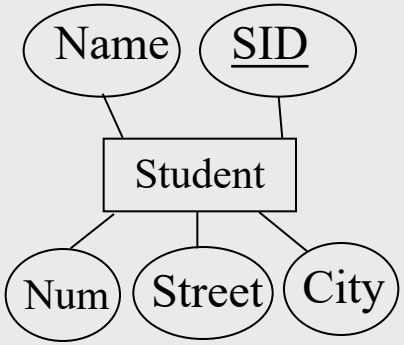
A classic example of a feature that is best modeled as a an entity set which is related to the attribute by a relationship set is an *address*.

Very bad choice for most applications.

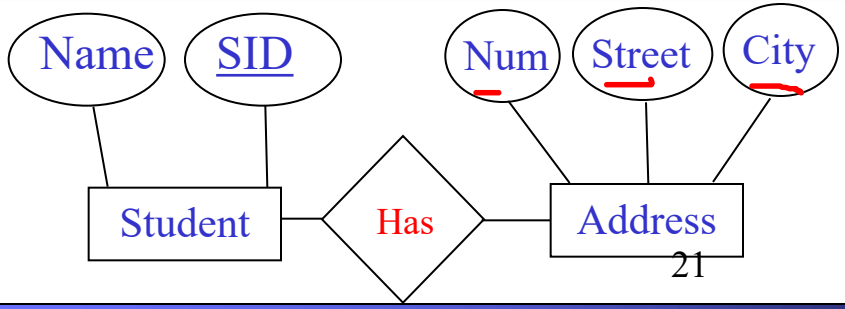



A better choose.

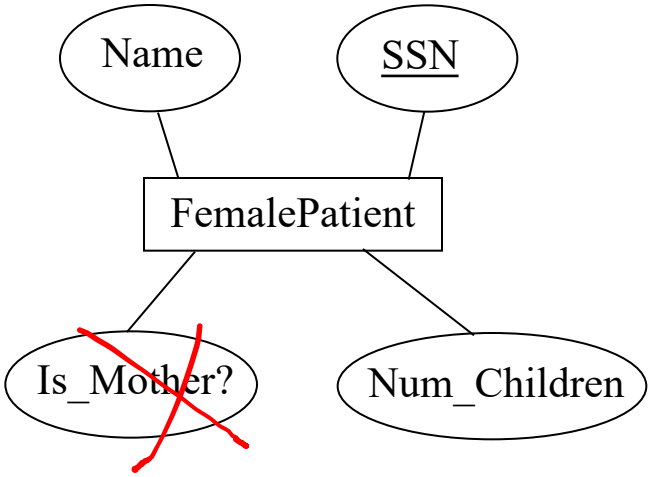
Many students have a two or more address!




The best choice for this problem



# Redundancy is an enemy

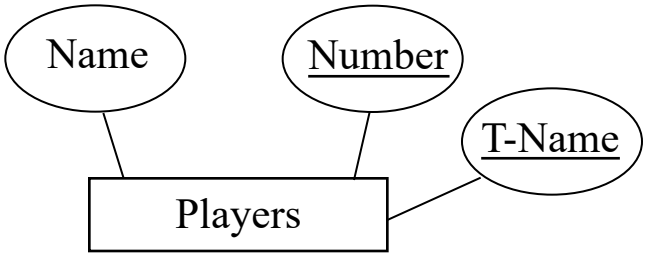



What's wrong with this ER Model?

# Key in ER-diagram

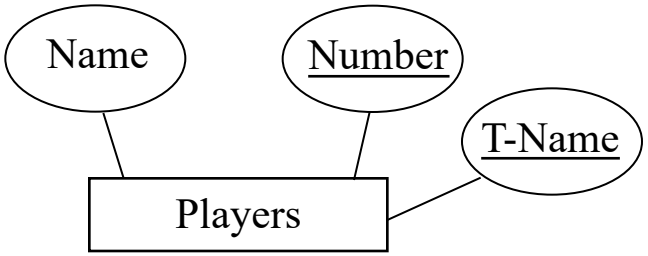
- Consider a simple entity: NBA player record consists of his name, Player number, and a team name.
- A player can be uniquely defined by Player number, and his team name
- Without team name, we could not uniquely define a player.
- How to draw this entity set?

# Key in ER-diagram



# Key in ER-diagram

- Key: The attributes (or a combination of attributes) that could uniquely define an entity



# Weak Entity Sets Example

- Consider Entity sets Team, and Player.

# Weak Entity Sets Example

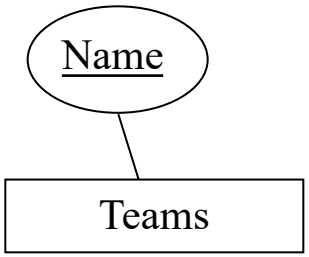
- Consider Entity sets Team, and Player.
  - Each Team entity stores a unique Name
  - Each Player entity stores a player Name, a Team Name and Number

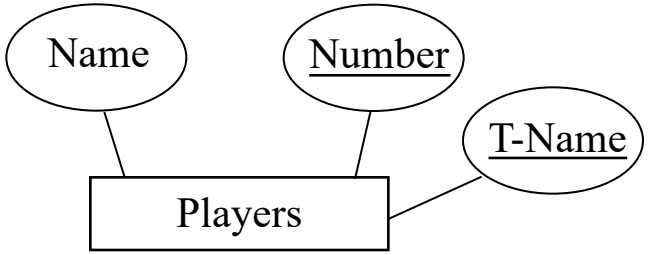
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Each Team entity stores a unique Name
  - Each Player entity stores a player Name, a Team Name and Number
  - Each Player at most participate one team
  - A Player should only associate with one team.
  - However, there can be players with the same number on different teams
- How to design Entity set Team and Player?

# Weak Entity Sets Example

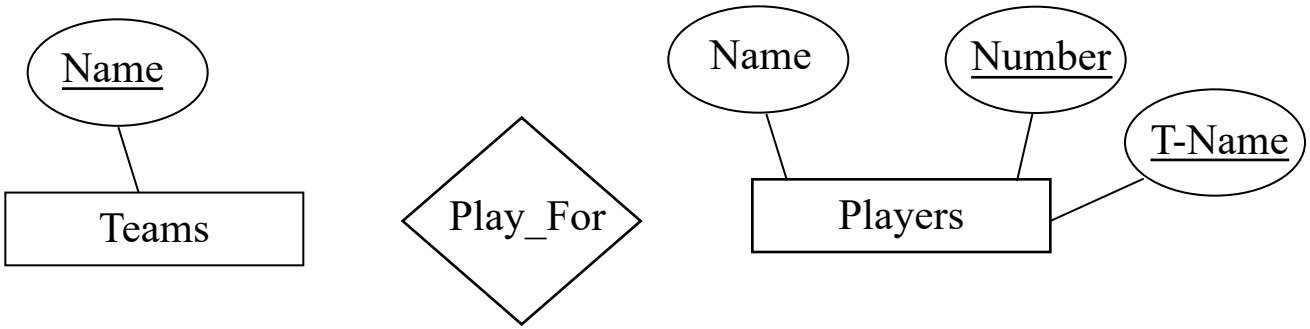
- Consider Entity sets Team, and Player.



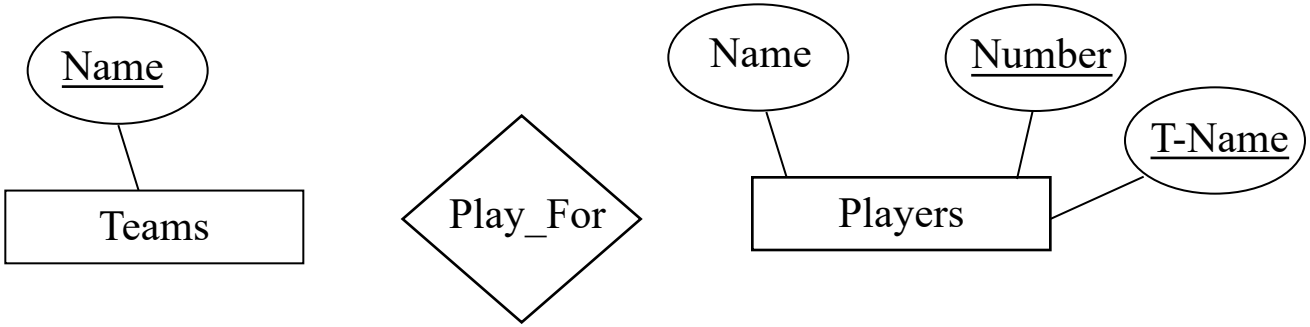
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.



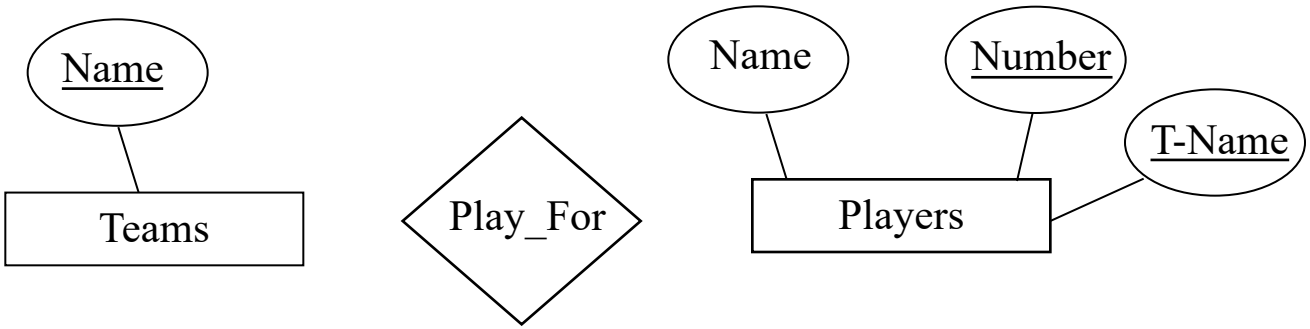
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Consider Key Constraint



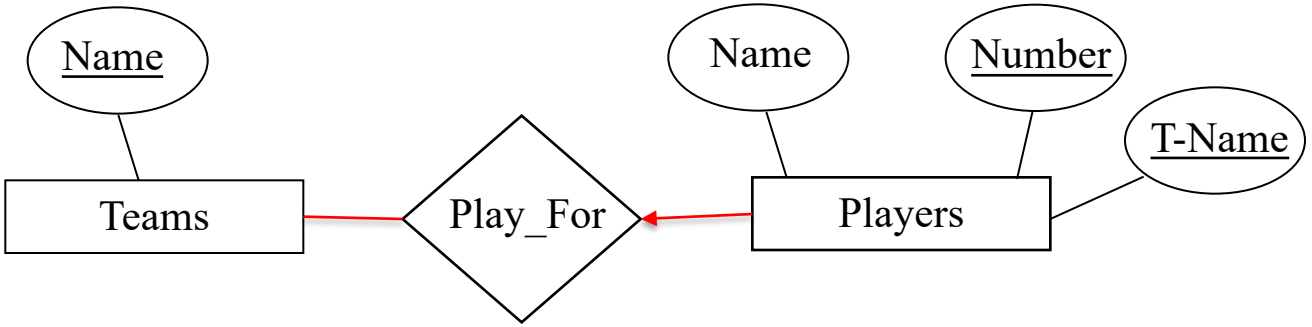
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Consider Key Constraint (one-to-many)
  - How to draw it?



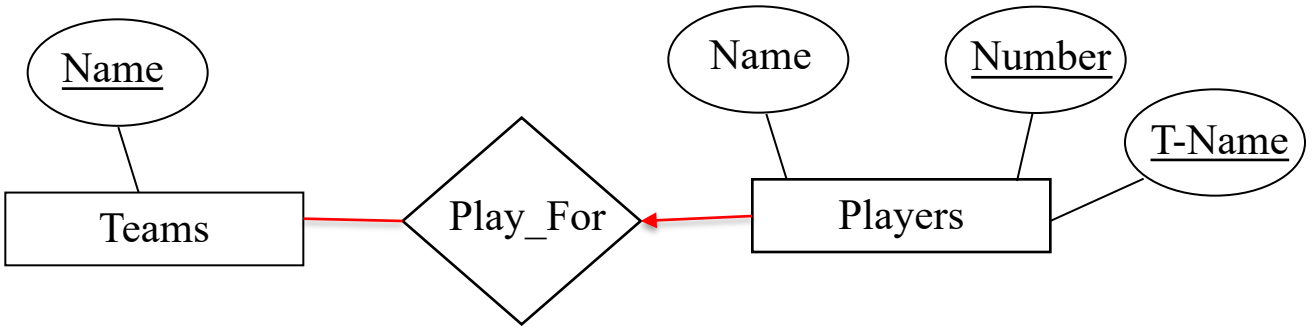
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Consider Key Constraint (one-to-many)
  - How to draw it?



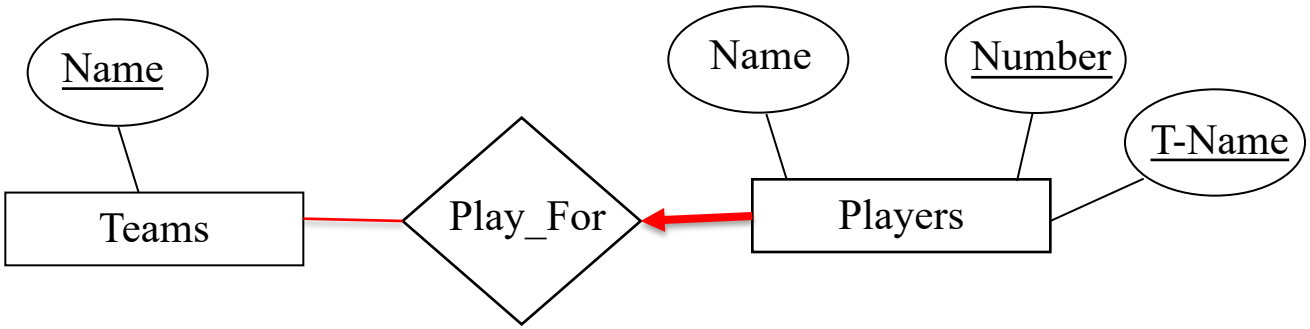
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Each Player at most participate one team
  - Consider Participate Constraint



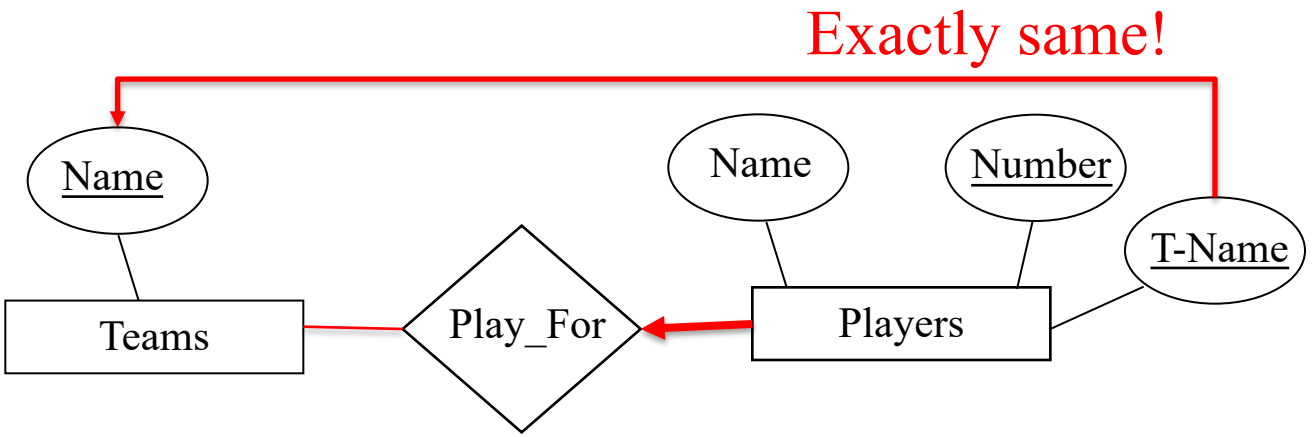
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.
  - Each Player at most participate one team
  - Consider Participation Constraint



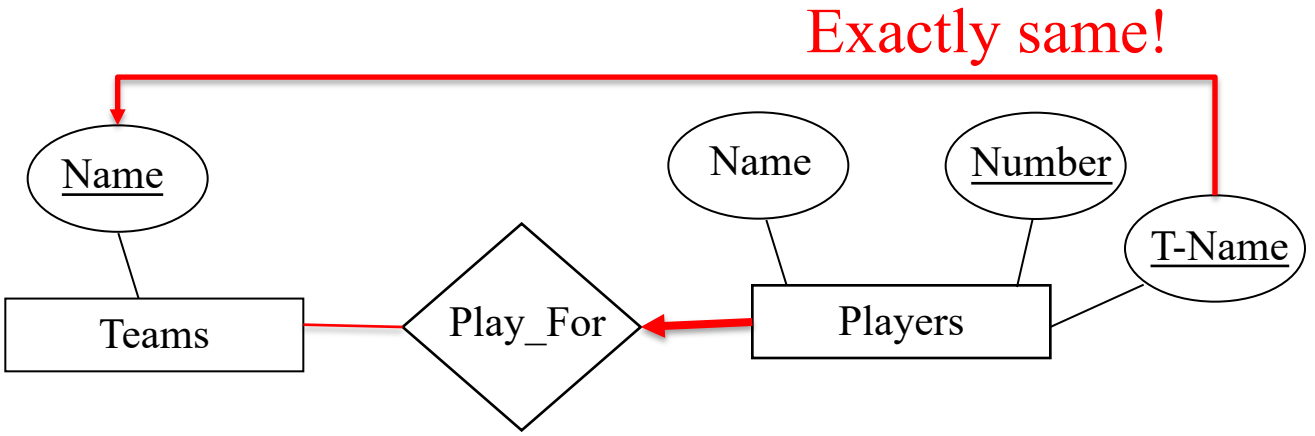
# Weak Entity Sets Example

- Consider Entity sets Team, and Player.

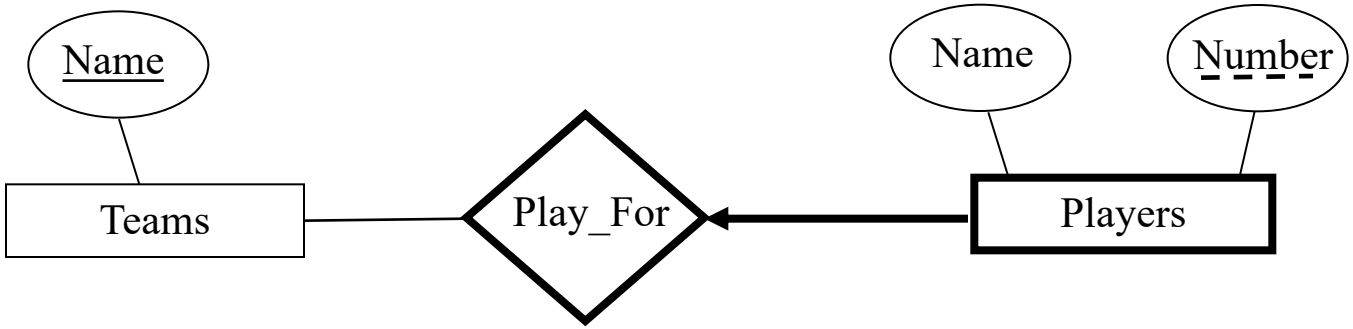


# Weak Entity Sets Example

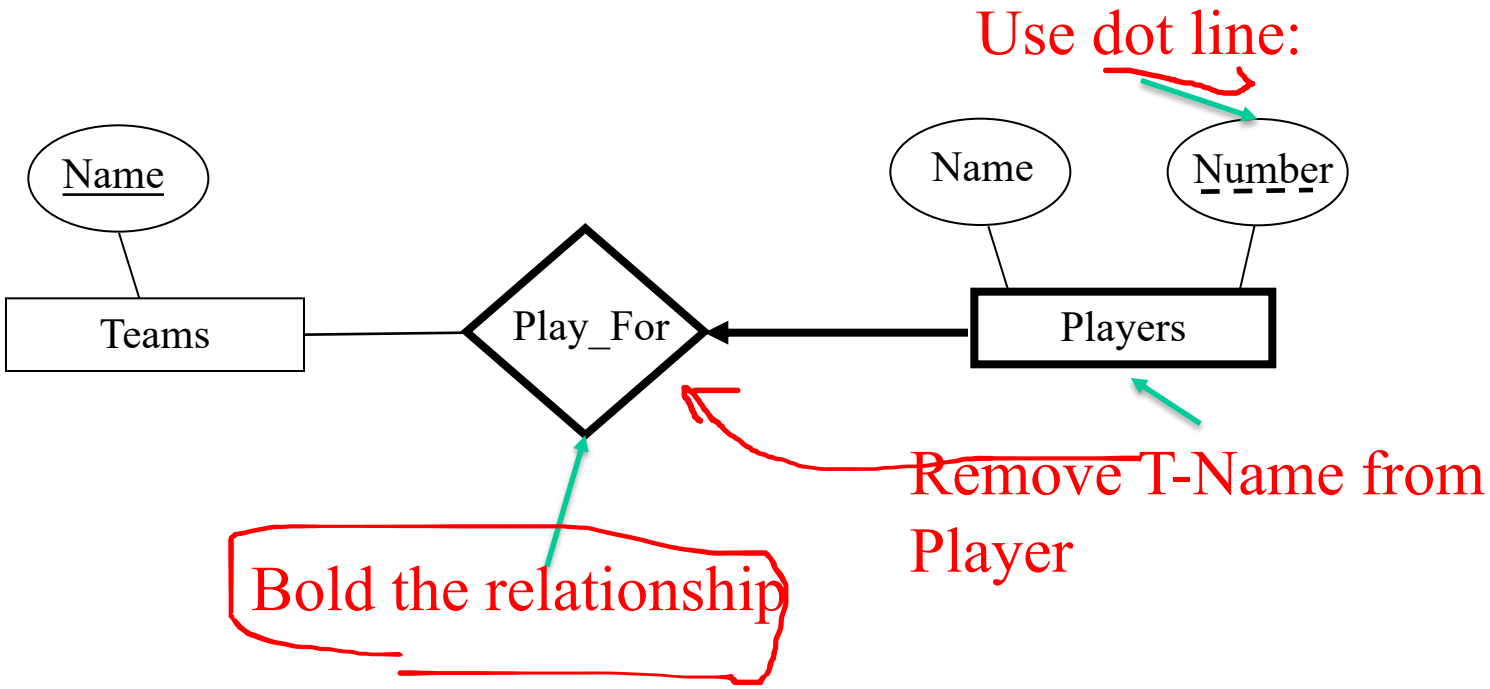
- Consider Entity sets Team, and Player.
- To simplify the expression… we introduce a new concept: Weak Entity Set



# Weak Entity Sets Example



# Weak Entity Sets Example



# Weak Entity Sets Example