

# ERD Attributes

# Attributes

course: Information Modelling

WHAT IS AN...

# Attribute



*The **information about an entity** or a relationship is obtained by observation or measurement, and is expressed by a set of **attribute-value** pairs.*

Peter Pin-Shan Chen. 1976.

WHAT IS AN...

# Attribute

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The **information about an entity** or a relationship is obtained by observation or measurement, and is expressed by a set of **attribute-value** pairs.

An **attribute** can be formally defined as a **function** which maps **from an entity set** or a relationship set **into a value set**

WHAT IS AN...

# Attribute

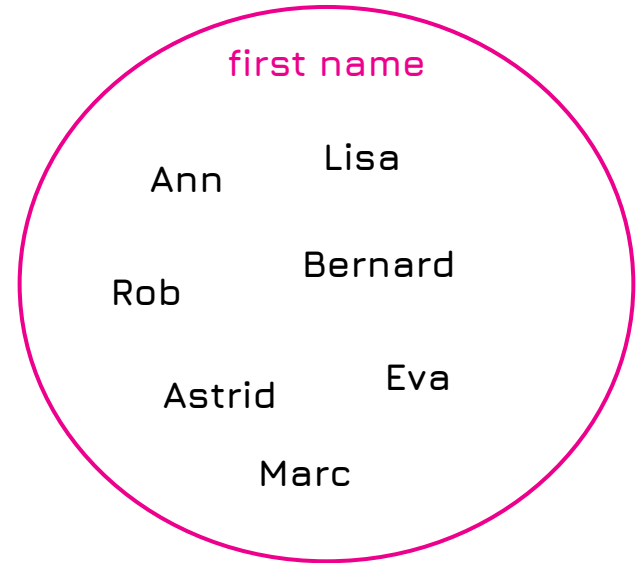
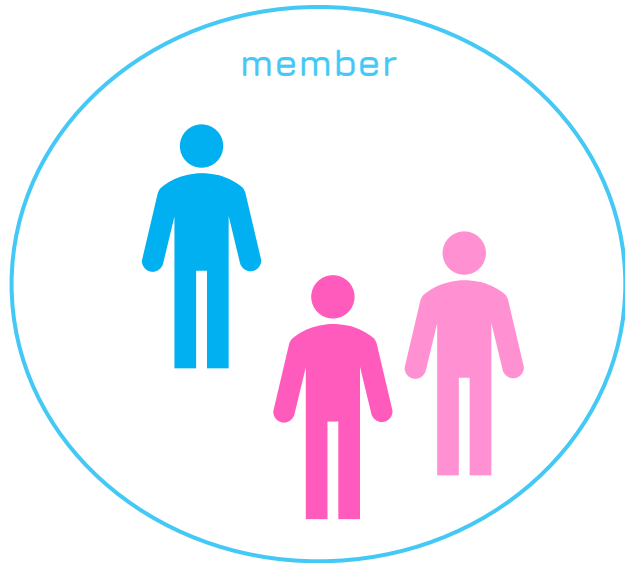


member

first name

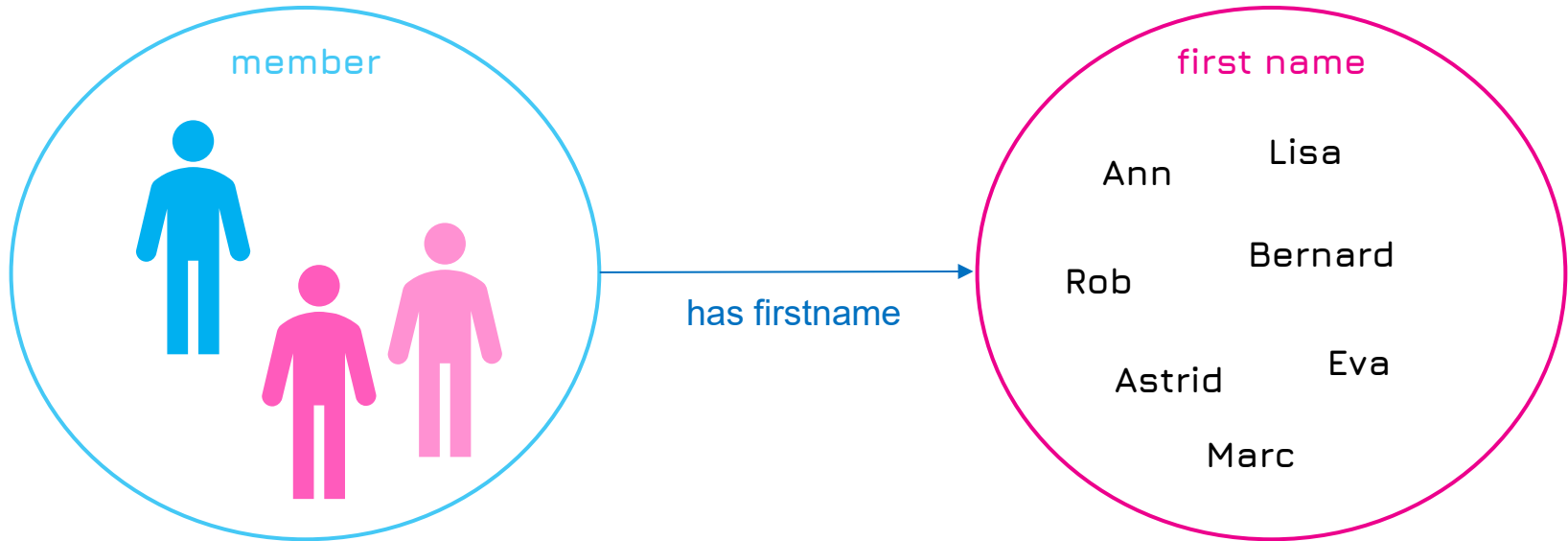
WHAT IS AN...

# Attribute



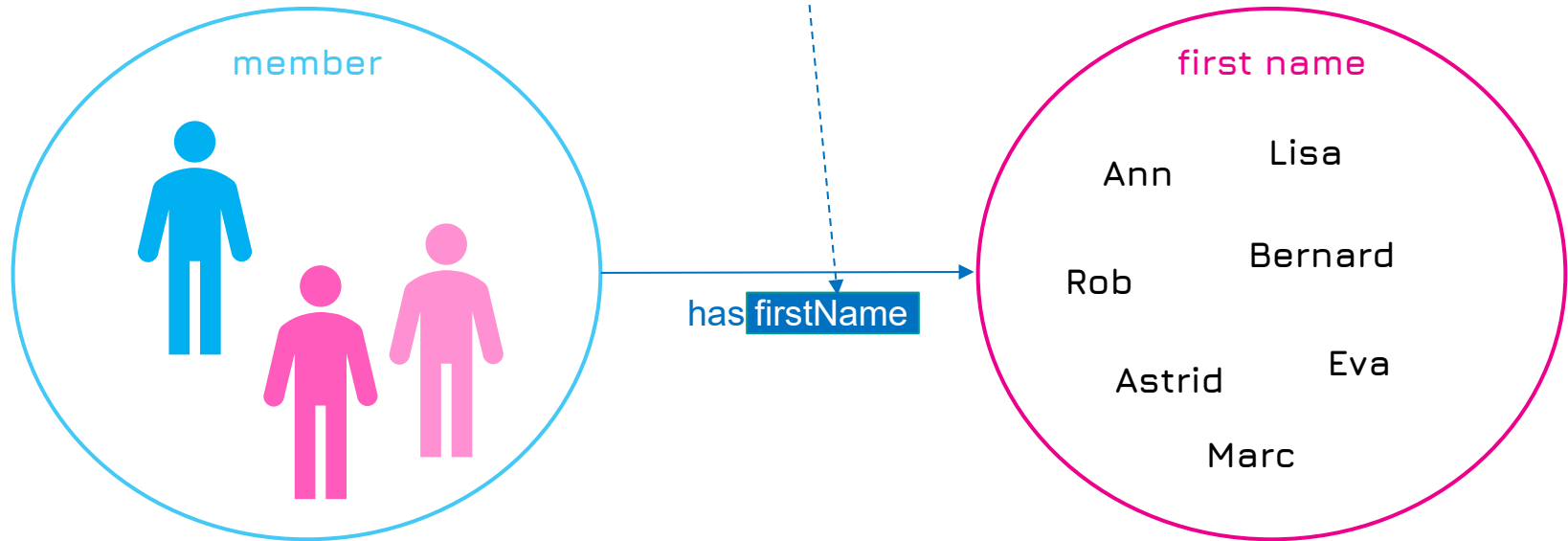
WHAT IS AN...

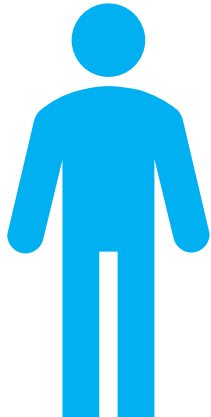
# Attribute



WHAT IS AN...

# Attribute





FINDING...

# Attributes

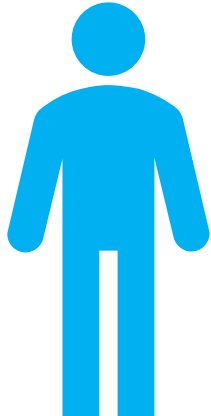
---

A specific member is an entity,  
belonging to the entity set Member.

*What are attribute-value pairs of a  
specific member?*



name: Van Voorden  
  firstname: Rob  
    age: 42  
    gender: male  
address: Vlamingstraat 5, 8000 Brugge  
  shoe size: 43  
  ...

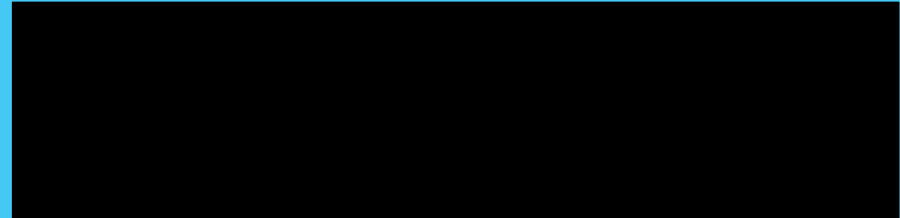


FINDING...

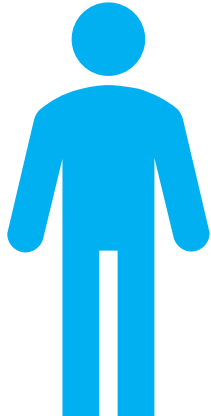
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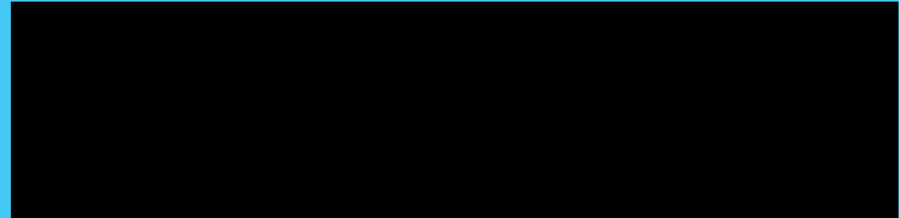
FINDING...

# Attributes

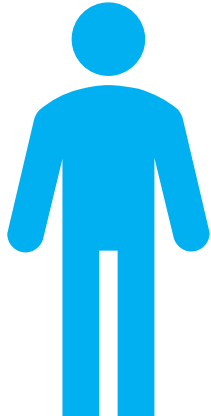
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Attributes are:

name  
firstname  
age  
gender  
address  
shoe size  
...



name: Van Voorden  
  firstname: Rob  
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    gender: male  
address: Vlamingstraat 5, 8000 Brugge  
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FINDING...

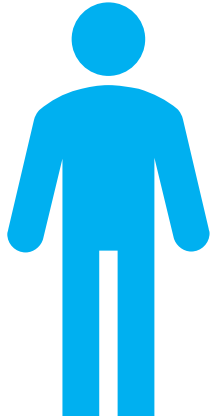
# Attributes

Attributes are:

name: Van Voorden  
firstname: Rob  
age: 42  
gender: male  
address: Vlamingstraat 5, 8000 Brugge  
shoe size: 42  
...

**Each attribute maps a specific entity  
to a certain value.**

name: Van Voorden  
  firstname: Rob  
    age: 42  
    gender: male  
address: Vlamingstraat 5, 8000 Brugge  
  shoe size: 43  
  ...



FINDING...

# Attributes

Attributes are:

name: <string>

firstname: <string>

age: <integer>

gender: <enum>

address: <string>

shoe size: <integer>

...

**Each attribute maps a specific entity  
to a certain value of a type.**

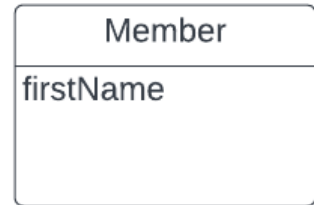
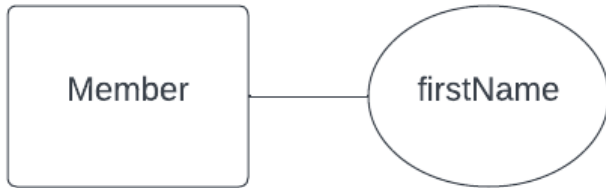
# Attribute Properties

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- Each attribute has a type
- Each attribute has a value. The number of values can be an infinite, a range, or a specific set of values
- A entity can have values for all the defined attributes, or only for a subset of attributes

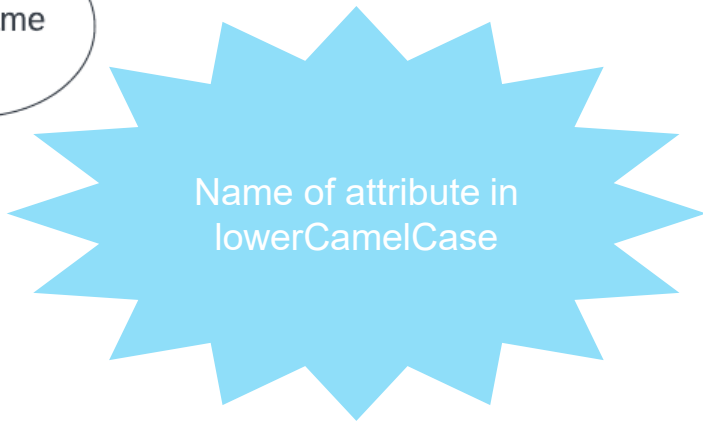
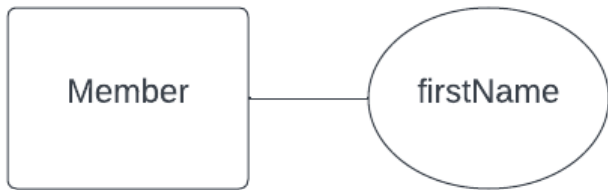
HOW TO DRAW AN...

# ATTRIBUTE

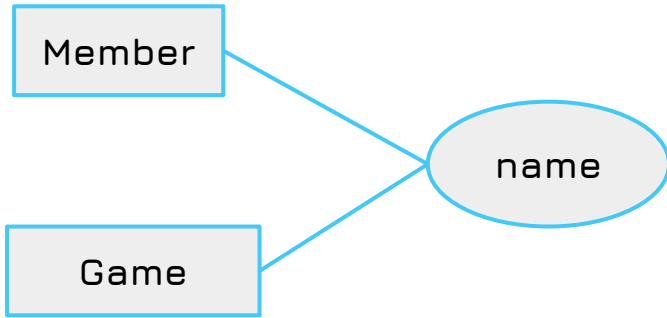


HOW TO DRAW AN...

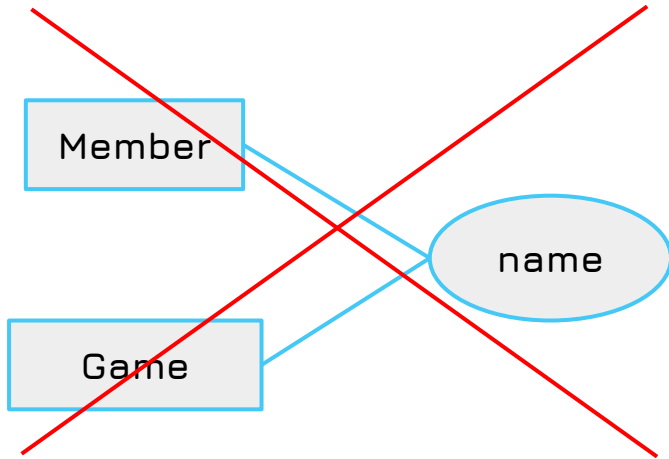
# ATTRIBUTE



Member
firstName

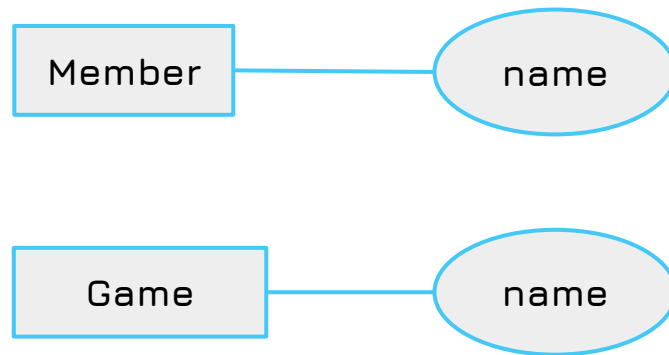
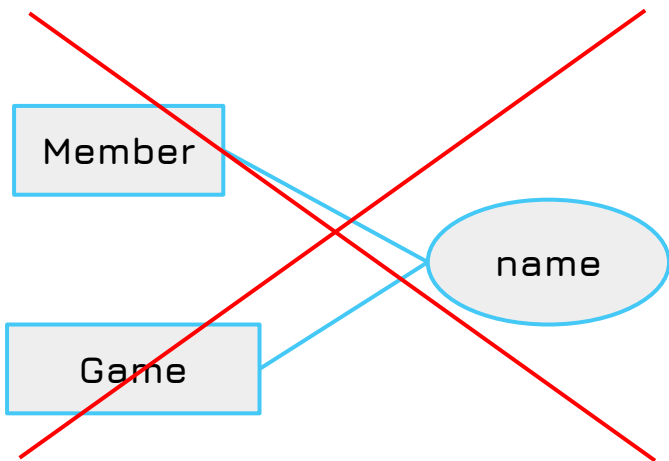


Each attribute can be connected to only 1 entity  
(Chen notation)



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'name' of a member is conceptually different from 'name' of a game,  
although the property name 'name' is the same



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TYPES OF

# Attributes

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- optional attributes
- derived attributes
- multivalued attributes
- composite attributes
- key attributes

# Optional attributes

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WHAT IS AN...

# Optional Attribute

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An **optional attribute** is an attribute that **may not have a value**. It means that **there is no value** or you **don't know the value**.

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An optional attribute is also called **nullable**.

WHAT IS AN...

# Optional Attribute

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An **optional attribute** is an attribute that **may not have a value** in the **UoD**. It means that **there is no value** or you **don't know the value**.

An optional attribute is also called **nullable**.

The opposite of an optional attribute is a required attribute.  
In most cases, attributes are implicitly required.

FINDING...

# Optional Attributes

A member has some attributes, such as

first name

middle name

last name

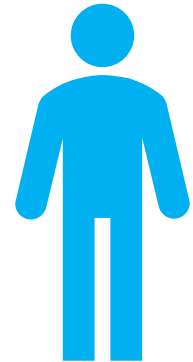
age

birthday

length

weight

shoe size



FINDING...

# Optional Attributes

A member has some attributes, such as

first name

middle name

last name

age

birthday

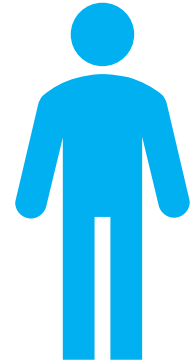
length

weight

shoe size

**some members don't have  
a middle name**

**It's optional to have the  
value for each member in  
this UoD**



# Derived attributes

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TYPES OF

# Attributes

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WHAT IS A...

# Derived Attribute



A **derived attribute** is an attribute where the values can be derived (calculated) from the values of other attributes.

WHAT IS A...

# Derived Attribute

---

A **derived attribute** is an attribute where the values can be derived, obtained or calculated from the values of other attributes.

It can be derived from multiple other attributes, even from attributes of other, related, entities.

FINDING...

# Derived Attributes

A member has some attributes, such as

first name

middle name

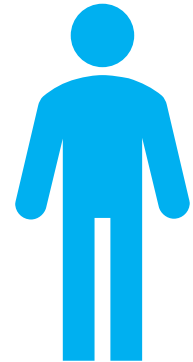
last name

age

birthday

length

weight



FINDING...

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A **member** has some attributes, such as

first name

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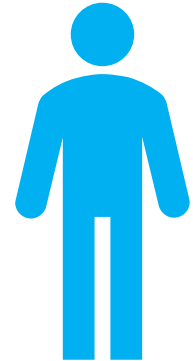
age

birthday

length

weight

age can be calculated if  
you know the birthday



FINDING...

# Derived Attributes

An **invoice** has some attributes, such as

subject

invoice date

due date

account name

list of items

terms and conditions

total amount

...



FINDING...

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An **invoice** has some attributes, such as

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account name

list of items →

terms and conditions

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attributes of an invoice item:

product

quantity

unit price

total item price



FINDING...

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$\Sigma$



FINDING...

## Derived Attributes

An **car** has some attributes, such as

doors: 4

engine type: electrical

airco: no

color: blue

hex-color: 2F8AA8

...



FINDING...

## Derived Attributes

An **car** has some attributes, such as

doors: 4

engine type: electrical

airco: no

color: blue

hex-color: 2F8AA8

...

color can be determined/is  
a function of hex-color



# Multivalued attributes

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TYPES OF

# Attributes

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WHAT IS A...

# Multivalued Attribute

A **multivalued attribute** is an attribute that can hold multiple values.

FINDING...

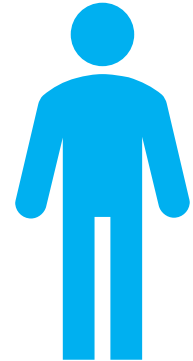
# Multivalued Attribute

A **member** has some attributes, such as

...

telephone number

...



FINDING...

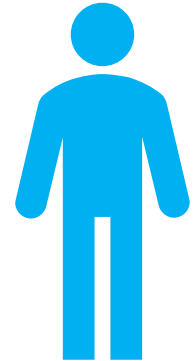
# Multivalued Attribute

A **member** has some attributes, such as

...

telephone number: 050 38 12 77, 0499 01 02 03

...



IT MAY BE OK FOR A SIMPLE ATTRIBUTES

# Multivalued Attribute

A **member** has some attributes, such as

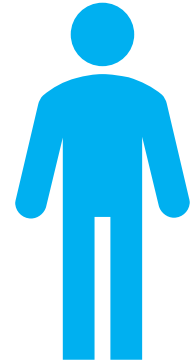
...

telephone number



**telephone number can  
have multiple values for  
one entity**

...



BUT IN MOST OF THE CASES IT'S NOT

# Multivalued Attribute

An **invoice** has some attributes, such as

subject

invoice date

due date

account name

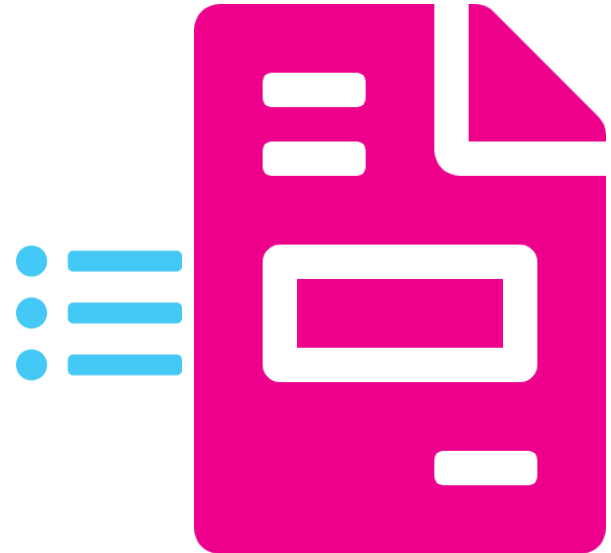
list of items

terms and conditions

total amount

...

an invoice can have  
multiple values for an  
invoice item



SPLIT MULTIVALUED ATTRIBUTE AS SEPERATE ENTITY TYPE

# Multivalued Attributes

An **invoice** has some attributes, such as  
subject

invoice date

due date

account name

terms and conditions

total amount

...



An **invoice item** belongs to an **invoice** and has attributes:

product

quantity

unit price

total item price



# Multivalued Attributes vs normalisation

---

## Multivalued attribute

An attribute can hold

*multiple values*

## 1st Normal Form

Each attribute should contain

*atomic values*



Will be  
covered  
later

If you run across a multivalued attribute, this is a major hint that you need an extra entity type

but you may use multivalued attributes sparsely

SPLIT MULTIVALUED ATTRIBUTE AS SEPERATE ENTITY TYPE

## Multivalued Attributes



We will cover this later and will see how entity types can be mutually related.

# Composite attributes

course: Information Modelling

TYPES OF

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WHAT IS A...

# Composite Attribute

A **composite attribute** is an attribute where the values of that attribute can be further subdivided into meaningful sub-parts.

WHAT IS A...

# Composite Attribute

A **composite attribute** is an attribute where the values of that attribute can be further subdivided into meaningful sub-parts.

A **composite attribute** is an attribute composed of multiple other attributes.

FINDING...

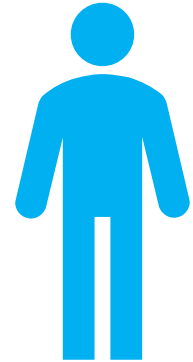
# Composite Attributes

A **member** has some attributes, such as

...

address

...



FINDING...

# Composite Attributes

A **member** has some attributes, such as

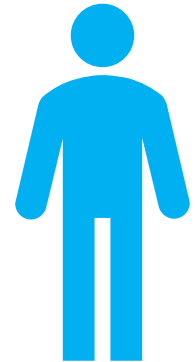
...

address



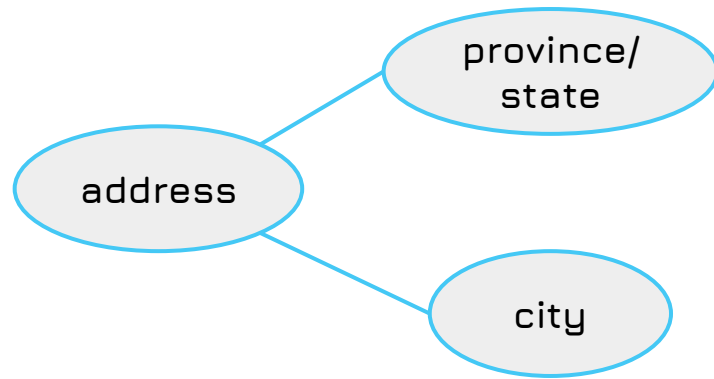
**an address is composed of**  
street, number, postal code, city,  
province, state, country,...

...

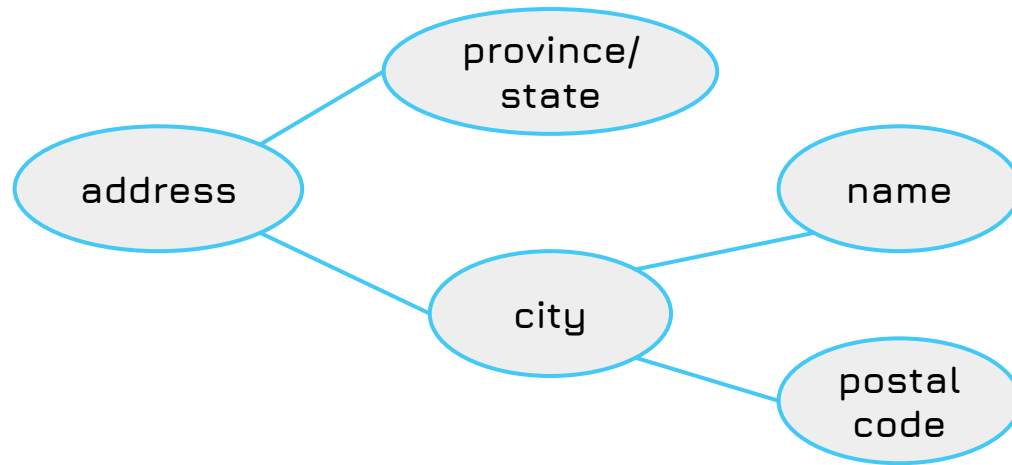




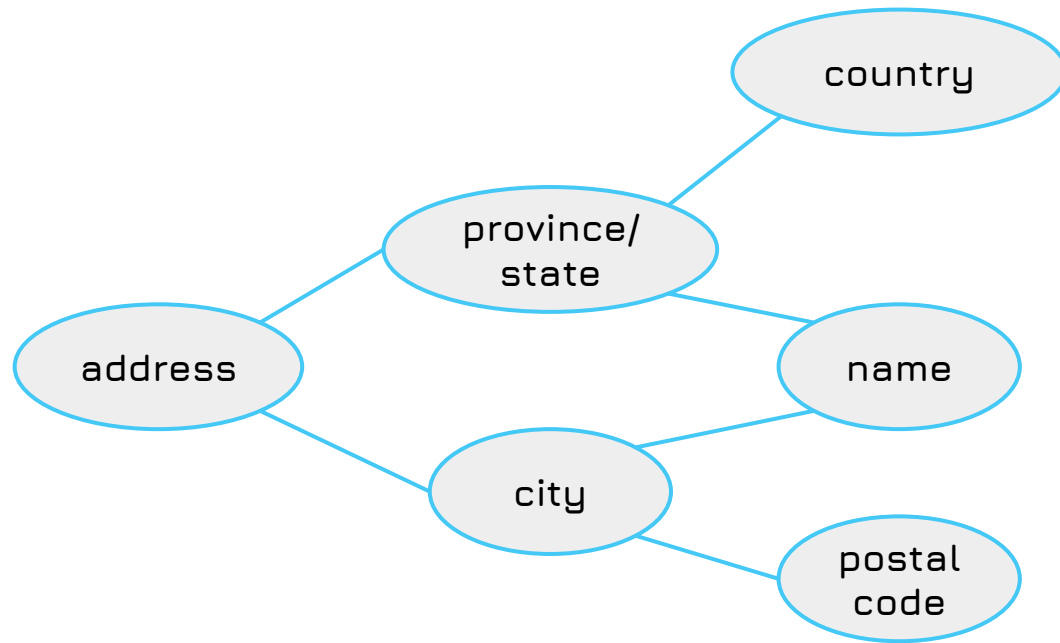
Every attribute must be connected to another attribute or the root entity by exactly 1 path  
(Chen notation)



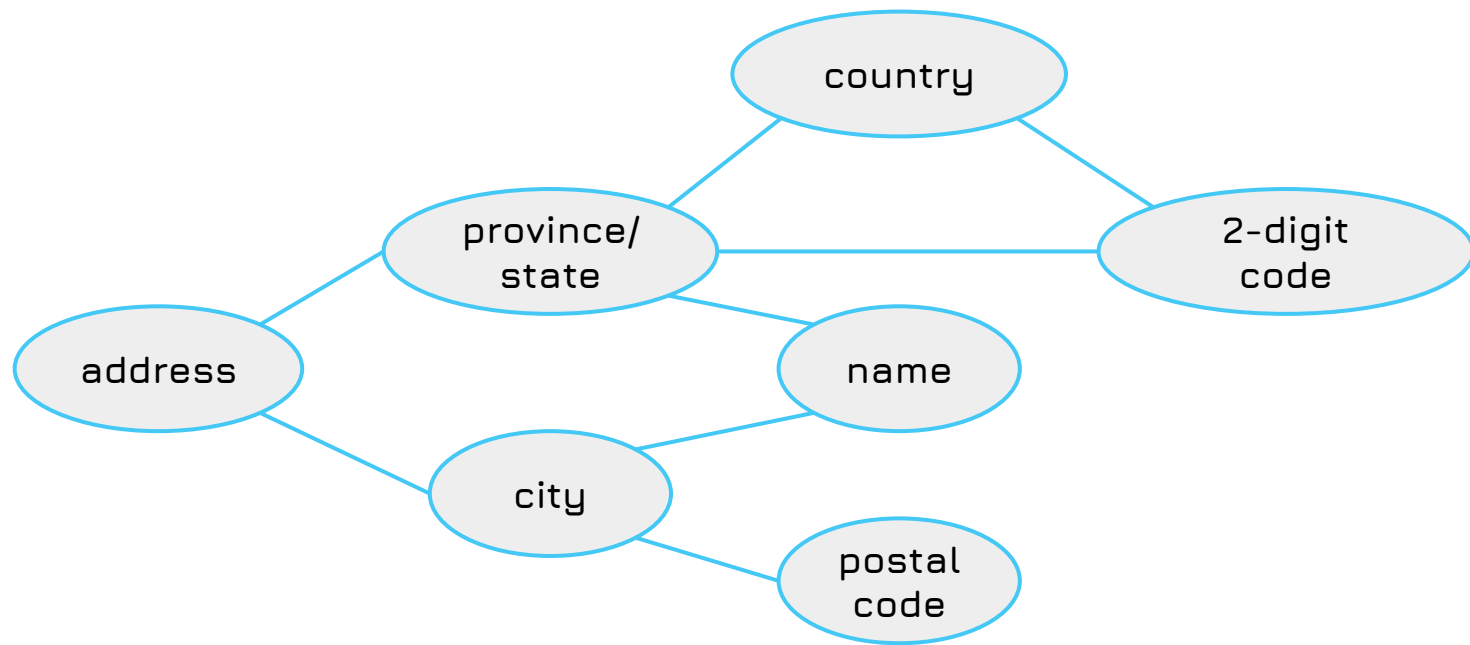
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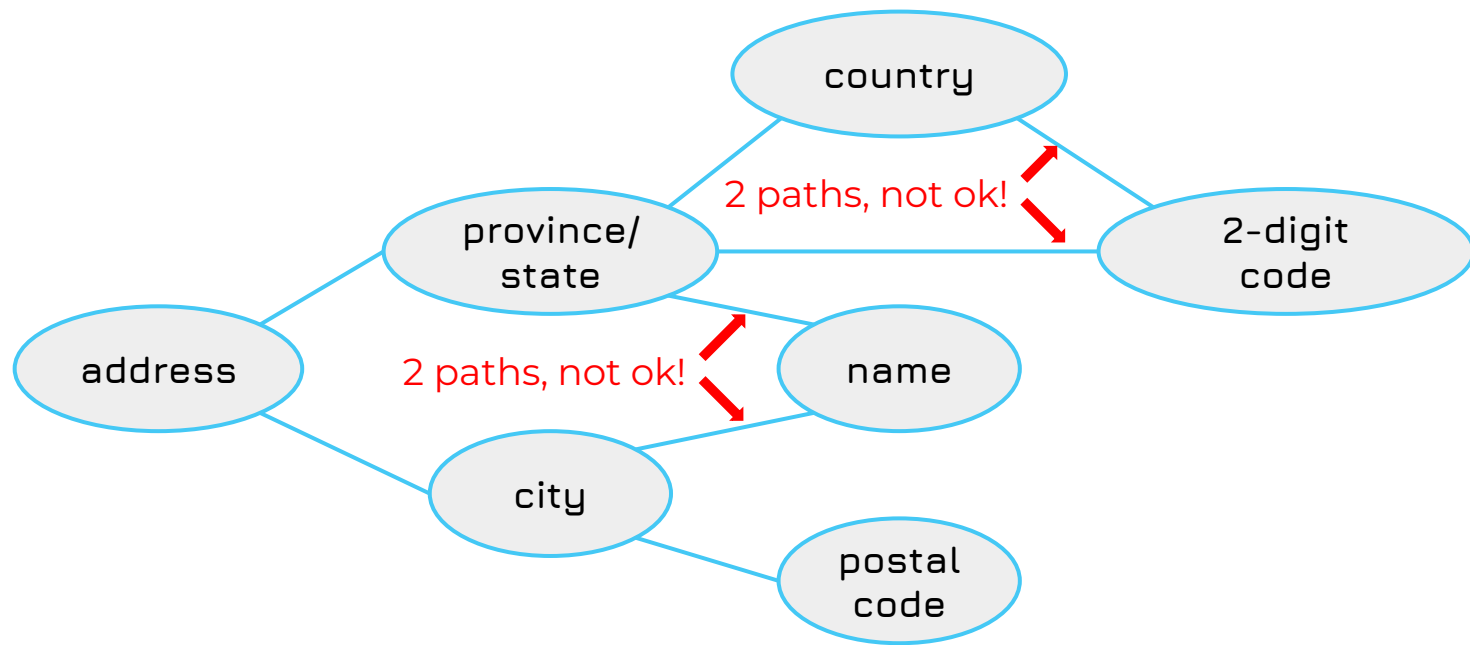
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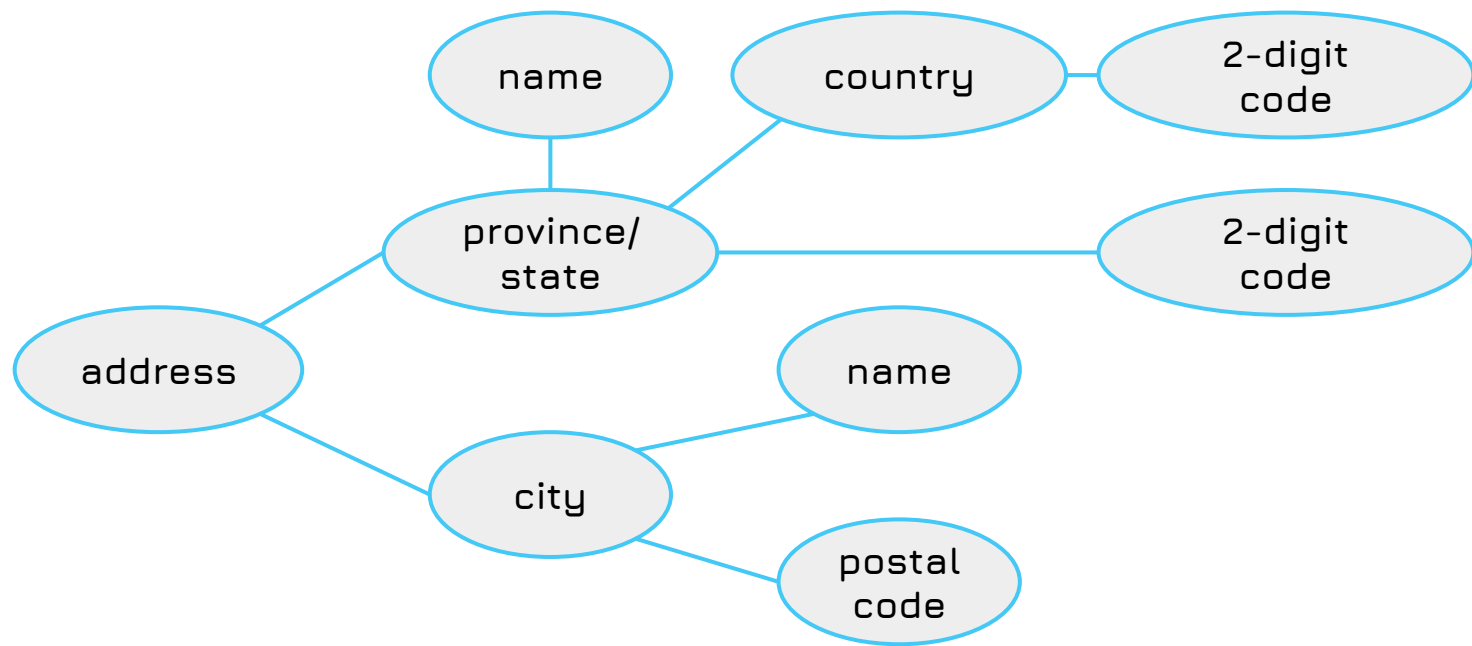
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# Composite Attributes vs normalisation

---

## Composite attribute

An attribute can hold a

**composition of values**

and each part has a meaning

## 1st Normal Form

Each attribute should contain

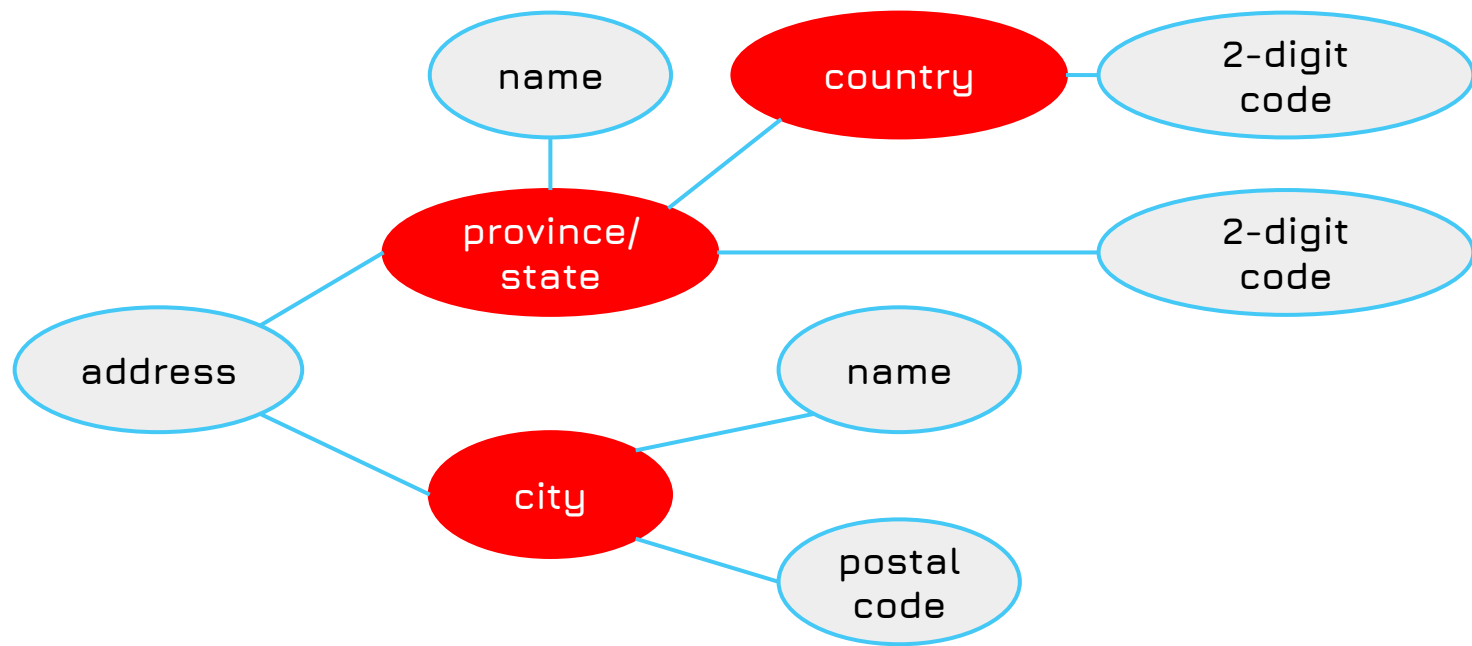
**atomic values**



Will be  
covered  
later

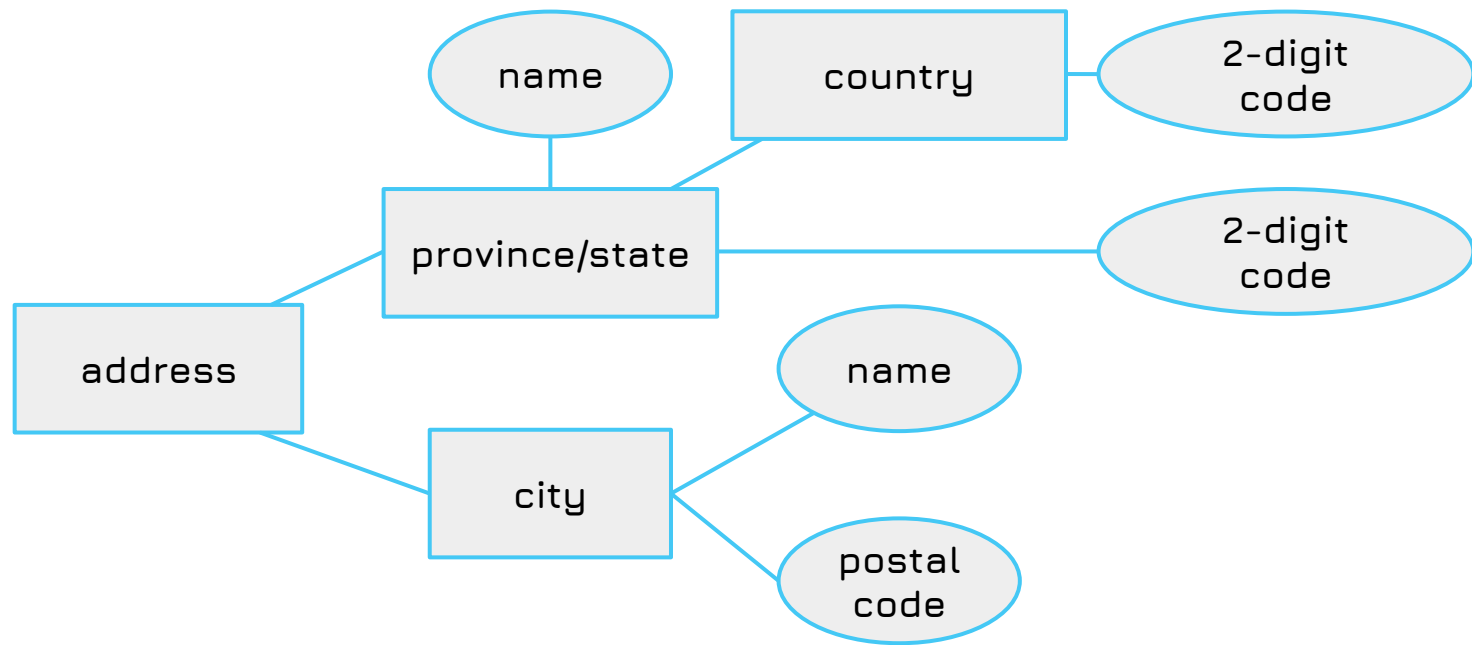
If you run across a composite attribute, this is a major hint  
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- key attributes

**we will discuss key attributes when we talk about uniqueness and identity**

## CROW'S FOOT SYNTAX

# Attributes

- optional attributes **attribute°**
- derived attributes **[attribute]**
- multivalued attributes **{attribute}**
- composite attributes **[attribute<sub>1</sub>, attribute<sub>2</sub>,...]**
- key attributes **\*attribute**

ERD attributes