Chapter 2B.

E-R Model to Relational Tables

CSIS0278 / COMP3278

Introduction to

Database Management Systems

Department of Computer Science, The University of Hong Kong

Slides prepared by - **Dr. Chui Chun Kit** for students in CSIS0278/COMP3278
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Outcome based learning (OBL)

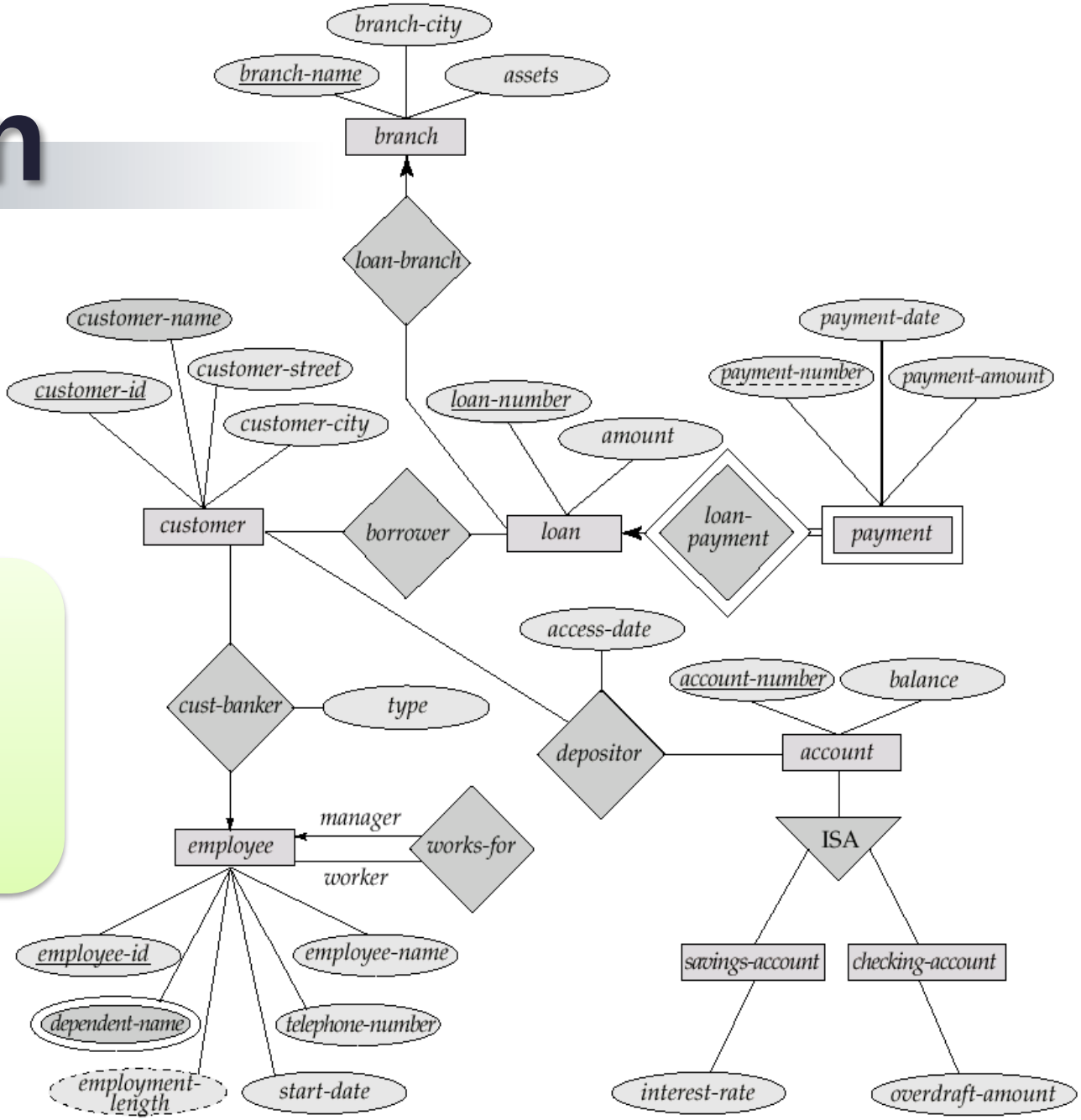
- Outcome 1. **Information Modeling**
  - Able to understand the modeling of real life information in a database system.
- Outcome 2. **Query Languages**
  - Able to understand and use the languages designed for data access.
- Outcome 3. **System Design**
  - Able to understand the design of an efficient and reliable database system.
- Outcome 4. **Application Development**
  - Able to implement a practical application on a real database.

We are going to learn…

- **E-R design decision.**
- **Reduction of an E-R schema to database tables.**

Revision

Can you understand the data model captured by this E-R Diagram?



E-R Diagram for a Banking Enterprise

Section 2B.1

E-R Design Decision

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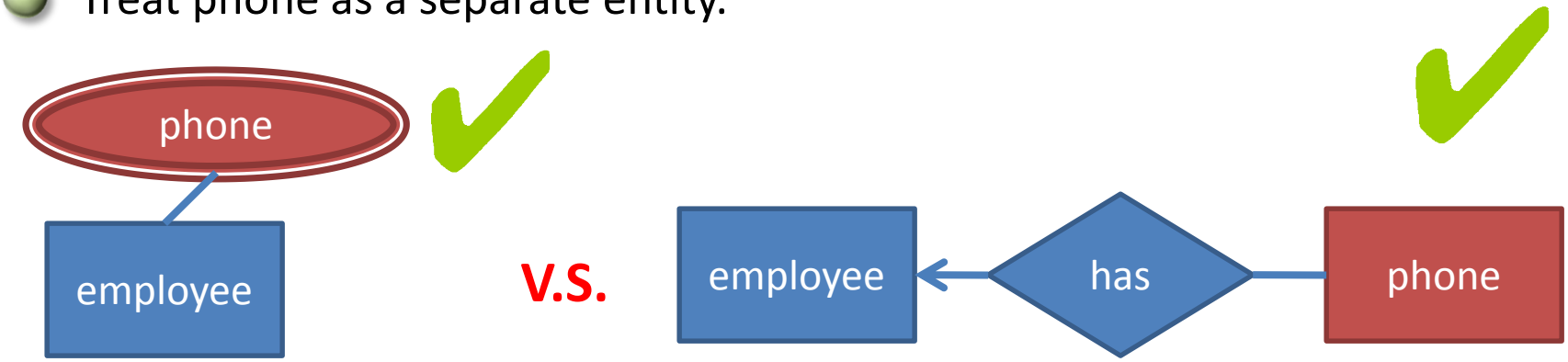
Entity sets v.s. Attributes

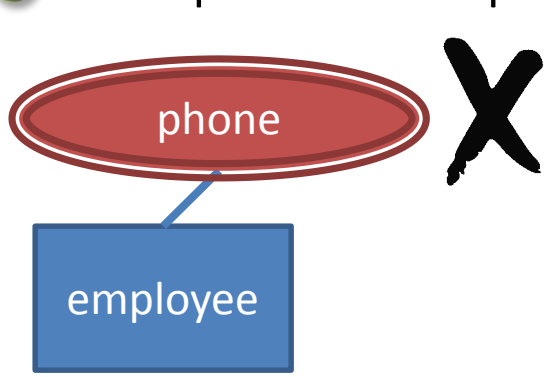
- How do you model an employee and his phone number?
  - Treat phone number as an attribute of an employee.
  - Treat phone as a separate entity.



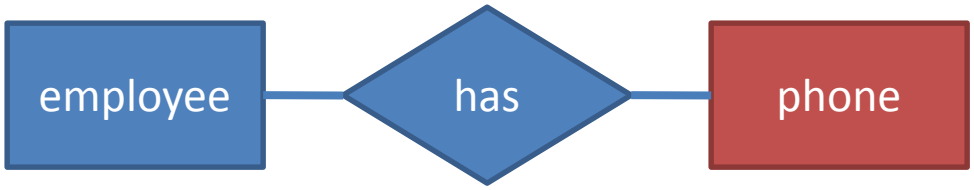
1. In my company, an employee can have multiple phone numbers…

Entity sets v.s. Attributes

- How do you model an employee and his phone number?
  - Treat phone number as an attribute of an employee.
  - Treat phone as a separate entity.



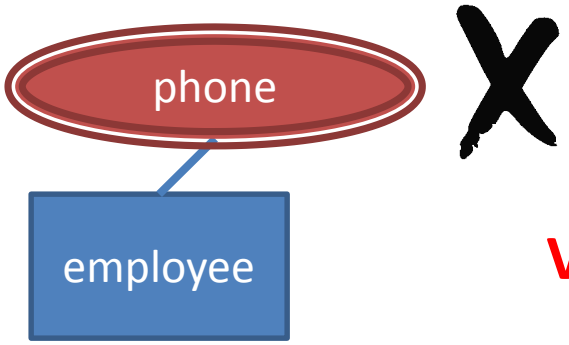
V.S.



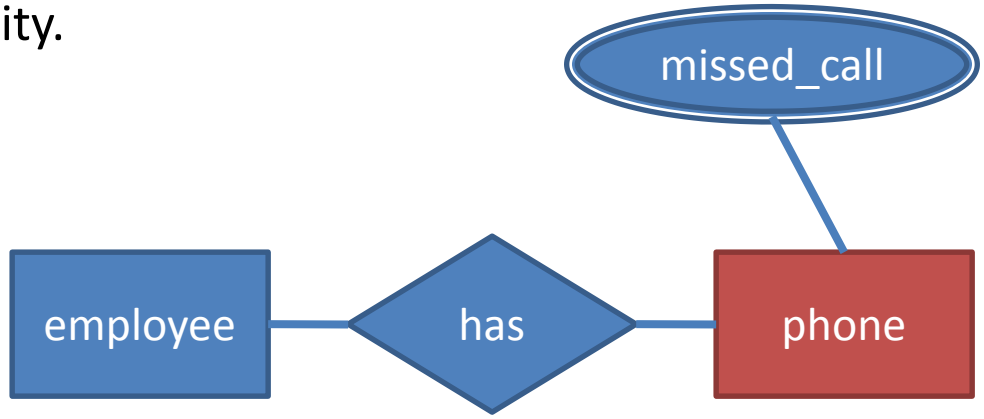
2. In my company, a phone number can be **shared by** multiple employee…

Entity sets v.s. Attributes

- How do you model an employee and his phone number?
  - Treat phone number as an attribute of an employee.
  - Treat phone as a separate entity.



V.S.



3. In the system, for each phone, I want to keep a list of missed call numbers.

Entity sets v.s. Relationship sets

- Use a relationship set to **describe an action that occurs between entities.**
  - **Hint:** entity sets often have “nouns” as name, and relationship sets have “verbs” as name.

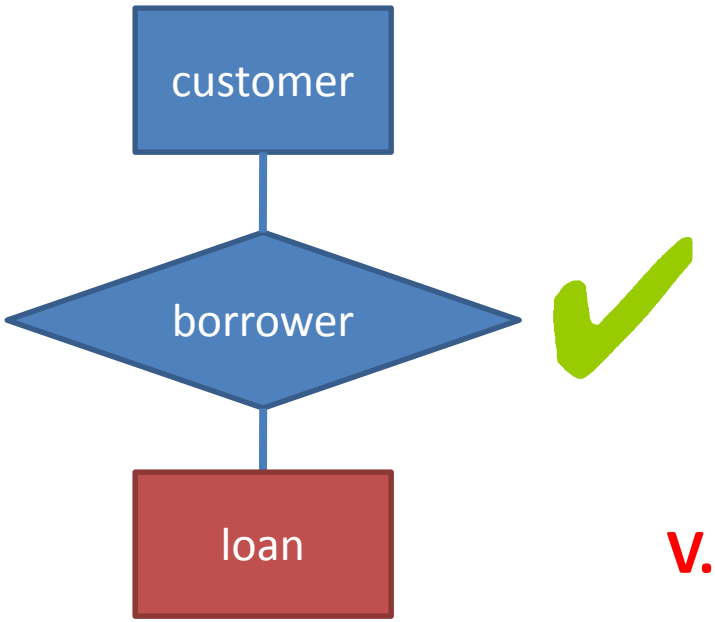
Entity sets v.s. Relationship sets

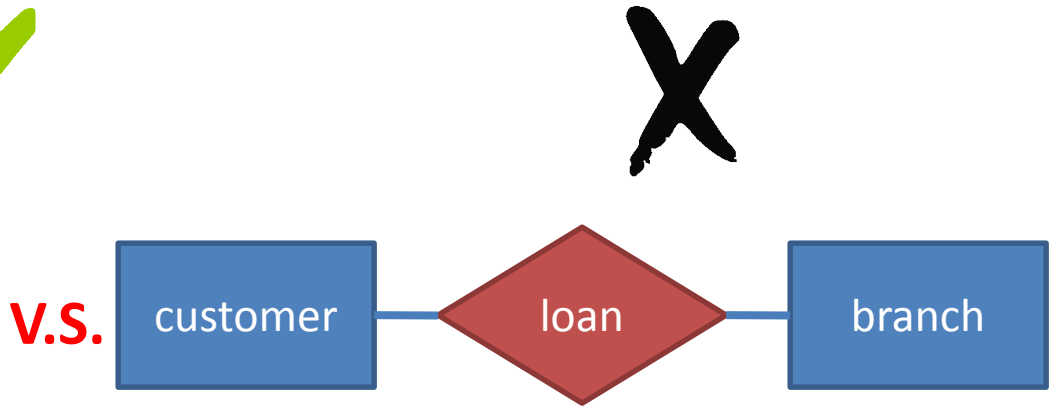
- How to model a loan?
  - 1. As a Loan entity.
  - 2. As a relationship between a customer and a branch.

A loan is an object in this phrase.

Can we have joint loan?
(E.g., Do we need to express something like **"A loan can be associated with multiple customers"**)

Entity sets v.s. Relationship sets





Can we have joint loan?
(E.g., Do we need to express something like **"A loan can be associated with multiple customers"**)

Section 2B.2

From E-R Schema to Relational Tables

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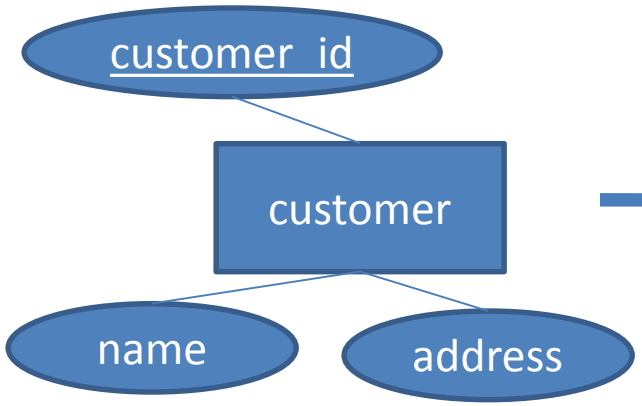
Entity sets

- An **Entity set** (or another name, **strong entity set**) reduces to **a table** with the same attributes.

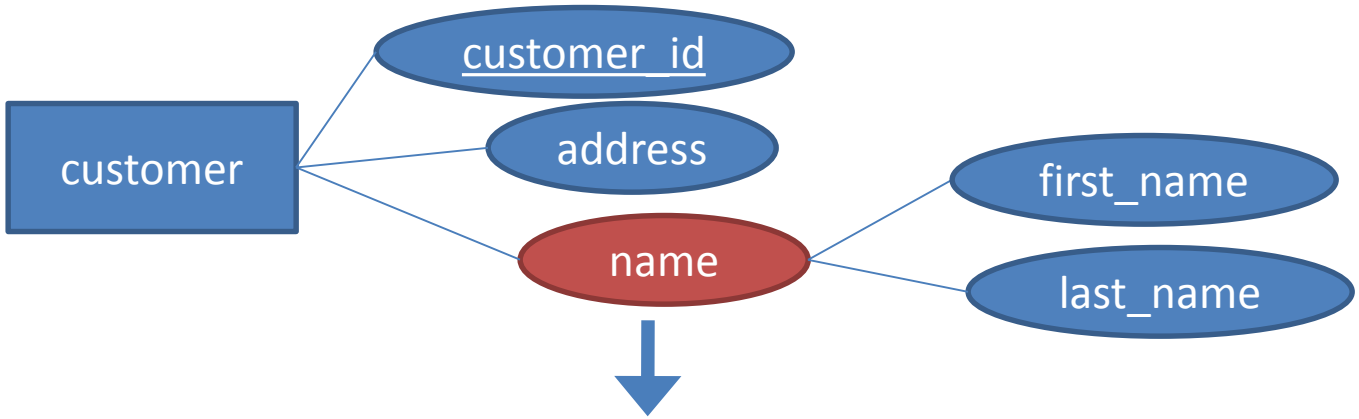


customer_id	name	address
…	…	…
…	…	…
…	…	…

Customer (customer_id, name, address)

Attributes

- **Composite attributes** are **flattened out** by creating a separate attribute for each component attribute.
  - e.g, **name** becomes **name.first_name** and **name.last_name**.

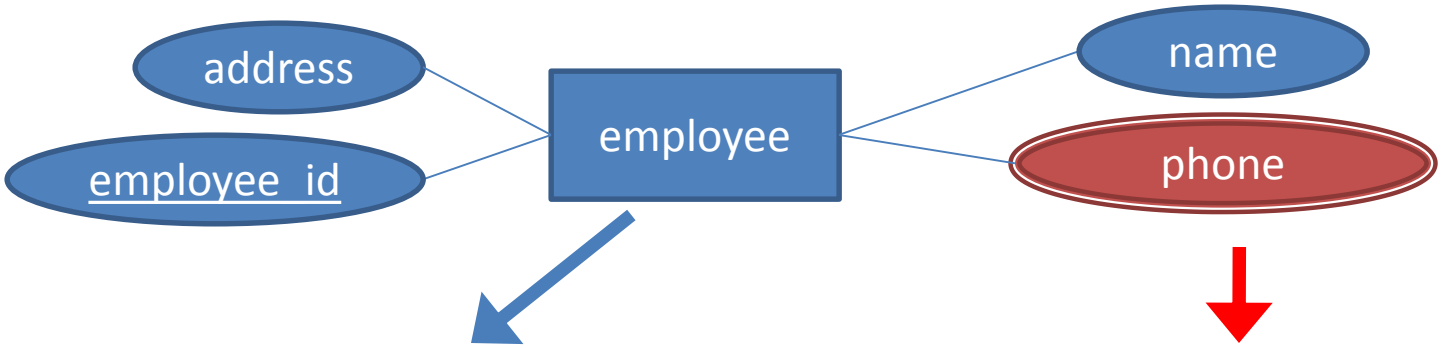


customer_id	name.first_name	name.last_name	address
…	…	…	…
…	…	…	…

Customer (customer_id, name.first_name, name.last_name, address)

Attributes

- A **multi-valued attribute** M of an entity set E is represented by **a separate table EM**, with the primary key of E as one of EM's attribute.



employee_id	name	address
1	Kit	…
2	Ben	…

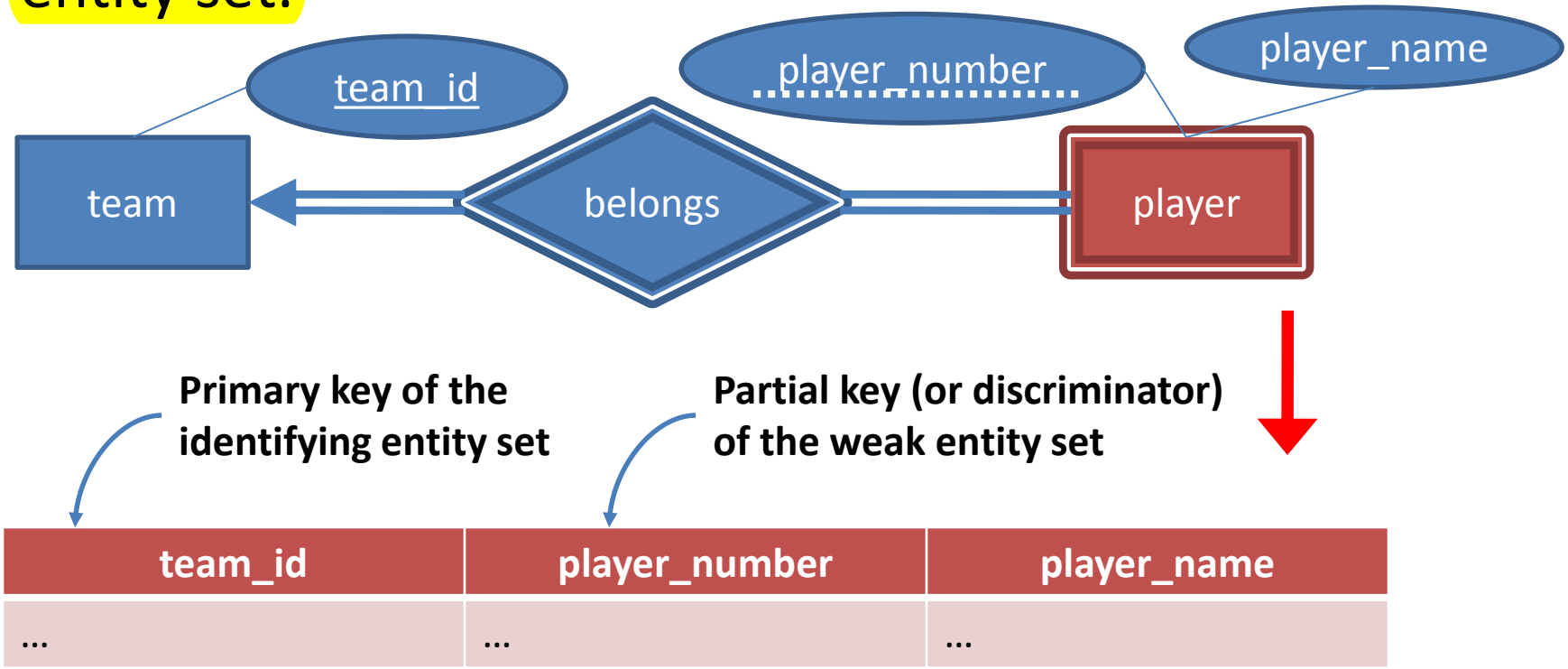
employee_id	phone
1	9123 4567
1	2987 6543

Employee(employee_id, name, address)

EmployeePhone(employee_id, phone)

Weak entity sets

- A **weak entity set** becomes a **table** that includes the columns for the primary key of the identifying strong entity set.



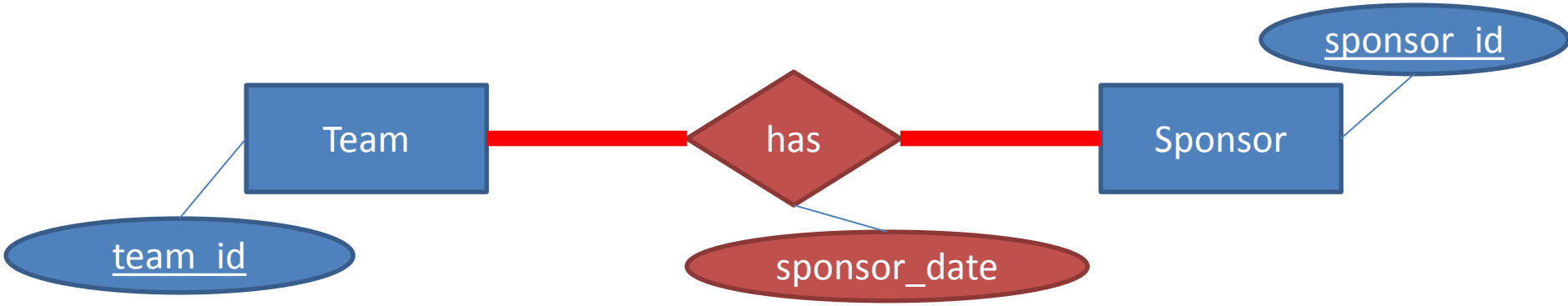
Player (teamID, player_number, player_name)

Relationship sets

- The reduction depends on their mapping cardinalities.
  - Many to many
  - One to many / many to one
  - One to one

Relationship sets

- A **many-to-many** relationship set is a table with columns for the primary keys of the participating entity sets, and any attributes of the relationship set.



team_id	…
1	…
2	…

Team(team_id, …)

team_id	sponsor_id	sponsor_date
1	1	2013-1-1
2	1	2013-9-1

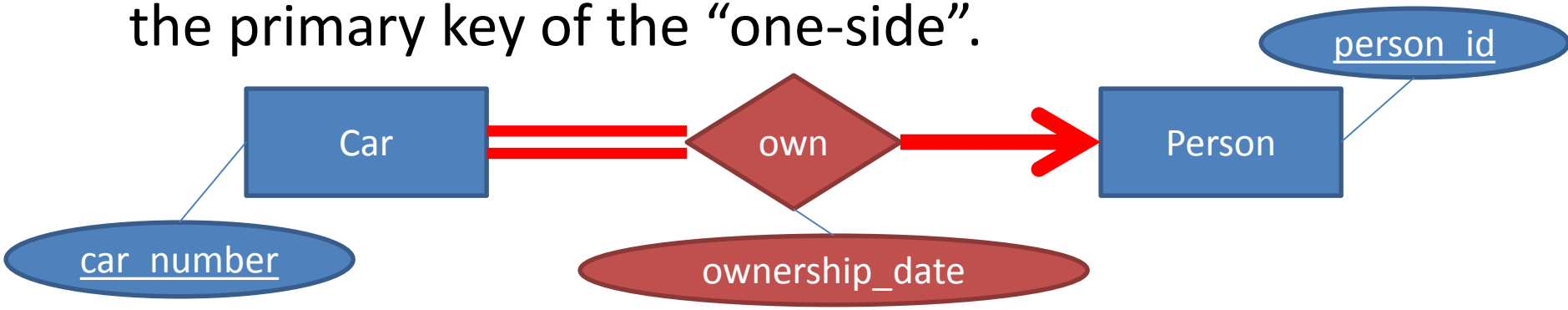
Team_asoc_sponsor
(team_id, sponsor_id, sponsor_date)

sponsor_id	…
1	…
2	…

Sponsor(sponsor_id, …)

Relationship sets

- **Many-to-one** and **one-to-many** relationship sets that are **total on the many-side** can be represented by adding extra attributes to the "many-side", containing the primary key of the "one-side".



car_number	ownership_date	person_id	...
HV 2299	2013-10-1	1	...
HW 2149	2013-12-4	1	...

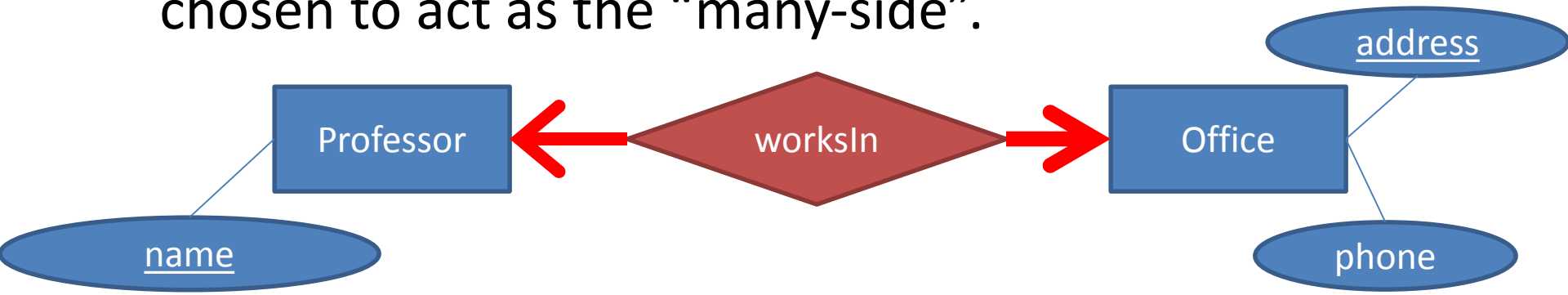
person_id	...
1	...
2	...

Car (car_number, ownership_date, person_id,...)

Person (person_id, ...)

Relationship sets

- For **one-to-one** relationship sets, either side can be chosen to act as the "many-side".



name	office.address	…
Professor Kao	CB312	…

Professor(name, **office.address**,…)

address	phone	…
CB312	21234567	…

Office(address, phone, …)

OR

name	…
Professor Kao	…

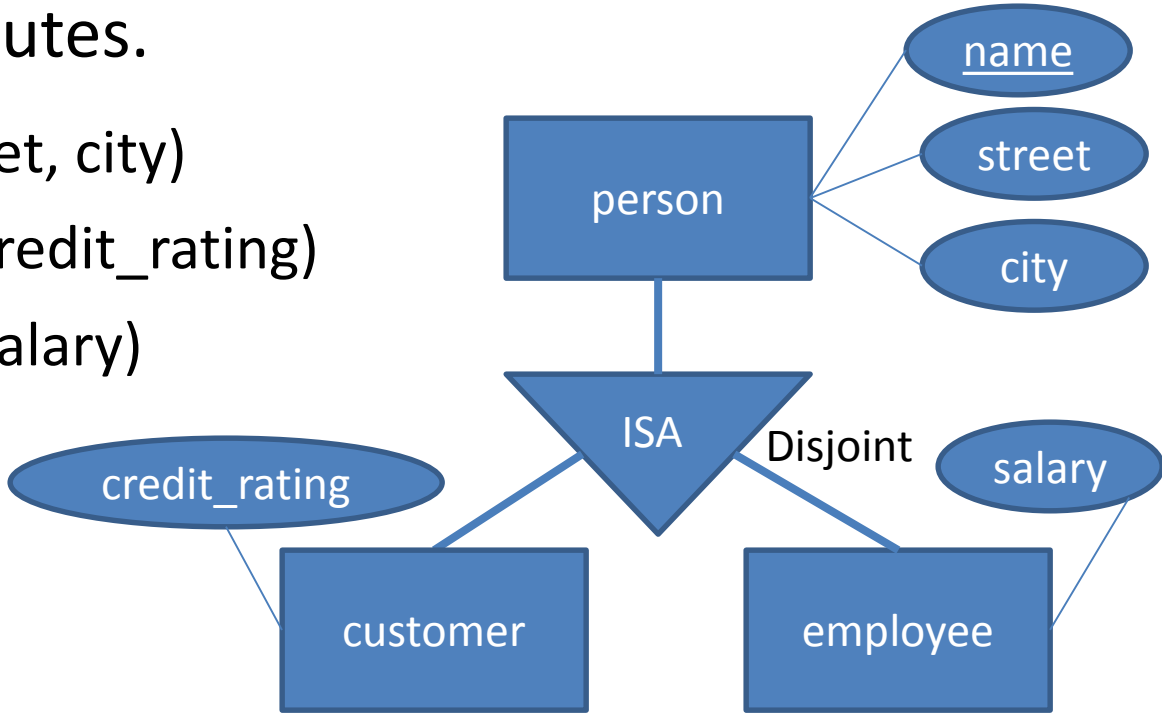
Professor(name, …)

address	professor.name	phone	…
CB312	Professor Kao	21234567	…

Office(address, **professor.name**, phone, …)

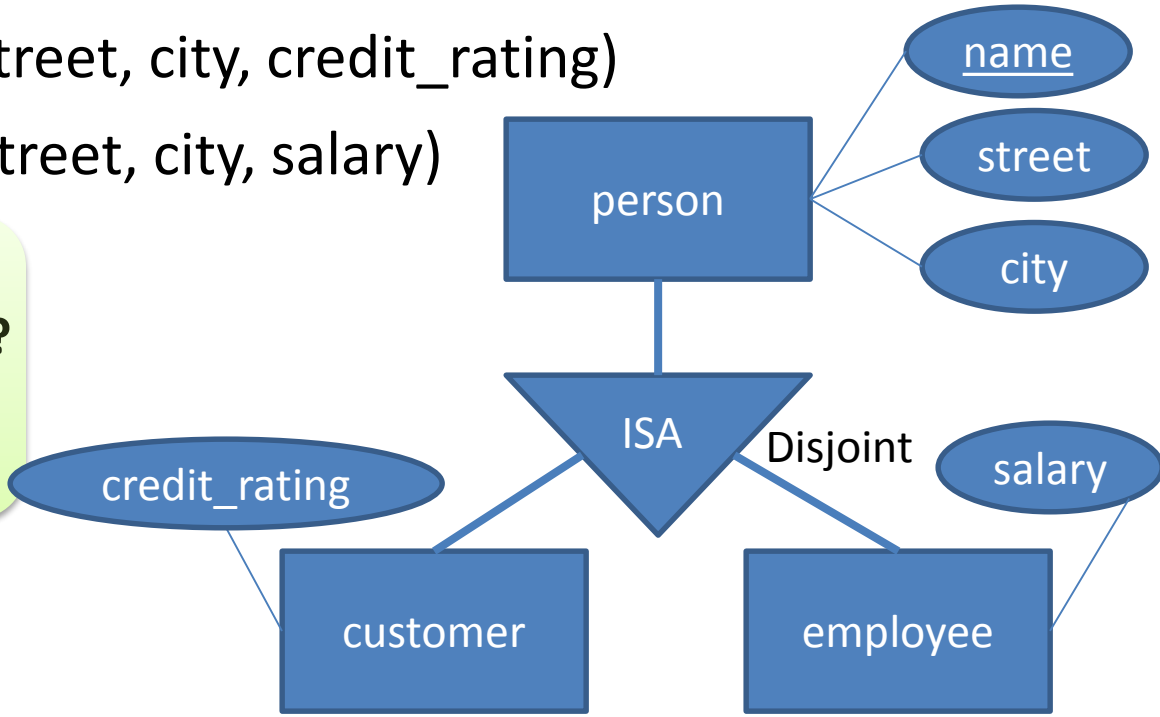
Specialization (method 1)

- Form a table for the **higher-level entity set**.
- Form a table for each **lower-level entity set**, which contains the **primary key** of the higher-level entity set and local attributes.
  - Person(name, street, city)
  - Customer(name, credit_rating)
  - Employee(name, salary)



Specialization (method 2)

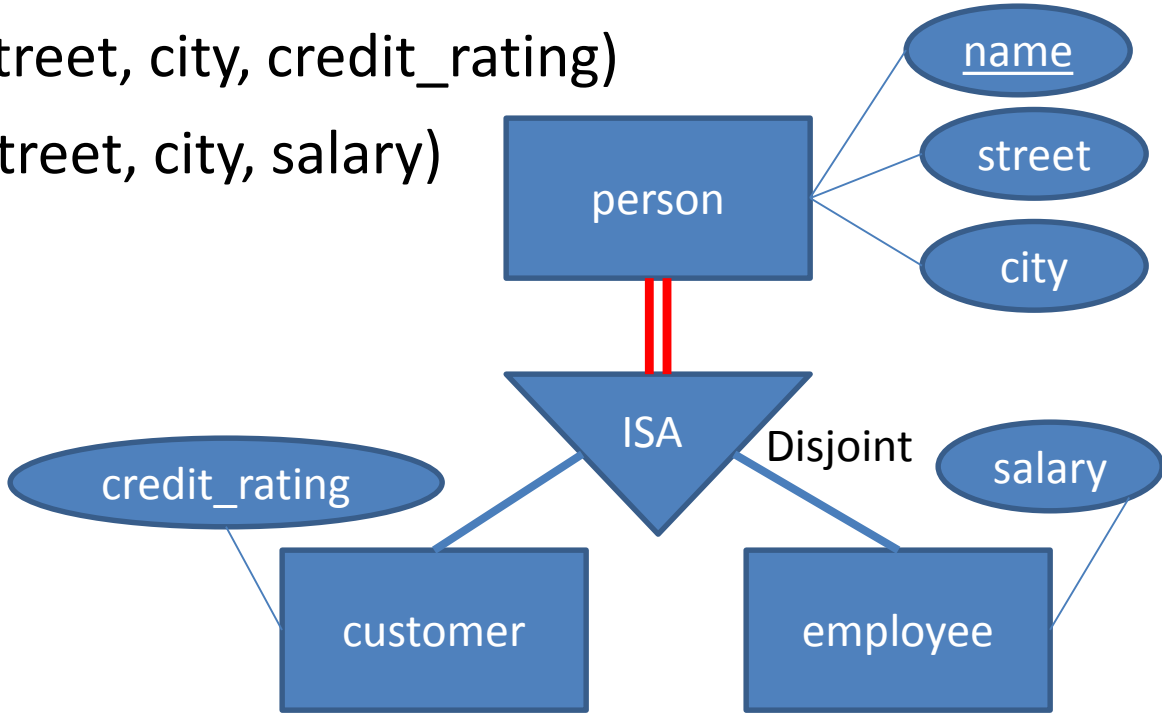
- Form a table for each entity set with all local and inherited attributes.
  - Person(name, street, city)
  - Customer(name, street, city, credit_rating)
  - Employee(name, street, city, salary)



What are the advantage and disadvantage of method 1 and 2?
1. Storage redundancy?
2. Efficiency in retrieving data?

Specialization

- **Observation:** If the specialization is **total**, the generalized entity set may not require a table!
  - ~~Person(name, street, city)~~
  - Customer(name, street, city, credit_rating)
  - Employee(name, street, city, salary)



Chapter 2B.

END

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