

# 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

---

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

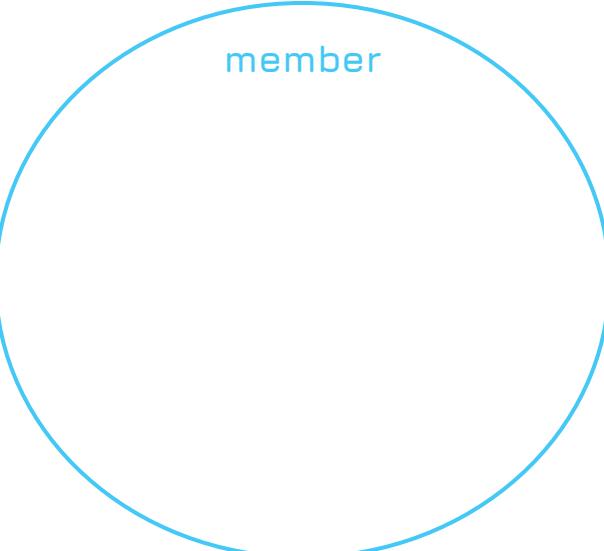
An **attribute** can be formally defined as a **function** which maps **from an entity set** or a relationship set **into a value set**

Peter Pin-Shan Chen. 1976.

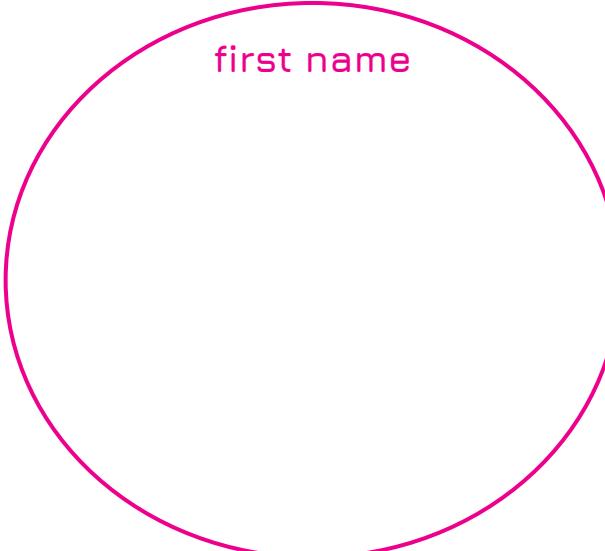
WHAT IS AN...

# Attribute

---



member

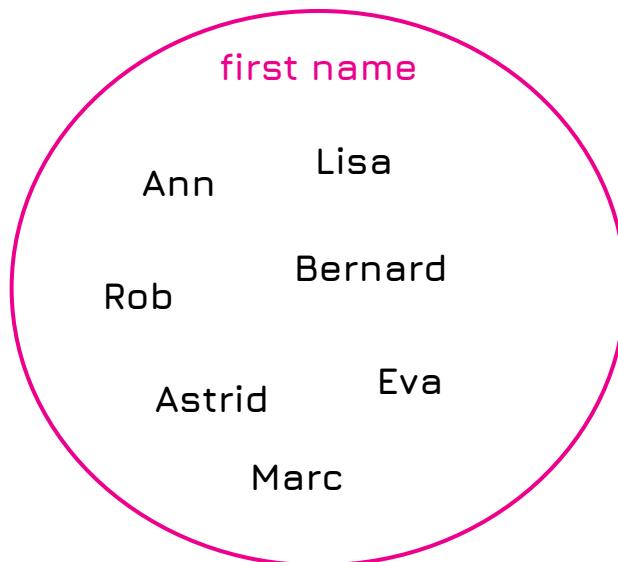
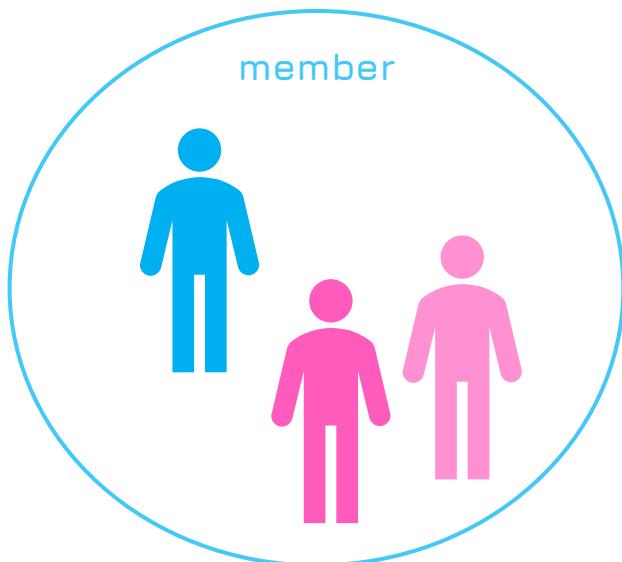


first name

WHAT IS AN...

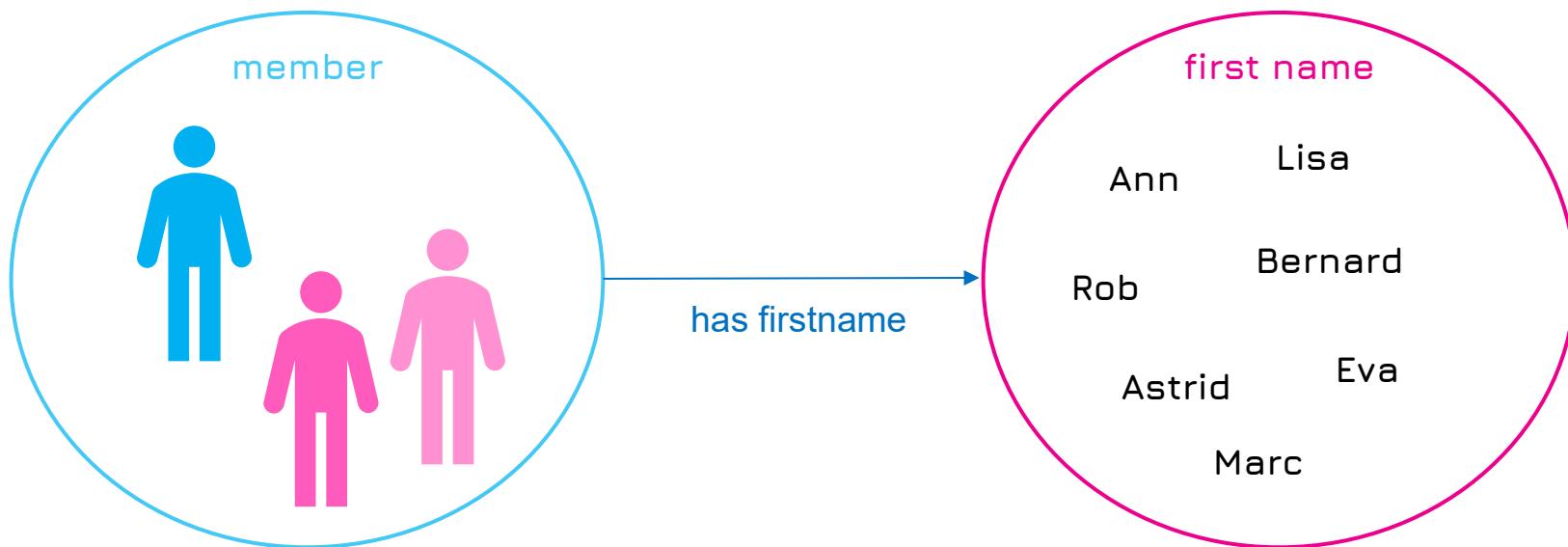
# Attribute

---



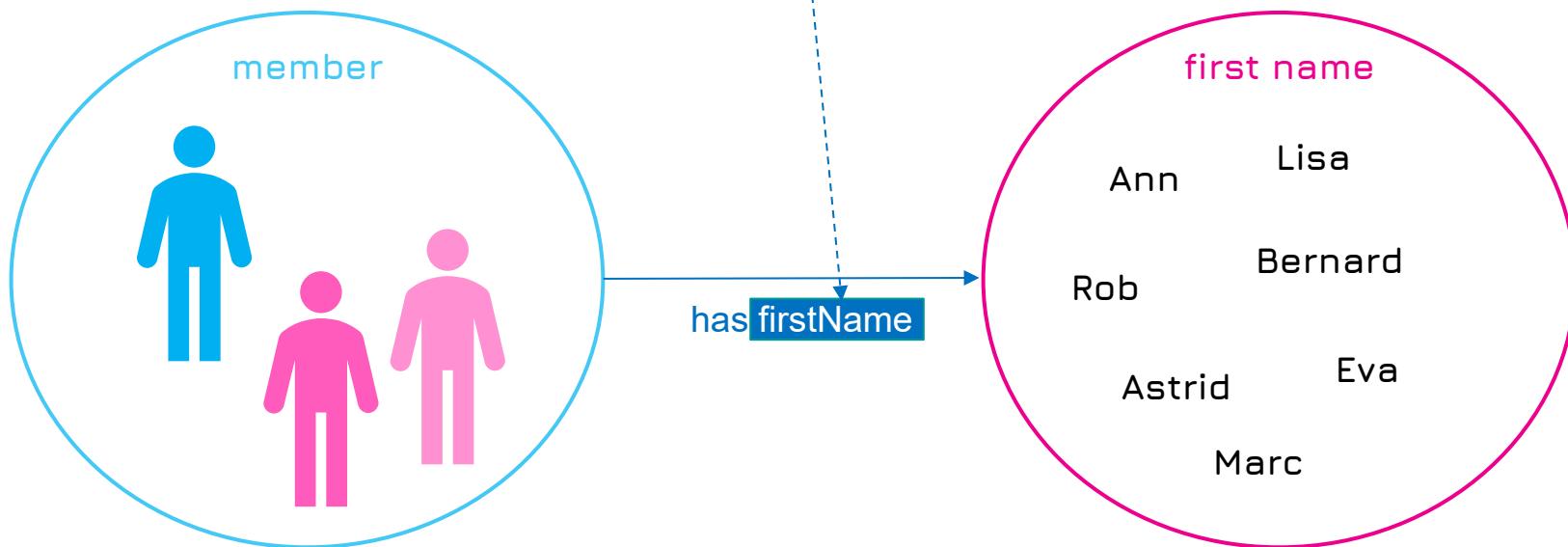
WHAT IS AN...

# Attribute

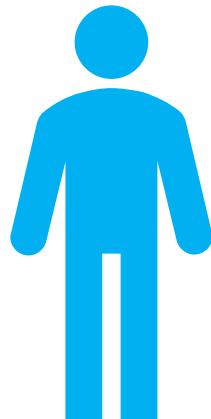


WHAT IS AN...

# Attribute



FINDING...



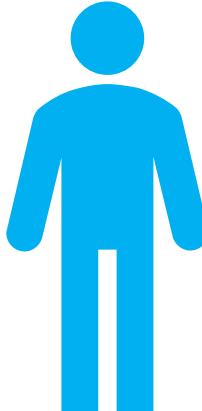
# Attributes

---

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...

# Attributes

---

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

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

FINDING...

name: Van Voorden

firstname: Rob

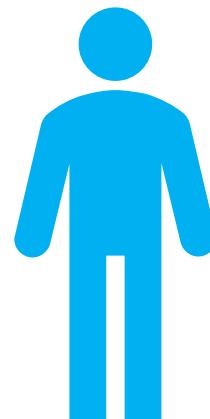
age: 42

gender: male

address: Vlamingstraat 5, 8000 Brugge

shoe size: 43

...



# Attributes

---

Attributes are:

name

firstname

age

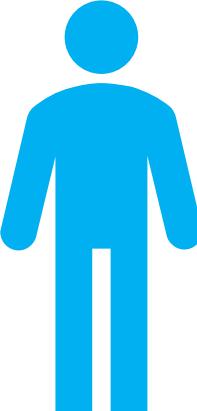
gender

address

shoe size

...





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

...

FINDING...

# Attributes

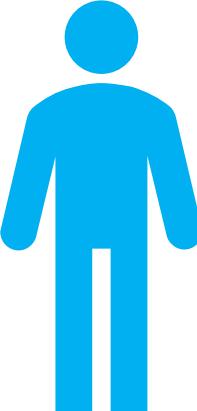
---

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.**

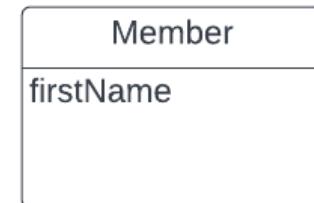
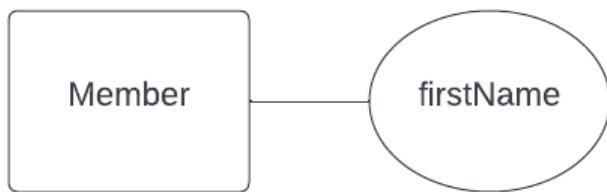
# Attribute Properties

- 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
- An entity can have values for all the defined attributes, or only for a subset of attributes

HOW TO DRAW AN...

# ATTRIBUTE

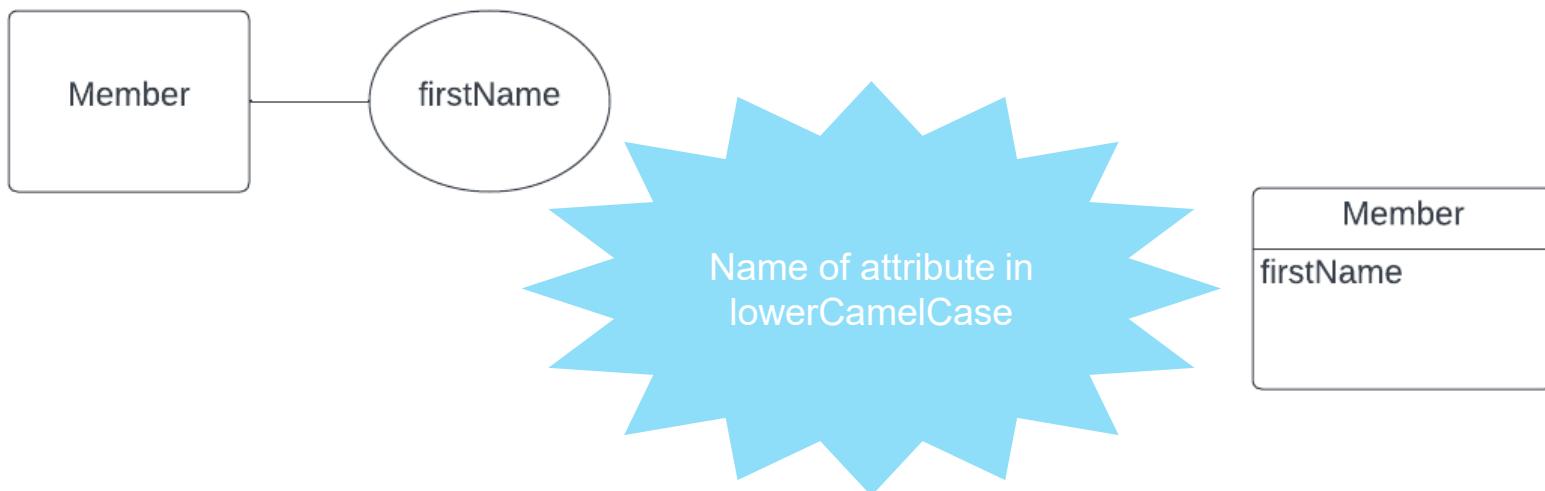
---

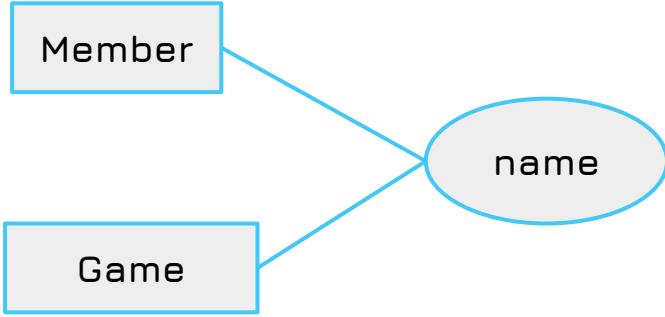


HOW TO DRAW AN...

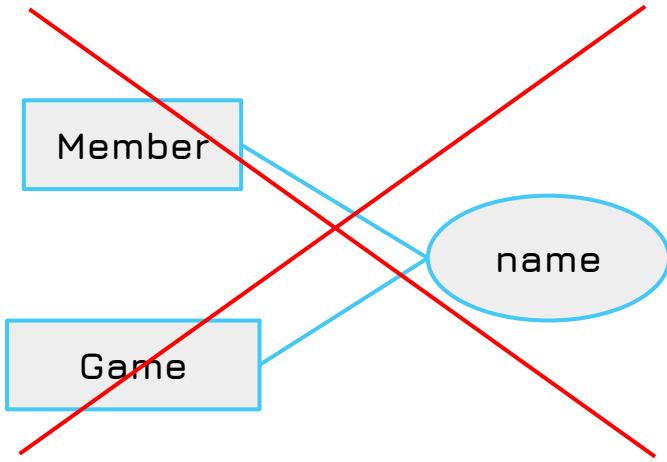
# ATTRIBUTE

---



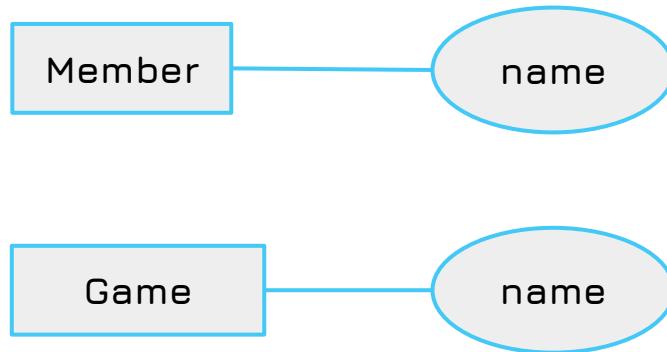
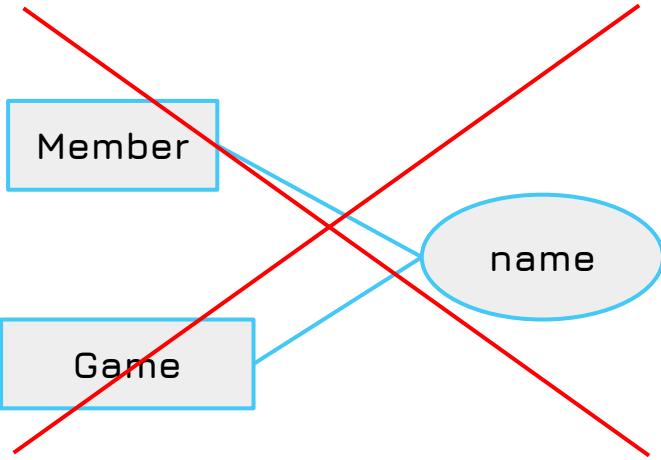


Each attribute can be connected to only 1 entity  
(Chen notation)



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

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



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

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

TYPES OF

# Attributes

---

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

# Optional attributes

course: Information Modelling

TYPES OF

# Attributes

---

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

WHAT IS AN...

# Optional Attribute

---

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**.

WHAT IS AN...

# Optional Attribute

---

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**.

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

WHAT IS AN...

# Optional Attribute

---

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

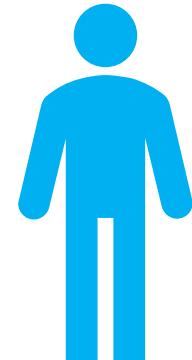
length

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

course: Information Modelling

TYPES OF

# Attributes

---

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

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

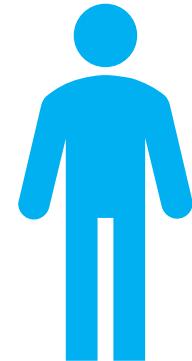
last name

age

birthday

length

weight



FINDING...

# Derived Attributes

---

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

first name

middle name

last name

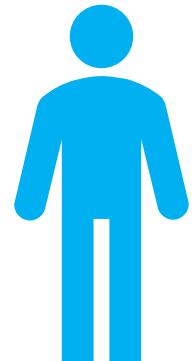
age

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

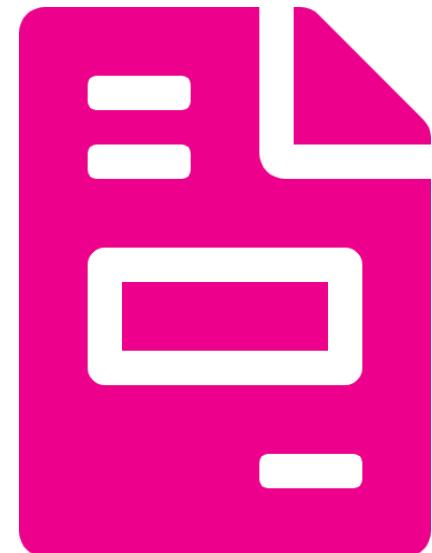
account name

list of items

terms and conditions

total amount

...



FINDING...

# Derived Attributes

---

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

subject

invoice date

due date

account name

list of items

terms and conditions

total amount

...

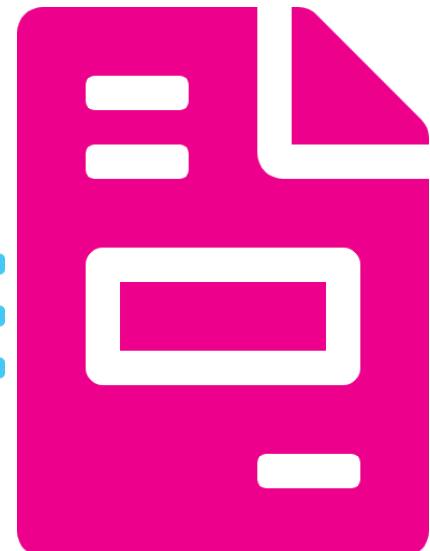
attributes of an **invoice item**:

product

quantity

unit price

total item price



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

...

attributes of an **invoice item**:

product

quantity

unit price

total item price



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

...

attributes of an **invoice item**:

product

quantity

unit price

total item price



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**

attributes of an **invoice item**:

product

quantity

unit price

**total item price**

...



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**

attributes of an **invoice item**:

product

quantity

unit price

**total item price**



...

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

`hex-color: 2F8AA8`

...



# Multivalued attributes

course: Information Modelling

TYPES OF

# Attributes

---

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

WHAT IS A...

# Multivalued Attribute

---

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

FINDING...

# Multivalued Attribute

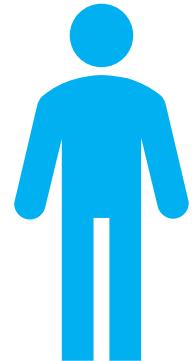
---

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

...

telephone number

...



FINDING...

# Multivalued Attribute

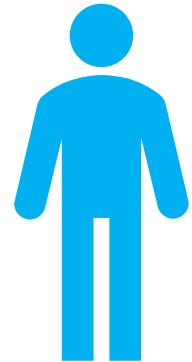
---

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

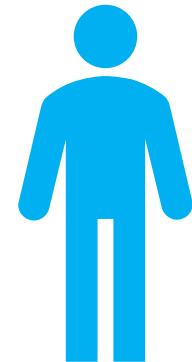
...

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

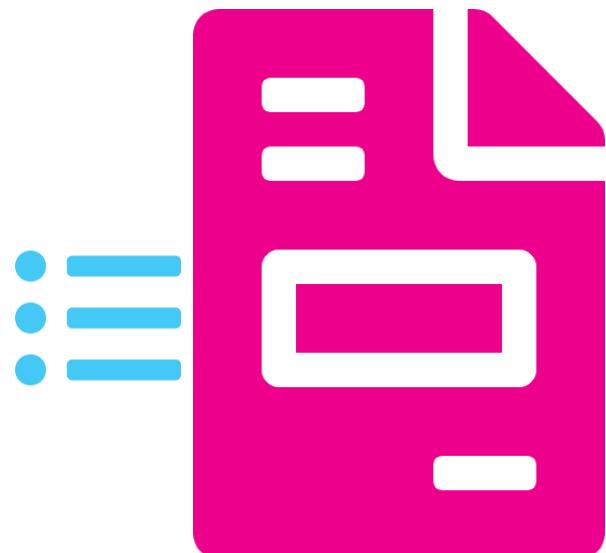
list of items



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*



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 we see how entity types can be mutually related.

# Composite attributes

course: Information Modelling

TYPES OF

# Attributes

---

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

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

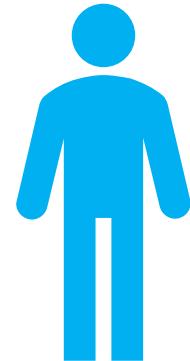
---

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

...

address

...



FINDING...

# Composite Attributes

---

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

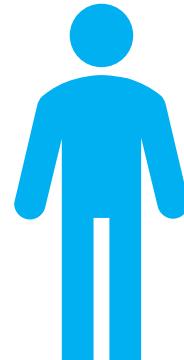
...

address



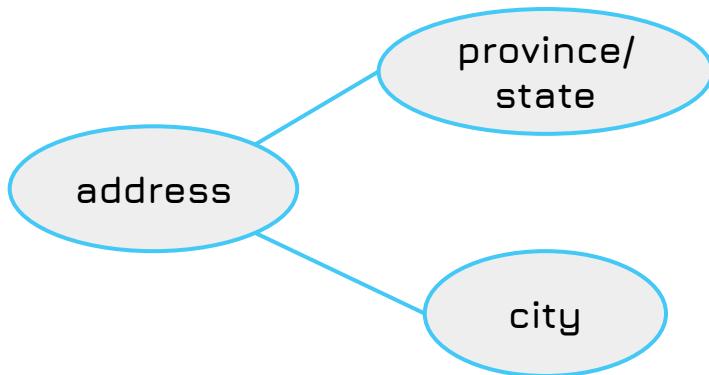
**an address is composed of**  
street, number, postal code, city,  
province, state, country,...

...

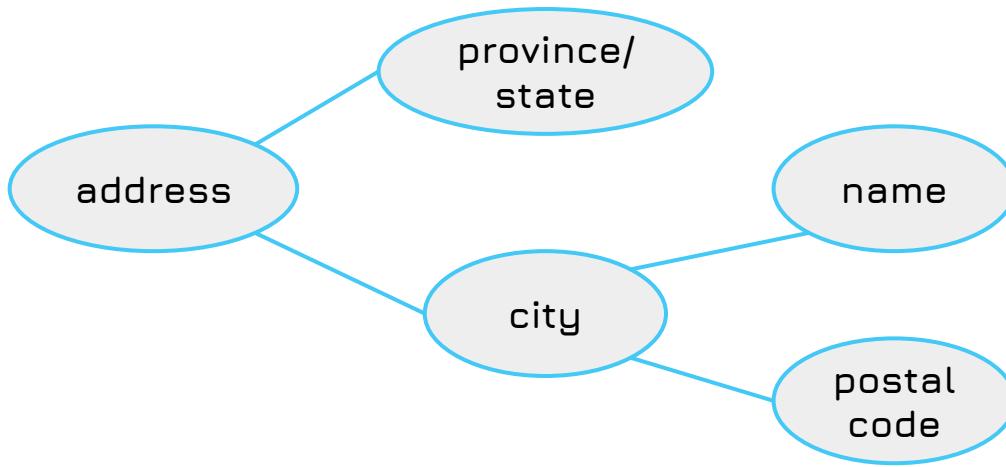




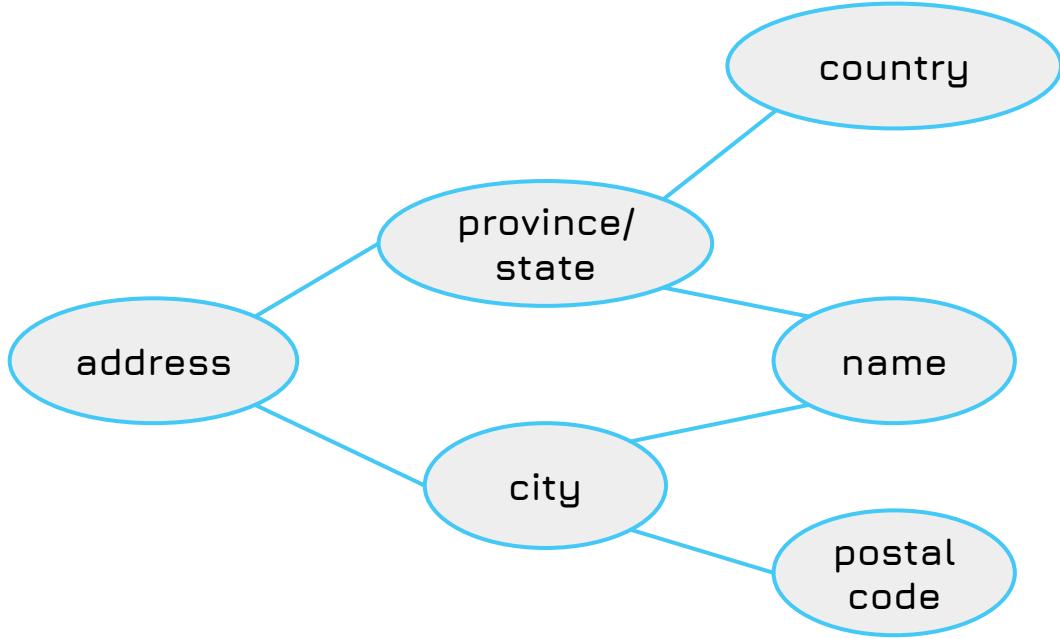
Every attribute must be connected to another attribute or the root entity by exactly 1 path  
(Chen notation)



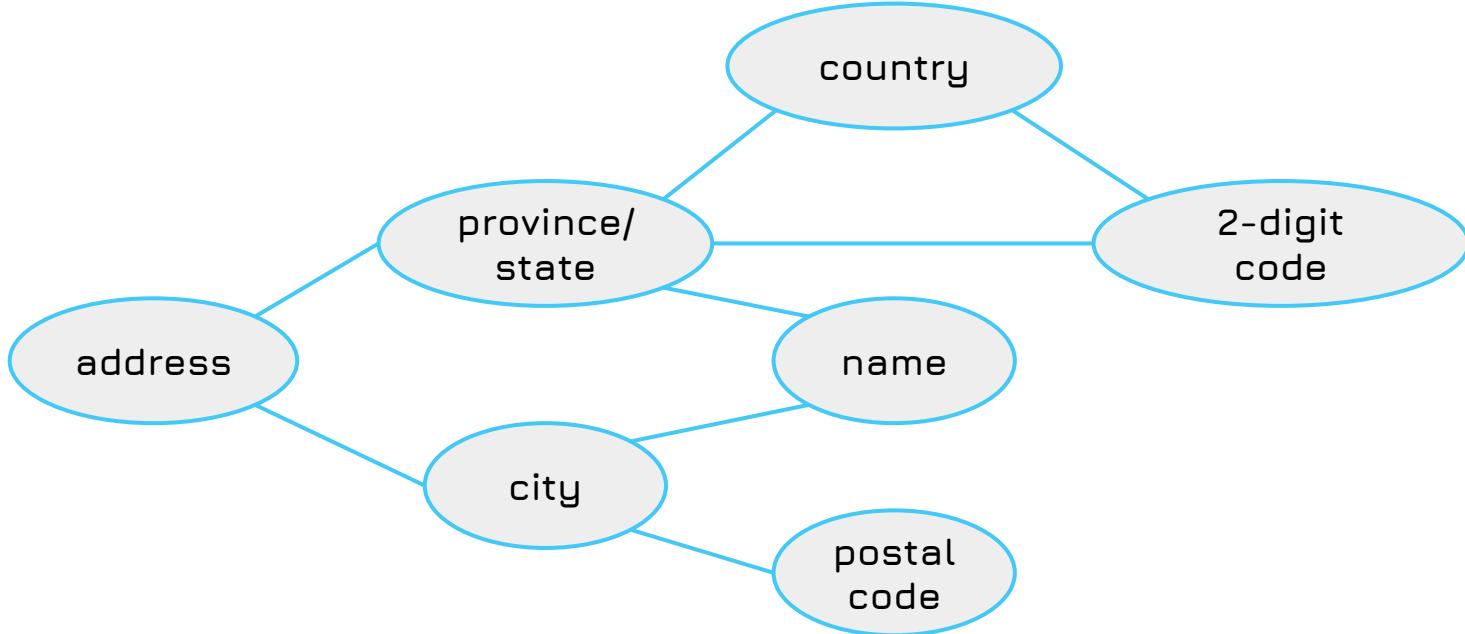
Every attribute must be connected to another attribute or the root entity by exactly 1 path  
(Chen notation)



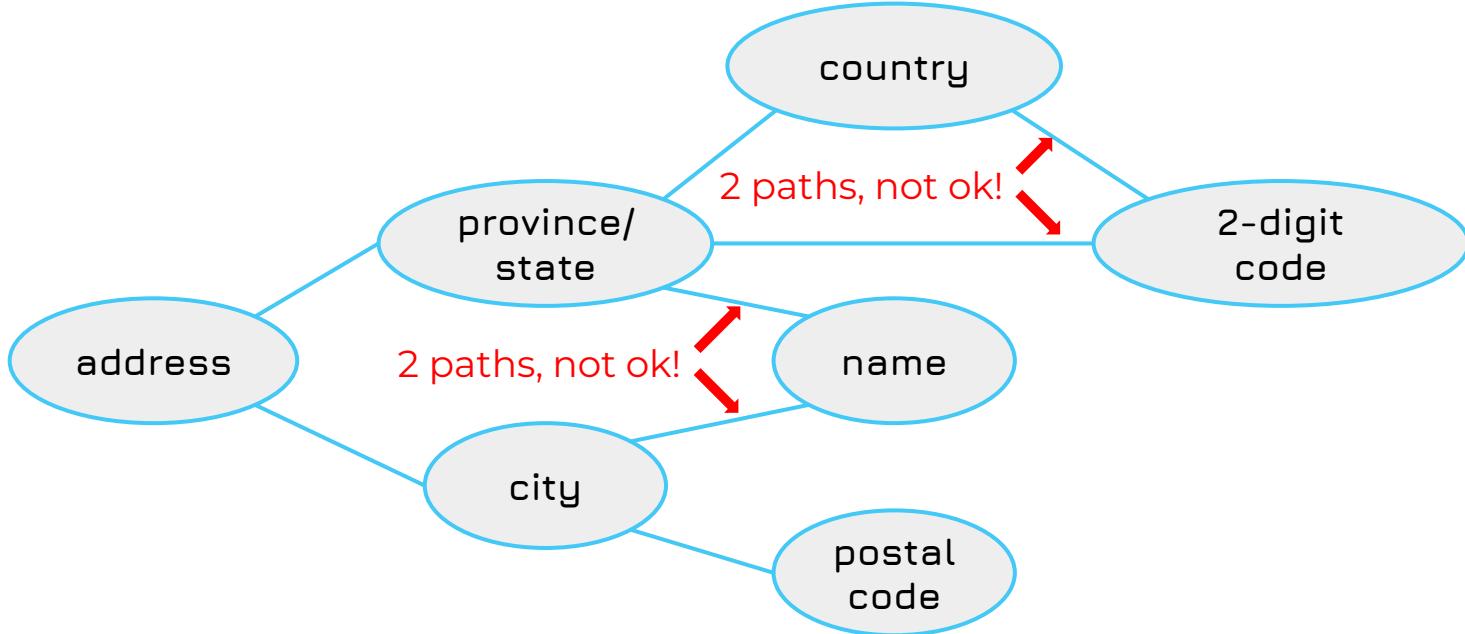
Every attribute must be connected to another attribute or the root entity by exactly 1 path  
(Chen notation)



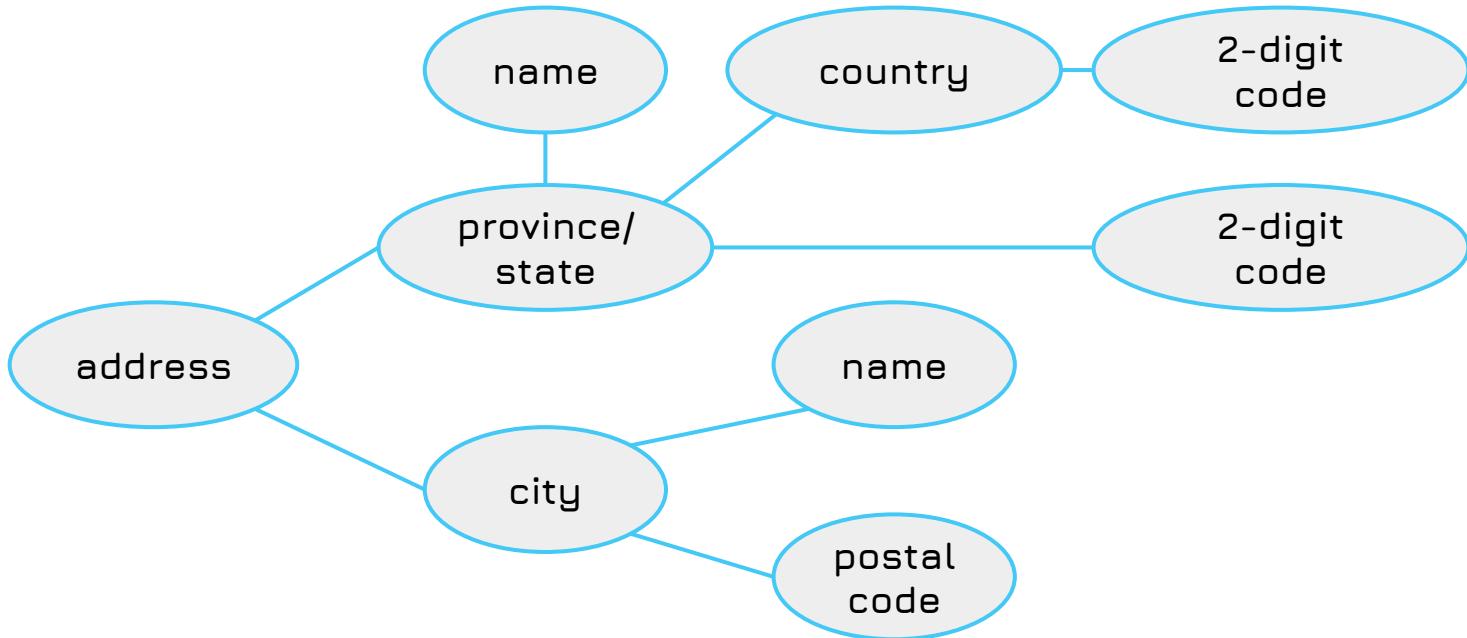
Every attribute must be connected to another attribute or the root entity by exactly 1 path  
(Chen notation)



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



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



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

# Composite Attributes vs normalisation

---

## Composite attribute

An attribute can hold a  
***composition of values***

and each part has a meaning

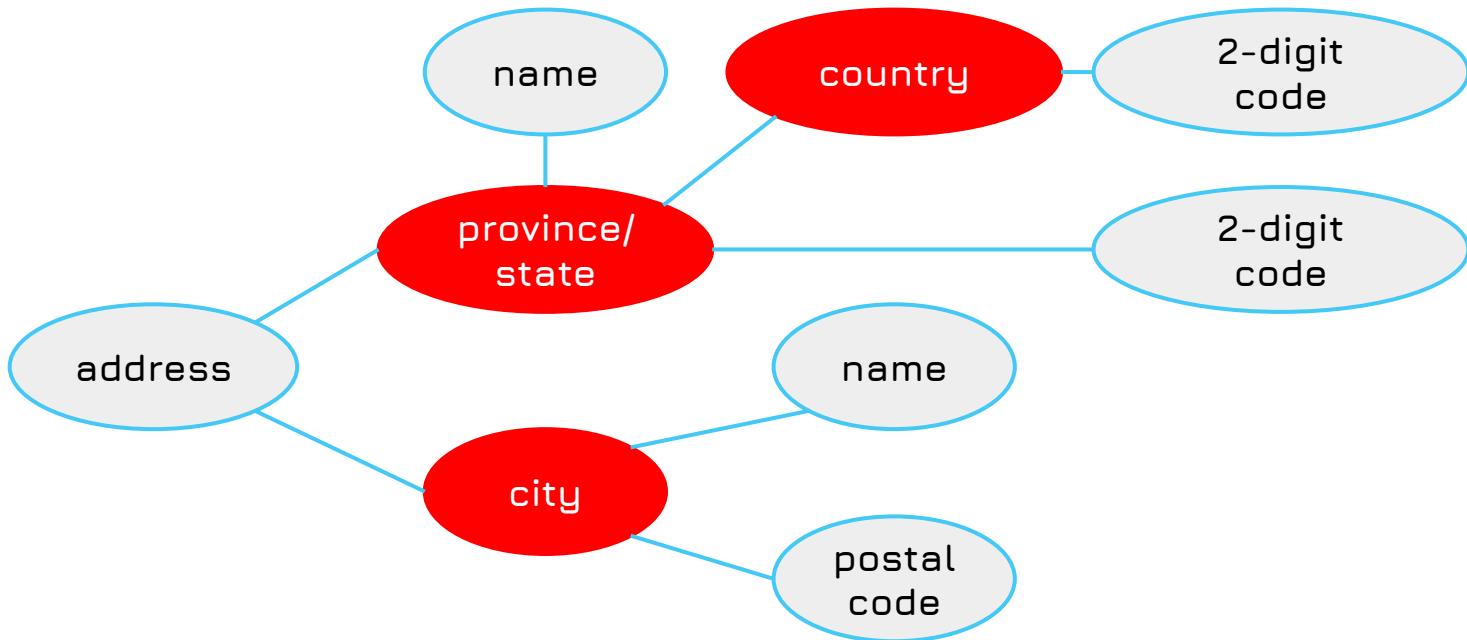
## 1st Normal Form

Each attribute should contain  
***atomic values***



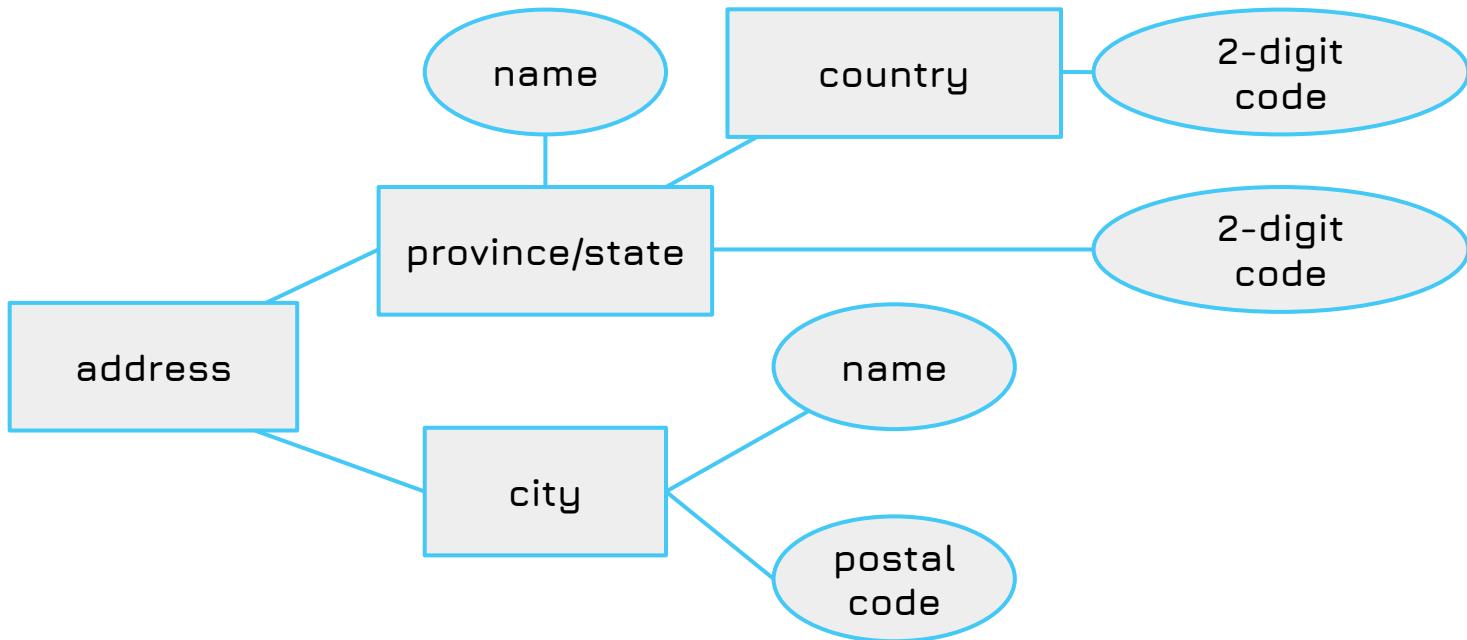
If you run across a composite attribute, this is a major hint  
that you need an extra entity

but you may use composite attributes sparsely



If you run across a composite attribute, this is a major hint that you need an extra entity (Chen notation)

but you may use composite attributes sparingly



If you run across a composite attribute, this is a major hint that you need an extra entity (Chen notation)

but you may use composite attributes sparingly

TYPES OF

# Attributes

---

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

TYPES OF

# Attributes

---

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

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

## CROW'S FOOT SYNTAX

# Attributes

---

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

# ERD attributes