

Relational Database Design

Module 4: Creating the Initial ER Model

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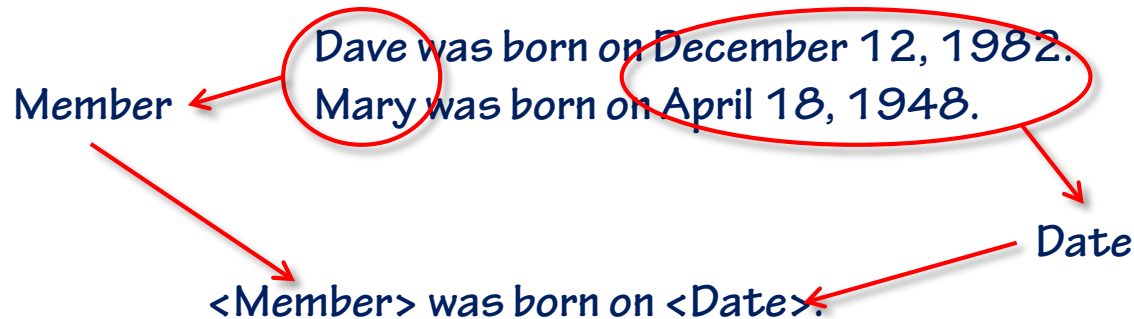
Outline

- **Fact types**
 - Template
 - Placeholders
 - Duplicates
- **Entity types**
 - Identifying fact type
- **Drawing the diagram**
 - Entity types
 - Attributes
 - Relationships
 - Artificial entity types

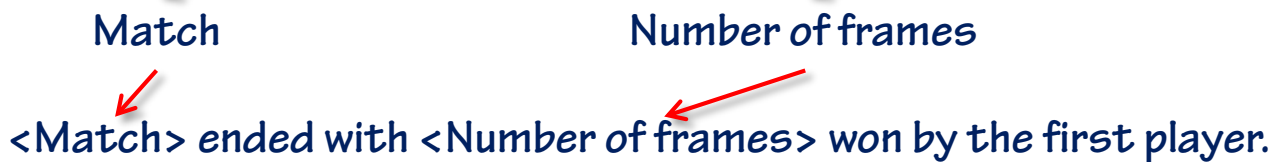
Generalizing fact types

- To a higher abstraction layer

- From individual facts
- To *fact types*.



The match played between Katie and Jim on October 3, 2012 ended with 2 frames won by the first player.
The match played between Dave and Mary on March 7, 2013 ended with 0 frames won by the first player.



Generalizing fact types

- To a higher abstraction layer
 - From individual facts
 - To *fact types*.
- Templates can have any number of placeholders

<Member> was born on <Date>.

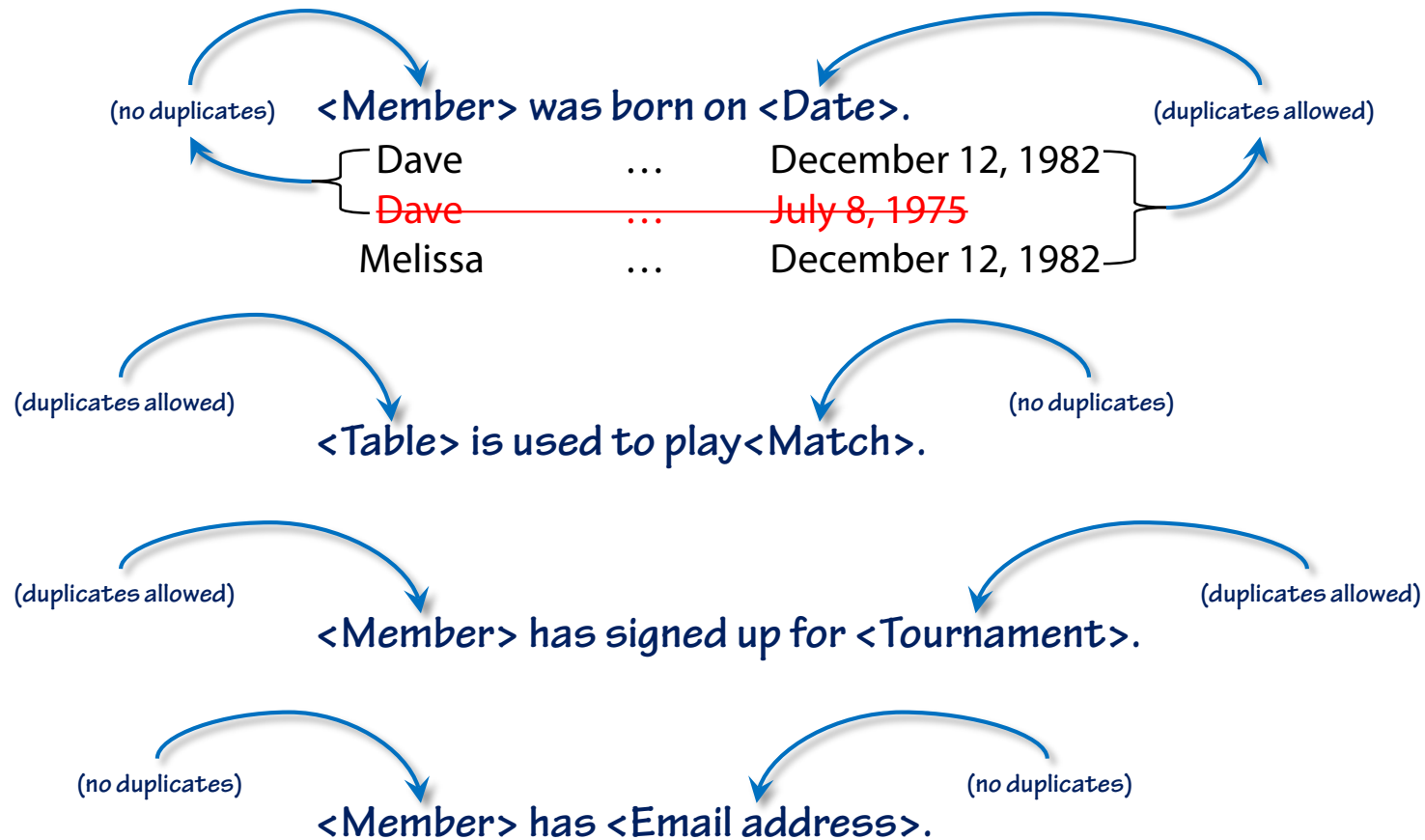
<Match> ended with <Number of frames> won by the first player.

<Member> smokes.

<Pluralsight member> watched <course> on <device>.

Generalizing fact types

- Finding where duplicates are allowed
 - Only required (at this stage) for fact types with two placeholders



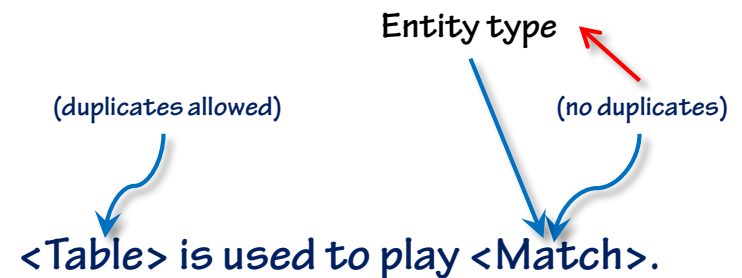
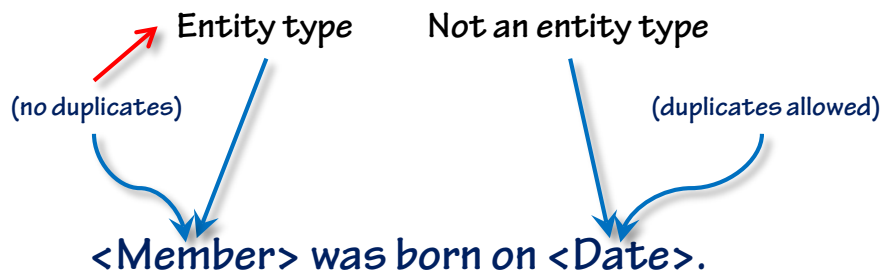
Finding entity types

- Representation of fact types

- Attribute of an **entity type**
- Relationship between **entity types**

- Indications for entity types

- Used in many fact types
 - **Probably** an entity type
- Fact type with duplicates allowed in one placeholder, not allowed in other
 - Placeholder without duplicates **definitely** an entity type



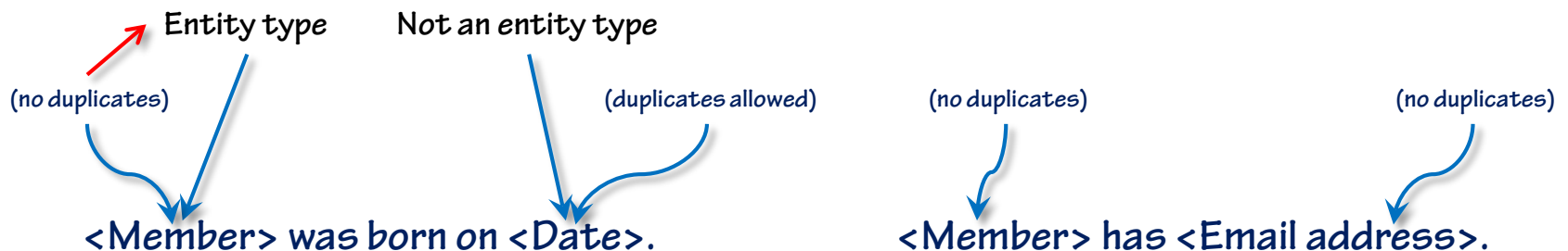
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- Attribute of an **entity type**
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 - No conclusive information from other fact types



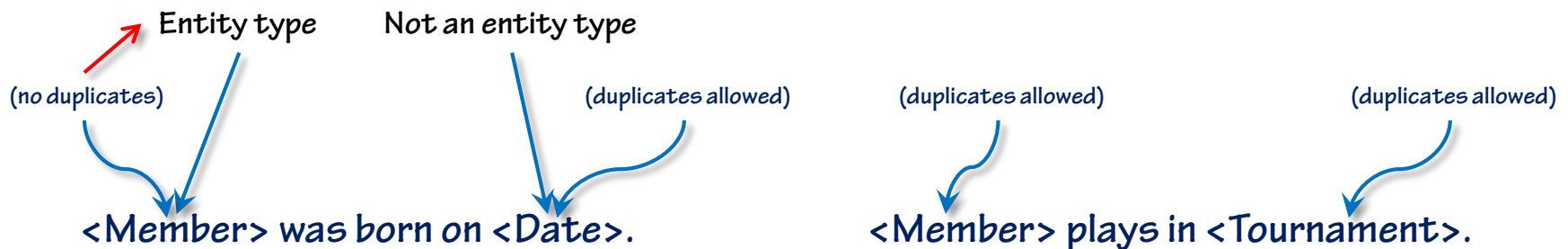
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- Attribute of an **entity type**
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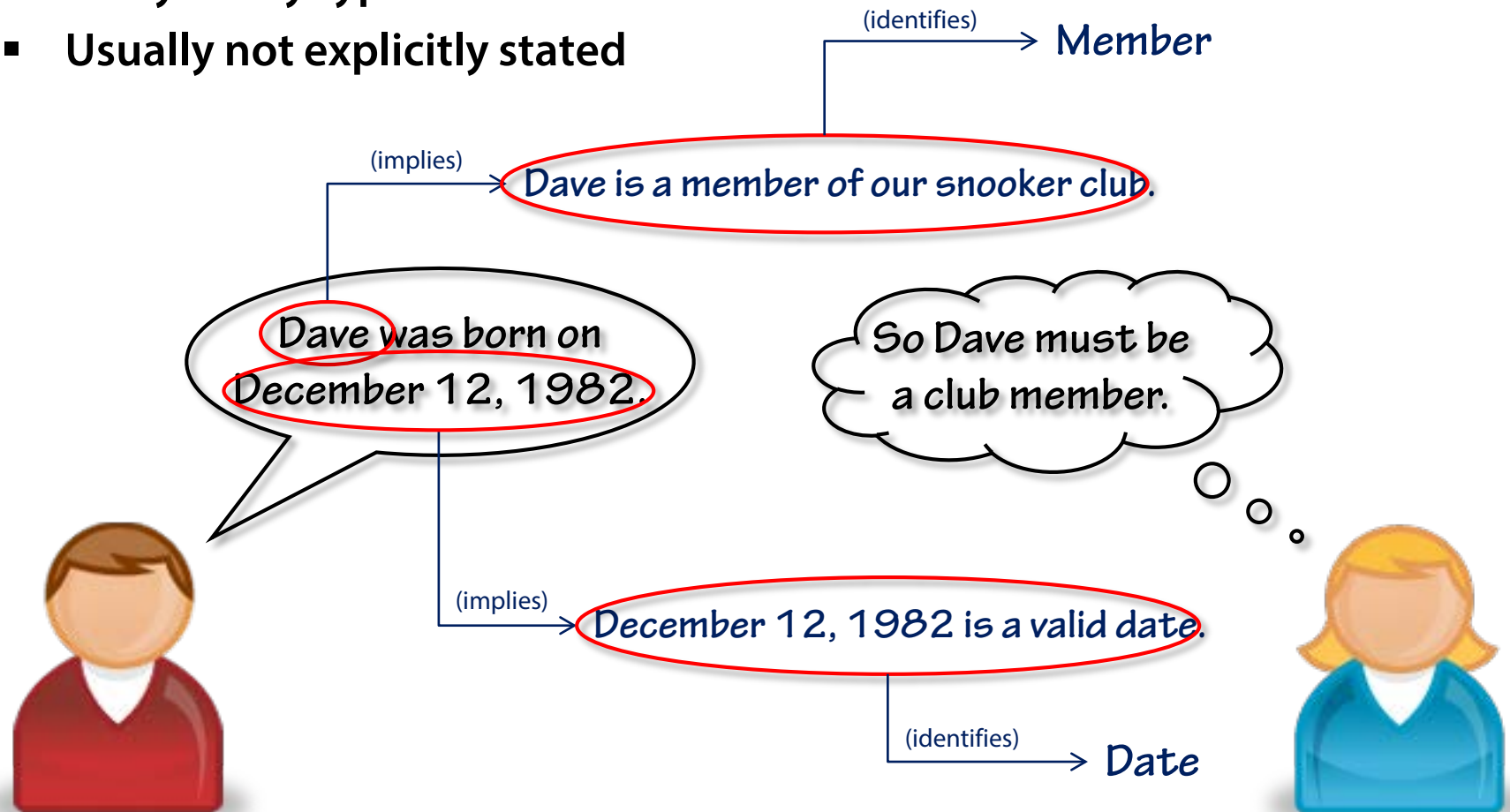
- Indications for entity types

- Used in many fact types
 - **Probably** an entity type
- Fact type with duplicates allowed in one placeholder, not allowed in other
 - Placeholder without duplicates **definitely** an entity type
 - No conclusive information from other fact types
- Word order in fact type templates is **NOT** an indication!



Identifying fact types

- Identify entity occurrences
- Every entity type has one
- Usually not explicitly stated



Identifying fact types

- Identify entity occurrences
- Every entity type has one
- Usually not explicitly stated
 - Unless...
 - Someone *wants to* state it explicitly
 - Nothing other than existence of occurrence is known

Identifying fact types

- Recognizing identifying fact types

- One placeholder
 - Check meaning of facts

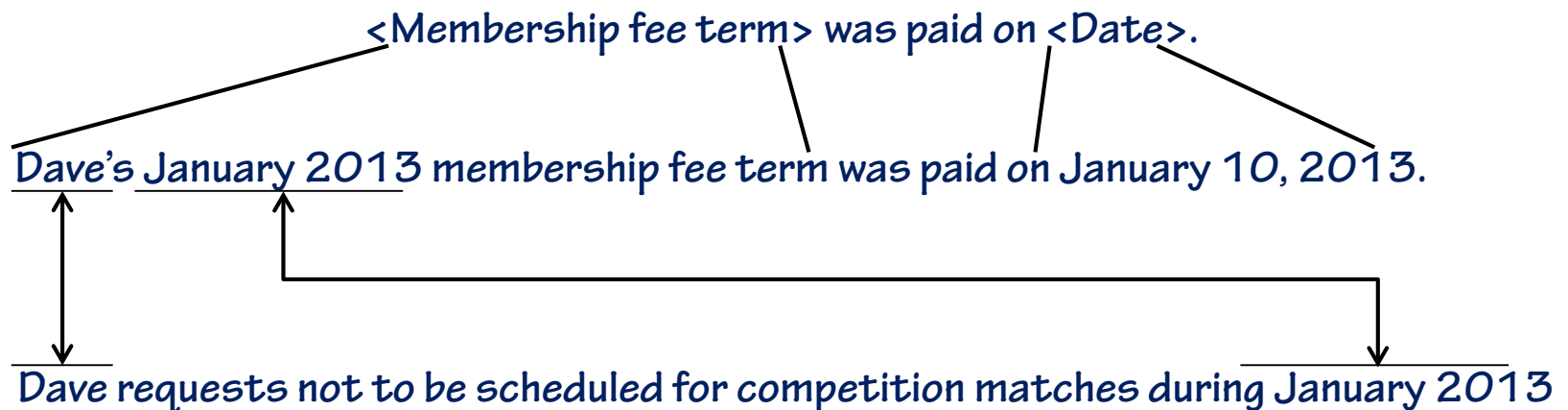
✓ *<Name> is a member of our snooker club.*

✗ *<Member> smokes.*

Identifying fact types

■ Recognizing identifying fact types

- One placeholder
 - Check meaning of facts
- Two placeholders
 - Only if duplicates allowed for both
 - Placeholders must match identification of entity type
 - Check meaning of facts



Identifying fact types

- **Recognizing identifying fact types**
 - One placeholder
 - Check meaning of facts
 - Two placeholders
 - Only if duplicates allowed for both
 - Placeholders must match identification of entity type
 - Check meaning of facts
 - Three or more placeholders
 - Placeholders must match identification of entity type
 - Check meaning of facts
- **Non-identifying fact types always reference *at least* one entity type**

Identifying fact types

- Identifying fact types not explicitly stated
 - (Optionally) add them with your own reading
 - (Definitely) analyze their structure

The first frame of the match played between Katie and Jim on October 3, 2012 ended with 37 points for the second player.

template

→ <Frame> ended with <Number of points> for the second player.

Identifying fact

→ A first frame was played in the match between Katie and Jim on October 3, 2012.

Wrong template

→ A <Frame number> was played in the match between <Member> and <Member> on <Date>.

Correct template

→ A <Frame number> was played in <Match>.

Entity types

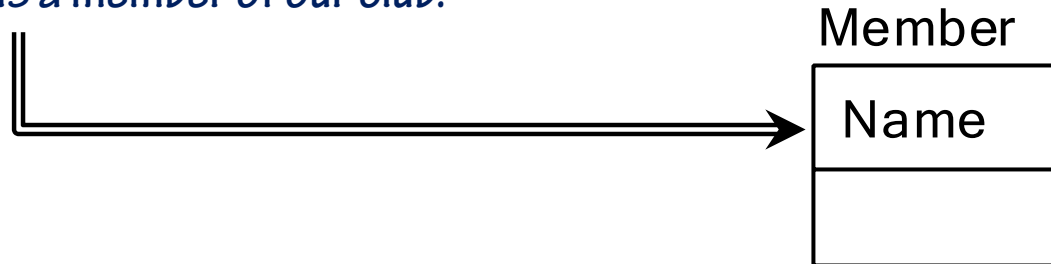
- **Diagram**
 - Layout may change
- **Check all entity types**
 - Identifying fact type references one or more other entity types? → Weak
 - Identifying fact type does not reference other entity types? → Strong

Entity types

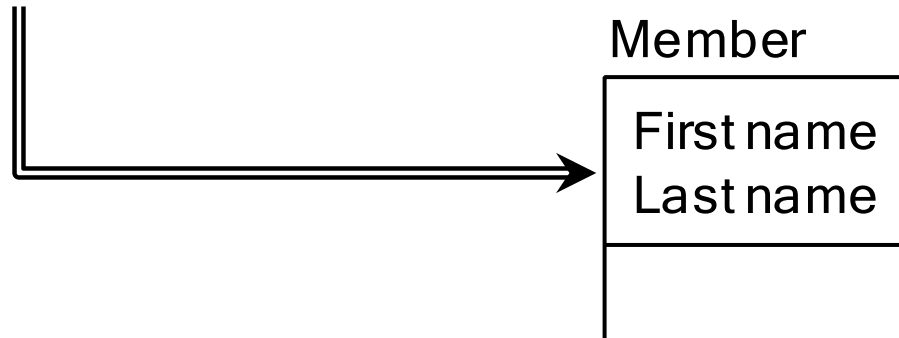
- **Strong entity types**
 - All placeholders become key attributes

Entity type: Member

Template: “<Name> is a member of our club.”



Template: “<First name> <Last name> is a member of our club.”



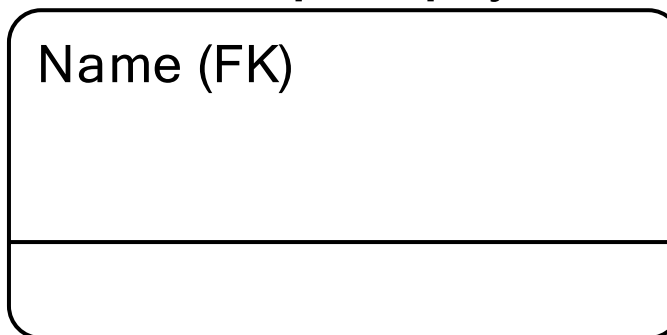
Entity types

- **Strong entity types**
 - All placeholders become key attributes
- **Weak entity types**
 - Placeholders referencing entity type
 - Copy key attributes as foreign key
 - Add relationship
 - Other placeholders become key attributes

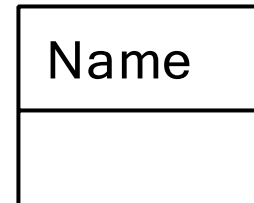
Entity type: Membership fee payment

Template: "<Member> has to pay membership fee for <Month> <Year>."

Membership fee payment



Member



Entity types

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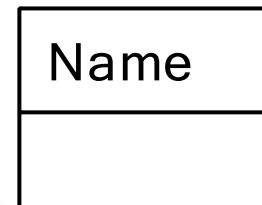
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Membership fee payment

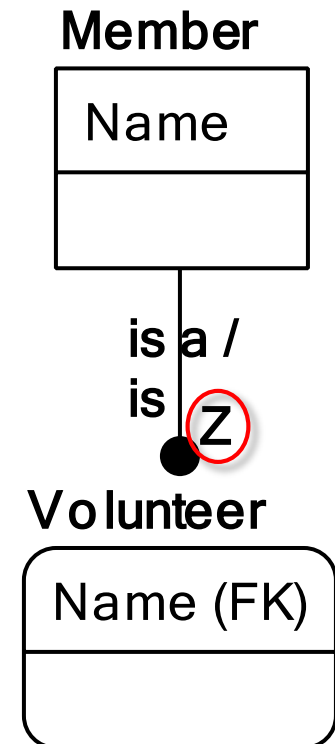


Member



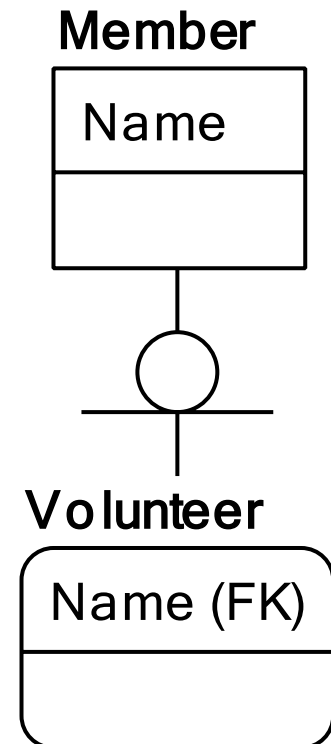
Entity types

- **Strong entity types**
 - All placeholders become key attributes
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- **Subtypes**
 - Weak entity types with single placeholder
 - Identifying relationship is **one to zero or one**



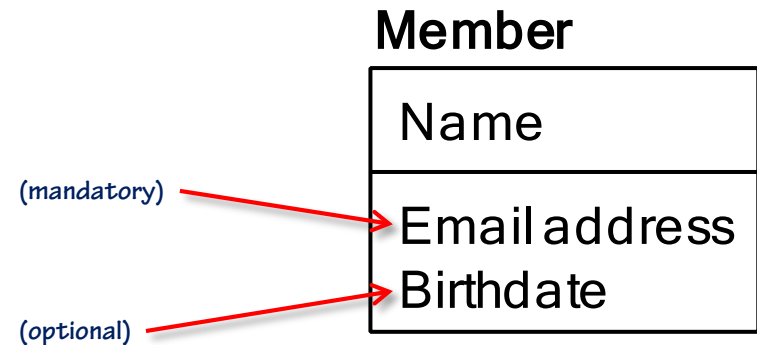
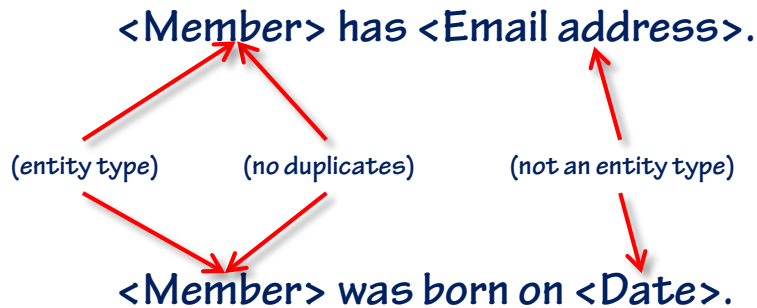
Entity types

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- **Subtypes**
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 - Identifying relationship is **one to zero or one**
 - Multiple subtypes → mutual relationship
 - Nested subtypes
 - Mutually exclusive → complete or incomplete?
 - Independent



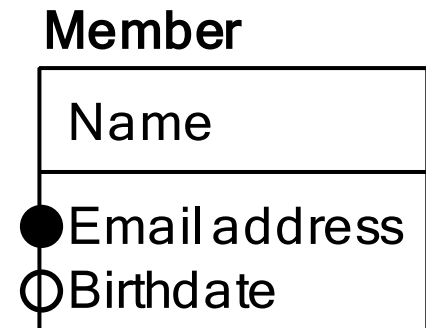
Attributes

- **Fact types with two placeholders in template**
 - One referencing entity type and not allowing duplicates
 - Other one not referencing entity type
- **Optionality:**
 - Mandatory – fact must be known for each instance
 - Optional – fact may be missing for some instances



Attributes


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 - Homebrew notation



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 - Separate accompanying document

Member




Name
Email address Birthdate

Attributes

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 - Separate accompanying document
 - Standardize across company!

Membership card

Name: Dave

Email: 

Birthdate:

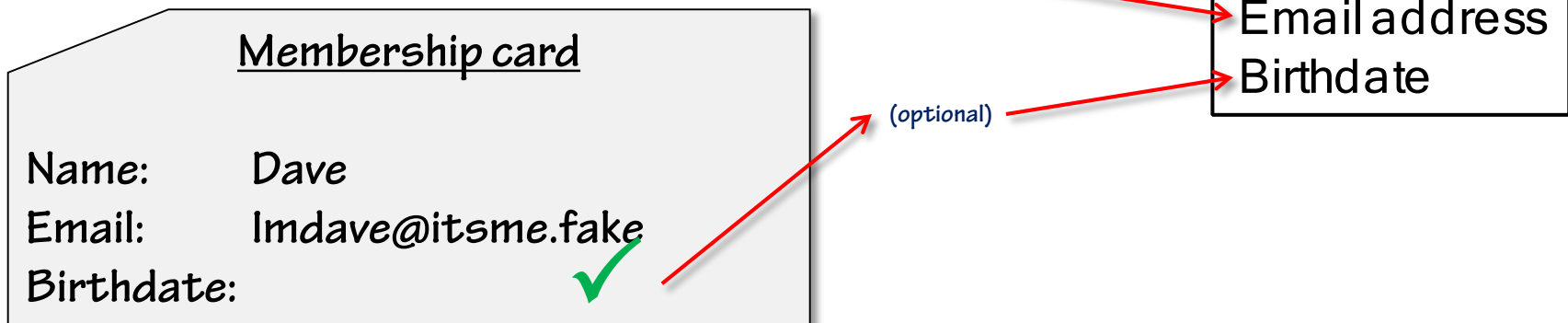
(mandatory)

Member

Name
Email address
Birthdate

Attributes

- **Fact types with two placeholders in template**
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 - Mandatory – fact must be known for each instance
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Attributes

- Fact types with one placeholder in template
 - Except identifying fact types

<Member> smokes.

Member

Name
Email address Birthdate is_smoker

Attributes

- **Fact types with one placeholder in template**
 - Except identifying fact types
- **Pure form**
 - Optional attribute
 - Only “true” allowed
- **Alternative**
 - Mandatory attribute
 - “True” or “false”

Name	Email address	Birthdate	Smoker
Dave	Imdave@itsme.fake		True
Angie	Angie@nowhere.net	7/3/1957	

We know that Dave smokes

We don't know if Angie smokes

Member

Name
Email address Birthdate is_smoker

Attributes

- **Fact types with one placeholder in template**
 - Except identifying fact types
- **Pure form**
 - Optional attribute
 - Only “true” allowed
- **Alternative**
 - Mandatory attribute
 - “True” or “false”

Name	Email address	Birthdate	Smoker
Dave	Imdave@itsme.fake		True
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We know that Dave smokes

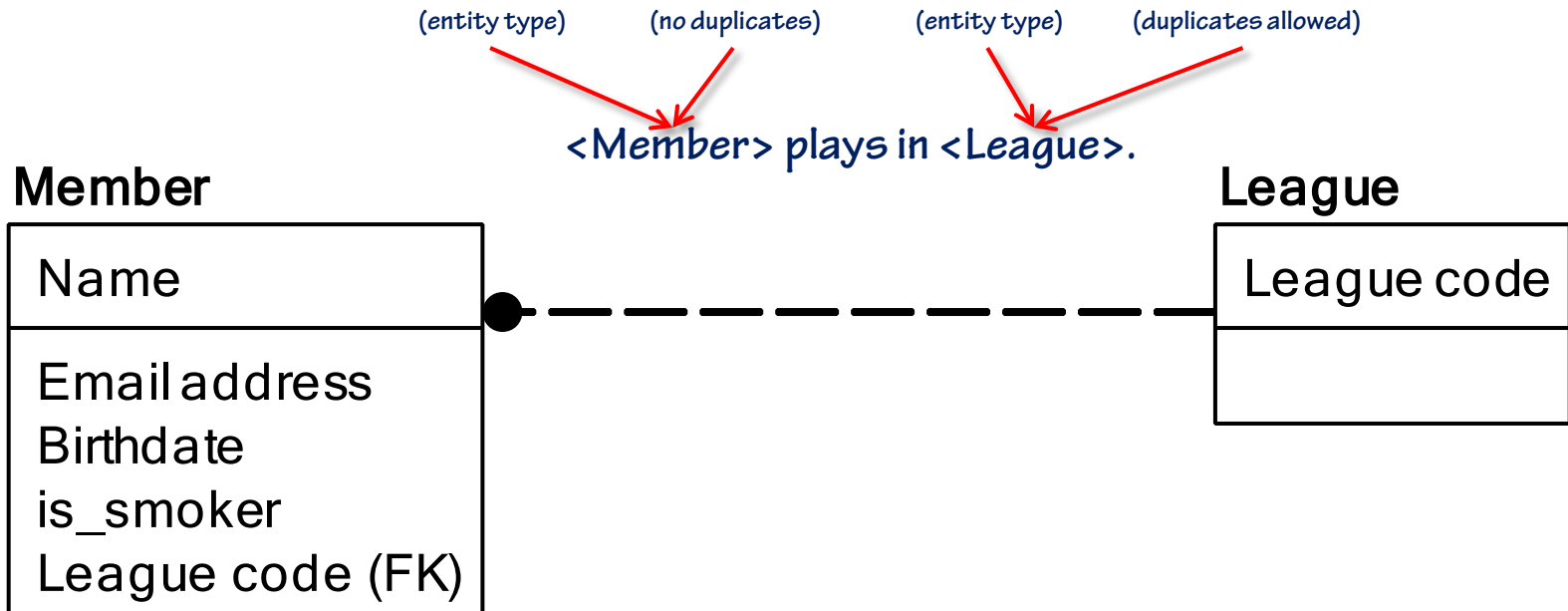
We know that Angie doesn't smoke

Member

Name
Email address Birthdate is_smoker

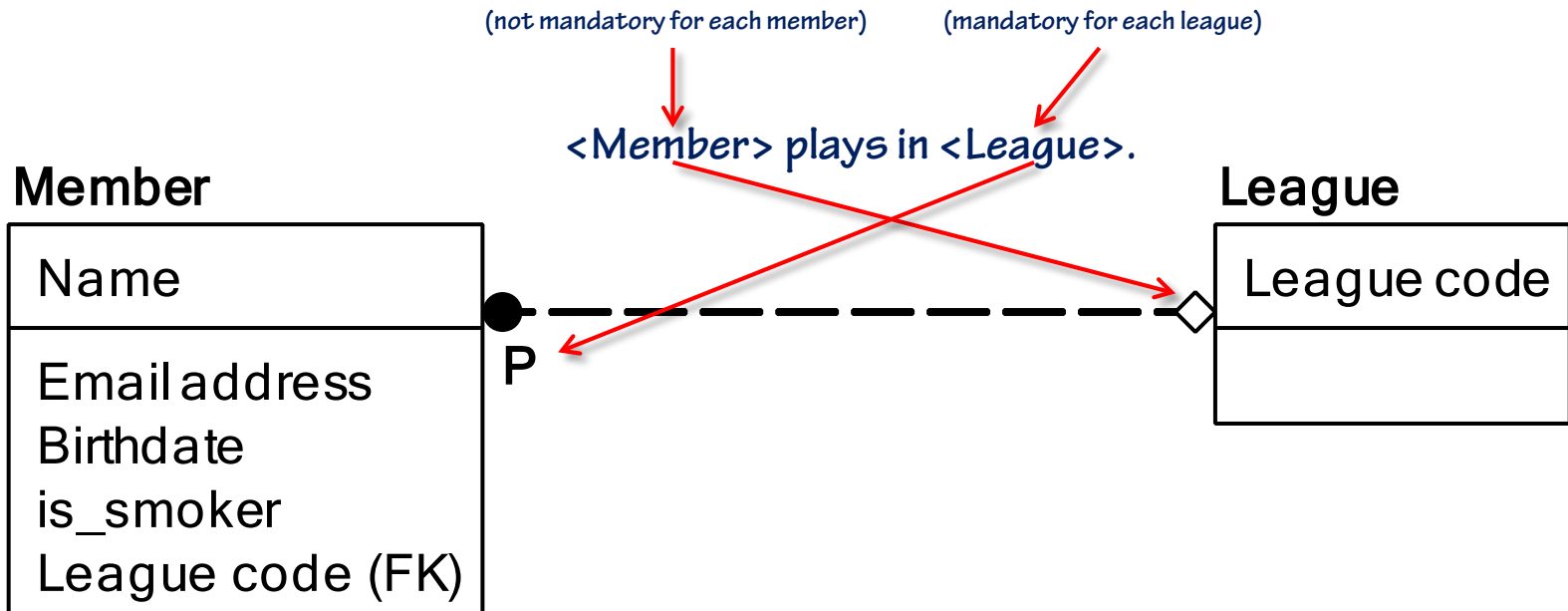
Relationships

- **Fact types with two placeholders in template**
 - Both referencing an entity type
 - One-to-many, many-to-many, one-to-one: based on duplicates in facts



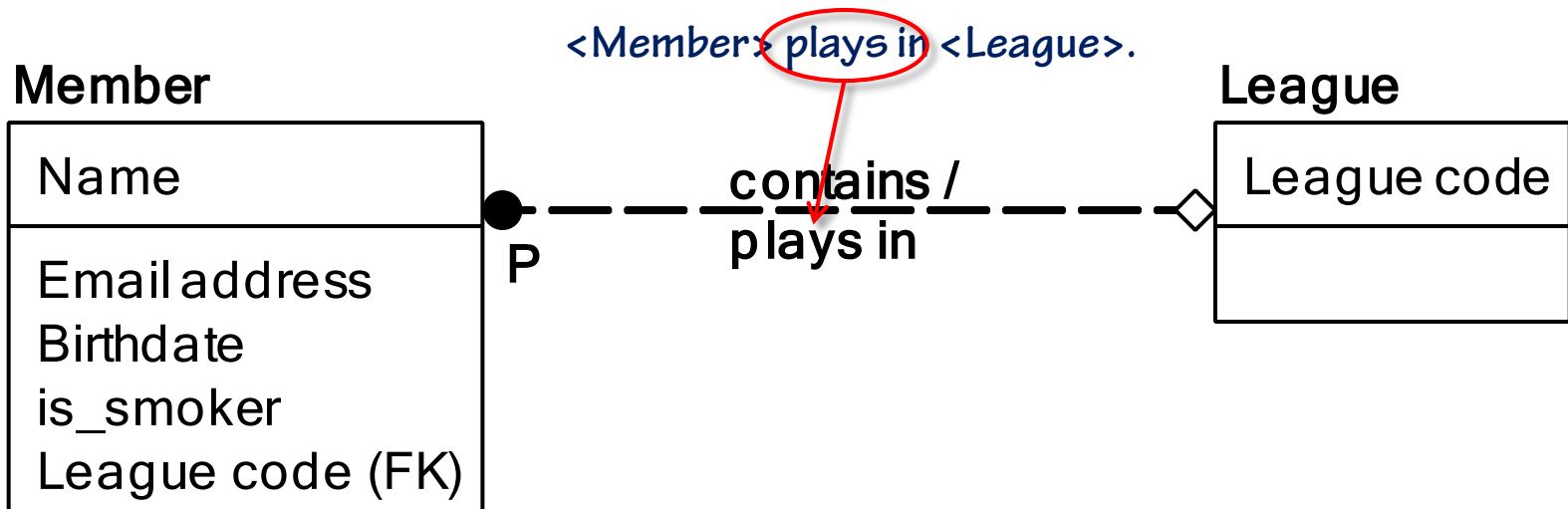
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Relationships

- **Fact types with two placeholders in template**
 - Both referencing an entity type
 - One-to-many, many-to-many, one-to-one: based on duplicates in facts
 - First relationship reading from template
 - Second relationship reading: DIY or consult subject matter expert



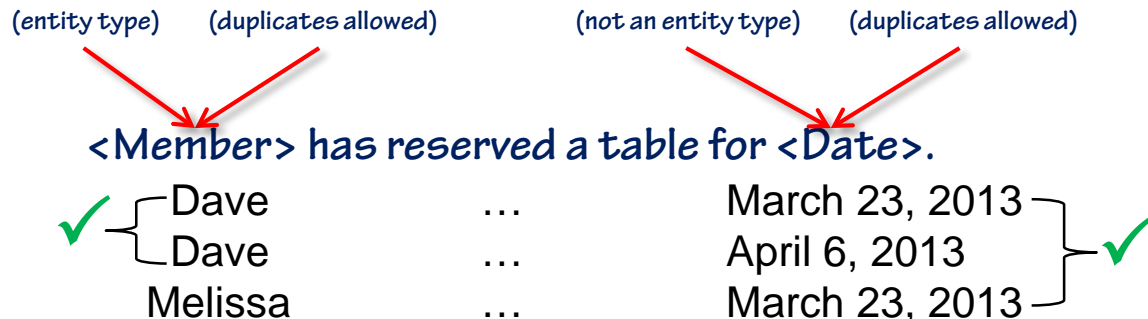
Artificial entity types

- **Fact types not yet represented in the diagram**

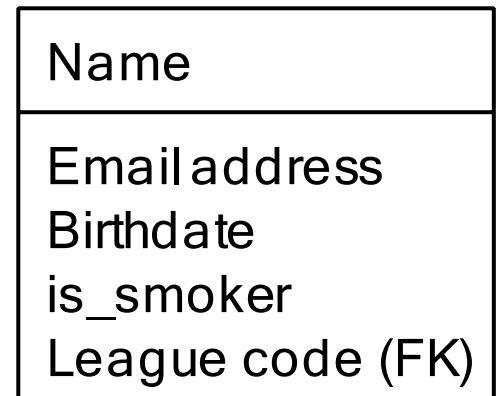
- Three or more placeholders
- □ Two placeholders
 - One referencing entity type and allowing duplicates
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- **Multi-valued attribute**

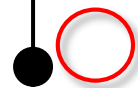
- Not supported in IDEF1X diagrams
- Workaround: nominalize
 - Make entity type out of fact type



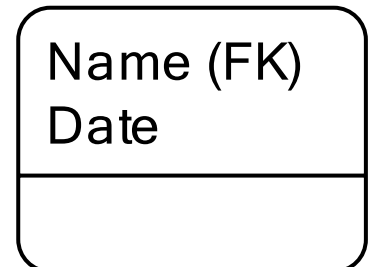
Member



made /
is for



Reservation

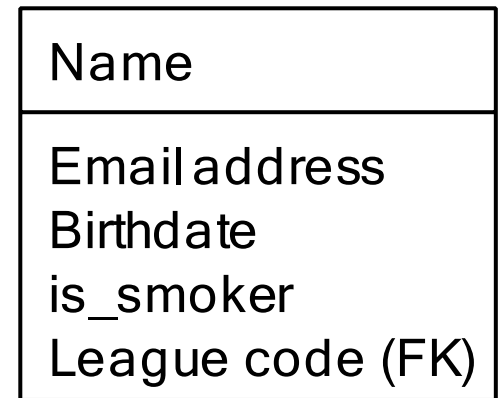


Artificial entity types

- Artificial or not artificial?
 - Depends...

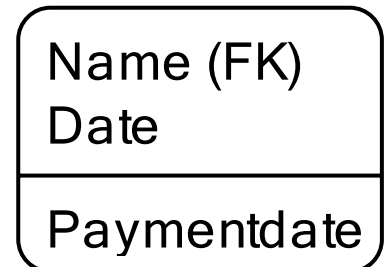
<Reservation> was paid on <Date>.

Member




made /
is for

Reservation



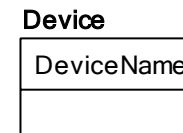
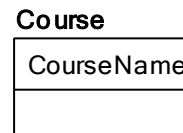
Artificial entity types

- **Fact types not yet represented in the diagram**

- Two placeholders
 - One referencing entity type and allowing duplicates
 - Other one not referencing entity type
-  □ Three or more placeholders
 - Relationship between more than two entity types
 - Relationship with its own attribute
 - Composite multivalued attribute

- **Not supported in IDEF1X diagrams**

- Workaround: nominalize



<Pluralsight member> watched <Course> on <Device>.

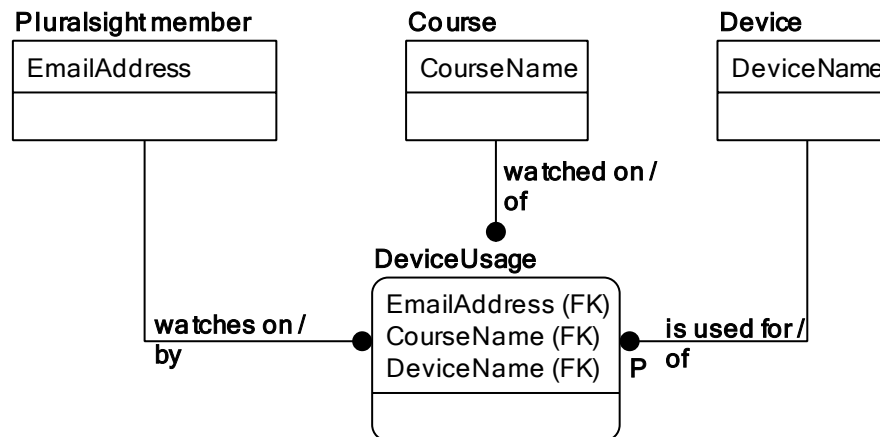
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Summary

- **Fact types**
 - Template
 - Rules for duplicates
- **Identifying fact type**
 - Entity types
 - Strong/weak
 - Key attributes
- **Other fact types**
 - Non-key attributes
 - Relationships
 - Artificial entity types