Relational Database Design

Module 2: ER Modeling

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pluralsight
hardcore developer training

Outline

- **ER modeling**

- **Elements of an ER model**
  - Entity types
  - Attributes
  - Relationships
    - Regular (non-identifying)
    - Identifying
    - Special relationships
      - One-to-one
      - Many-to-many
      - Recursive
      - Higher arity
  - Subtypes

ER modeling

- **Many methods, many notations**
  - Entity-Relationship (ER) modeling
  - This course uses the IDEF1X notation
- **Benefits**
  - Relatively easy to understand
  - Hide/expose details when zooming in or out
  - Maps to relational database design
- **Risks**
  - Wrong responsibility
  - Incomplete
  - Different notations

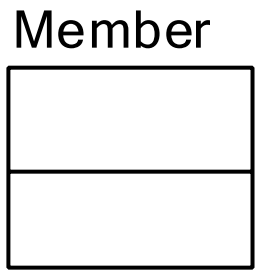
Entity types

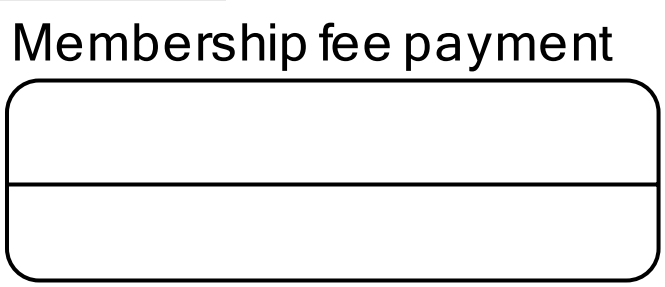
- **Entity**
  - Objects, persons, events, or abstractions
  - Relevant in the context of the data application
  - Also called “entity instance” (or “instance”)

- **Entity type**
  - Class of objects
  - Same characteristics
  - Also called “entity”
    - (And yes, that is indeed confusing!)

Entity types

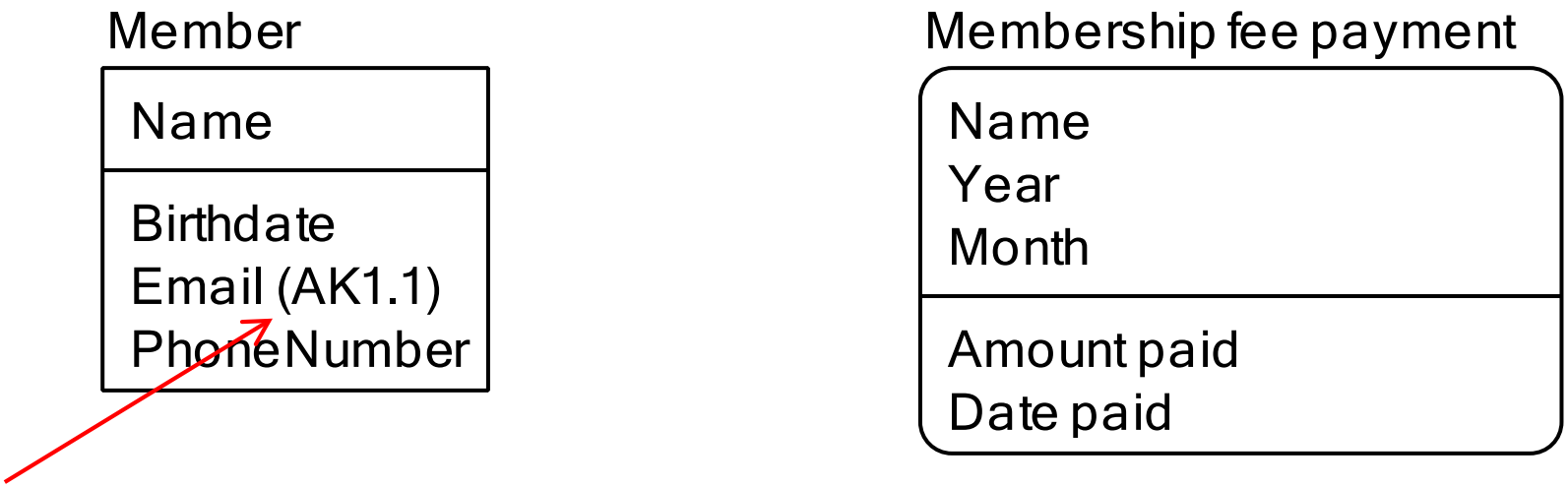
Entity instances	Entity type
Mary Dave	Club member
Table 1 Table 3	Table
2012 Christmas Tournament 2013 Midsummer Tournament	Tournament
A League B League C League Junior League	League





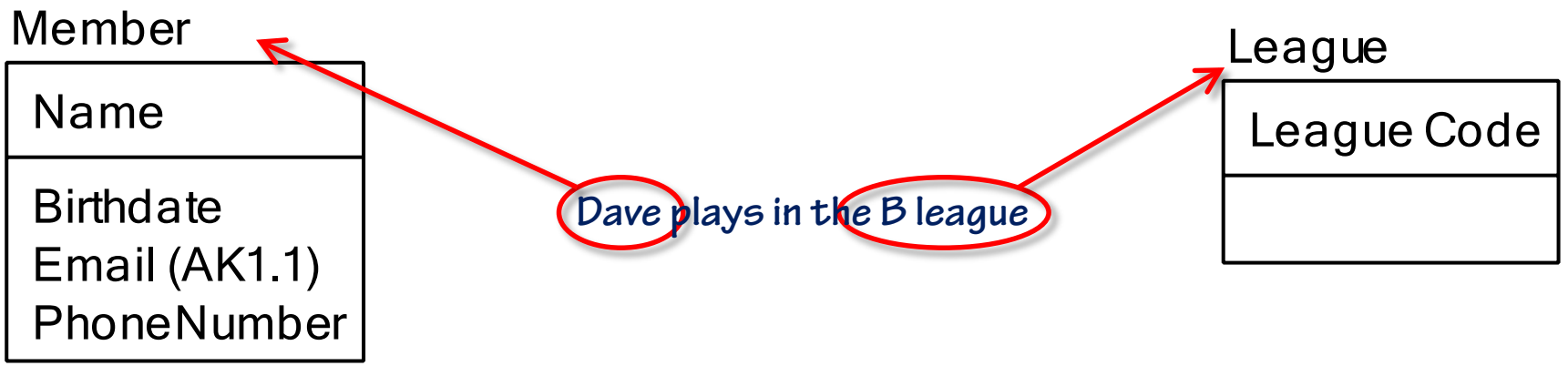
Attributes

- **Instance level: A fact about an entity occurrence**
- **Abstract level: A class of facts about instances of an entity type**
- **Key attributes**
  - Composite key
- **Candidate keys**
  - One primary key
  - Zero or more alternate keys



Relationships

- **Class of facts that associate an instance of an entity type with another instance of an entity type**



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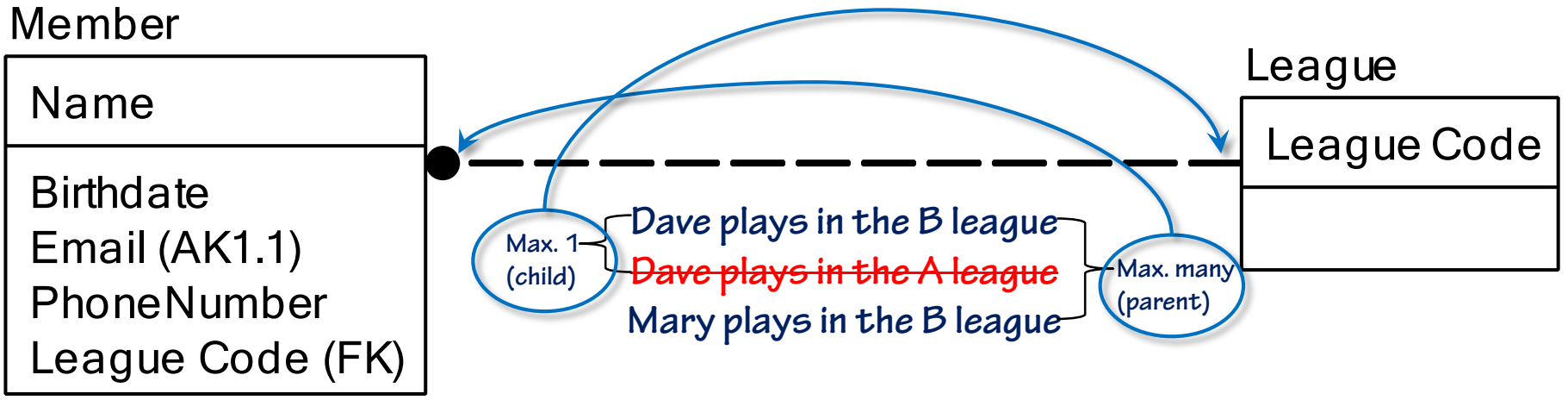
  - One-to-many: one "parent" may associate with multiple "children"



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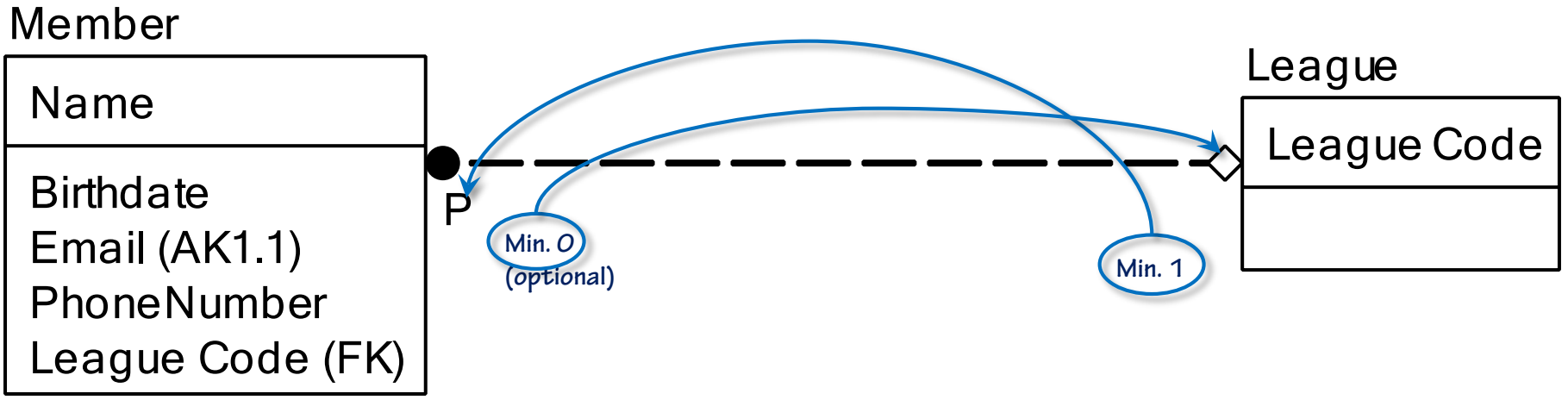

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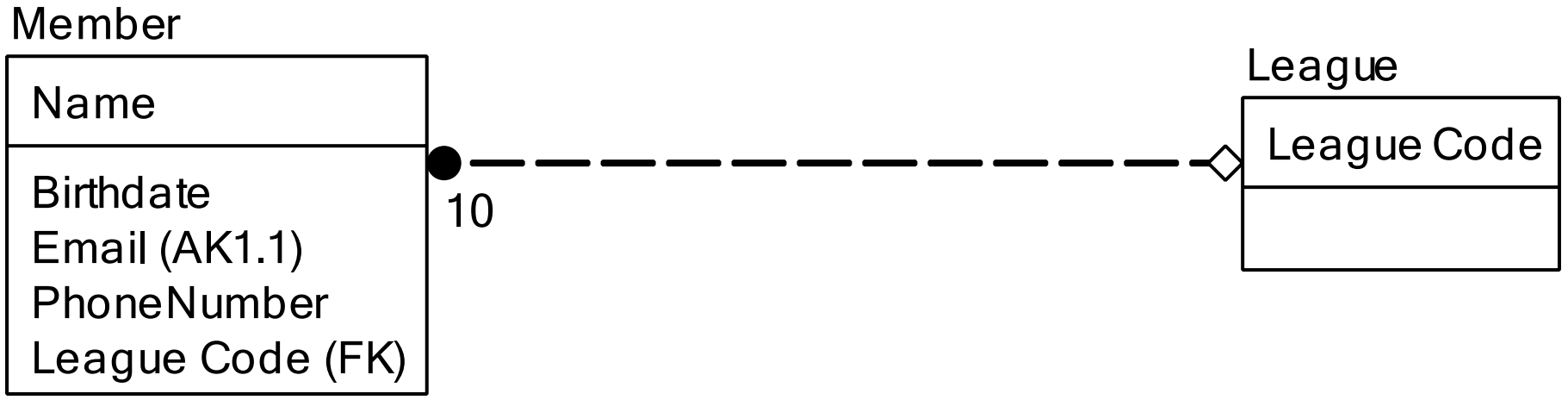

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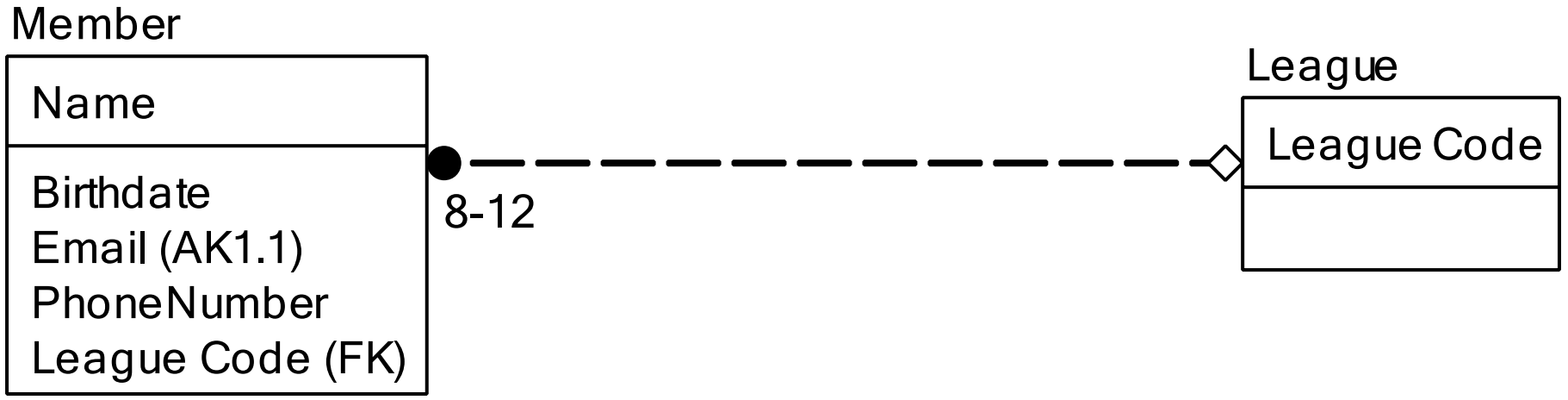

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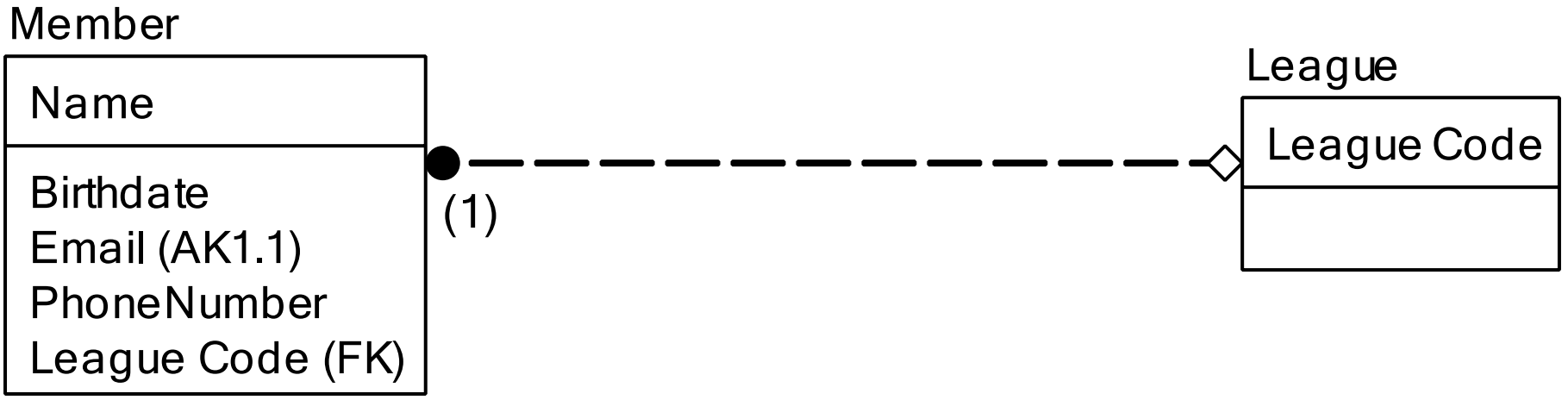

(1) Each league contains an even number of members

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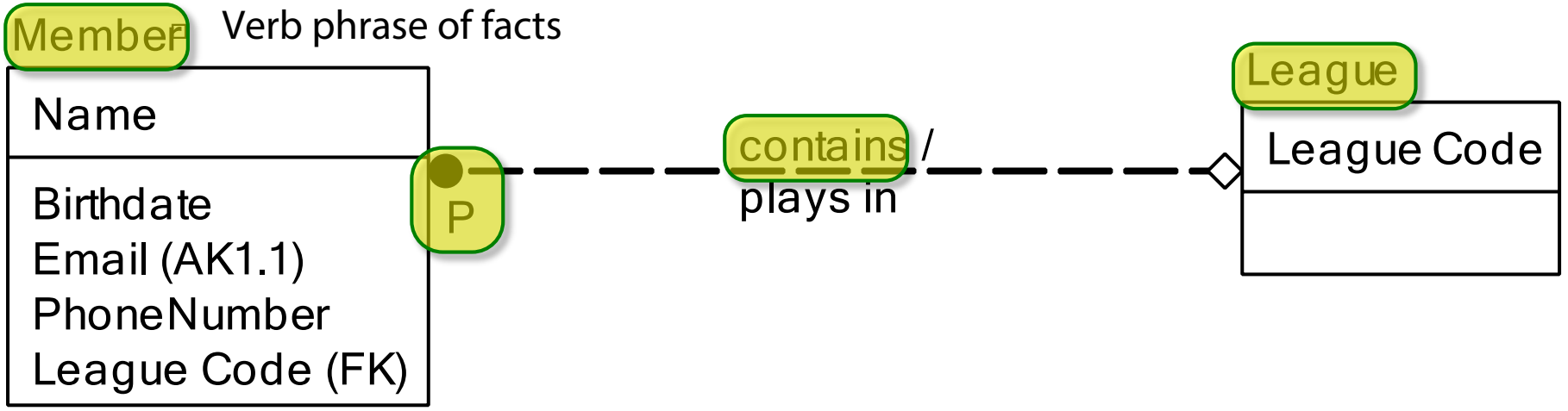

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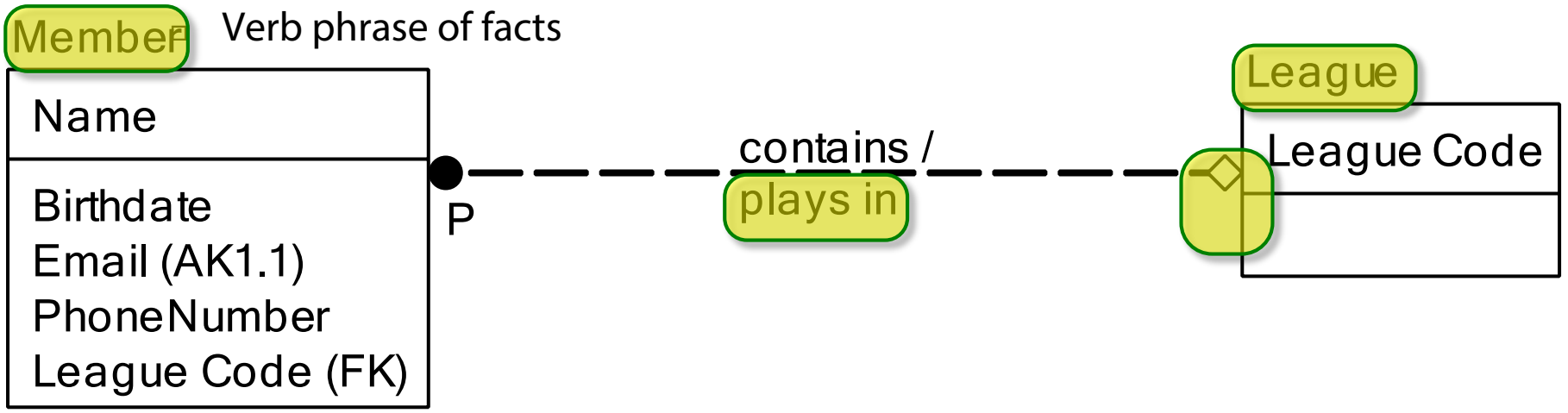
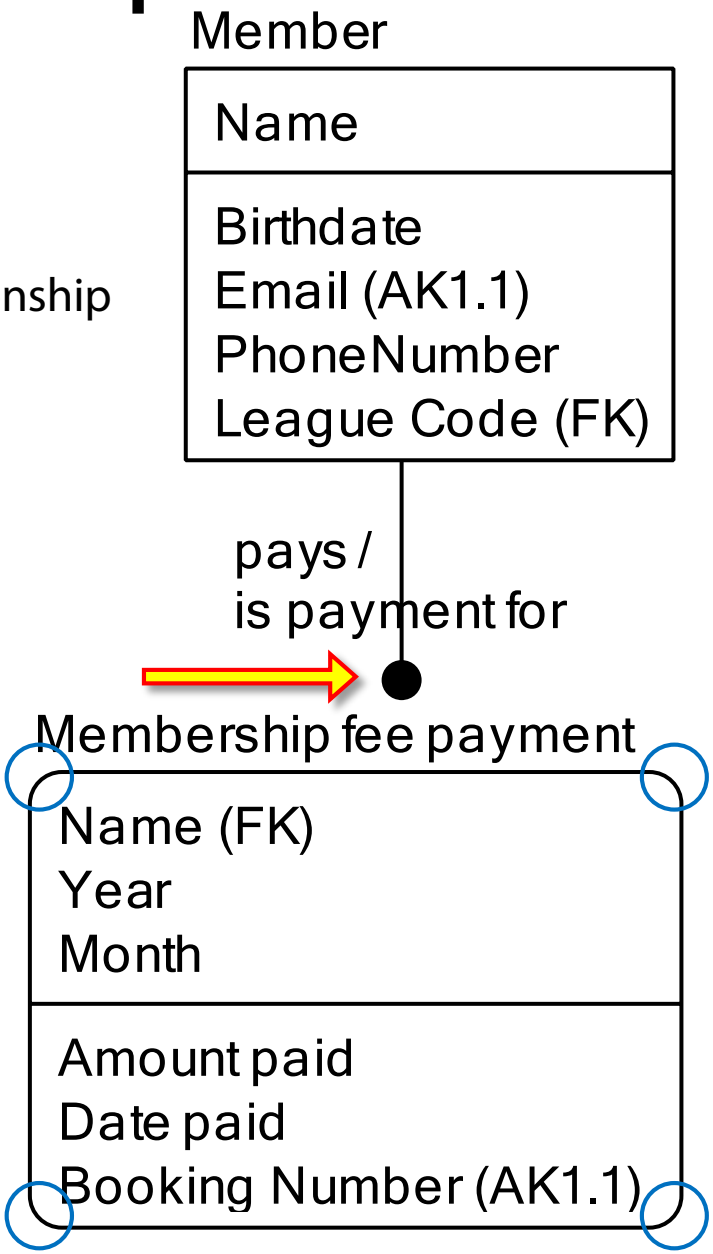


Identifying relationships

- **Foreign key attribute(s) part of child entity types key**
  - Cardinality for parent: same as normal relationship
  - Cardinality for child: never optional
- **Entity types:**
  - Child in identifying relationship: *weak*
  - Others: *strong*



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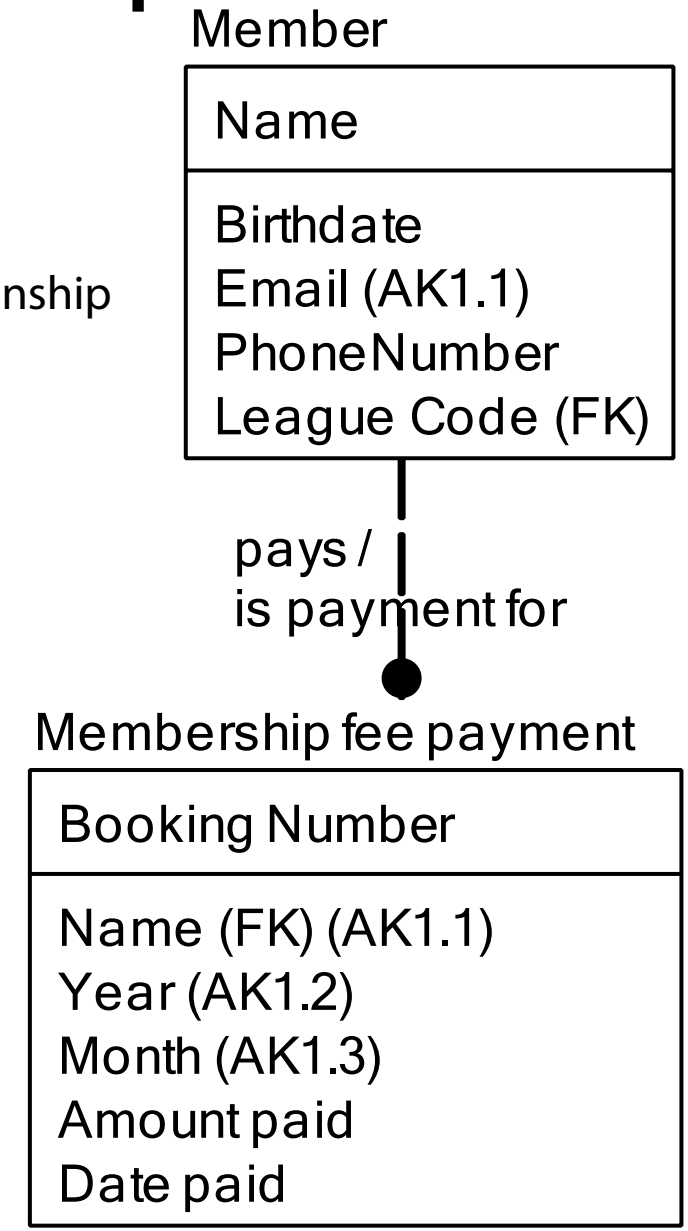
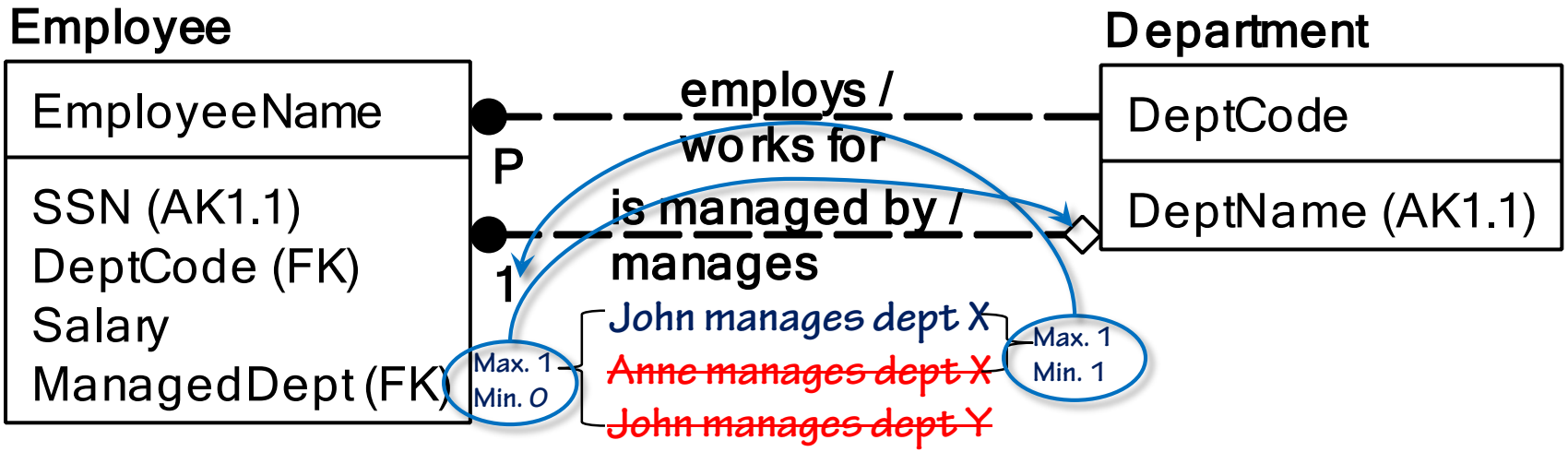


Special relationships

- **One to one**
  - Designate one of the entity types as parent, one as child
  - In physical model, the choice is based on storage and performance
  - In logical model, either choice is valid



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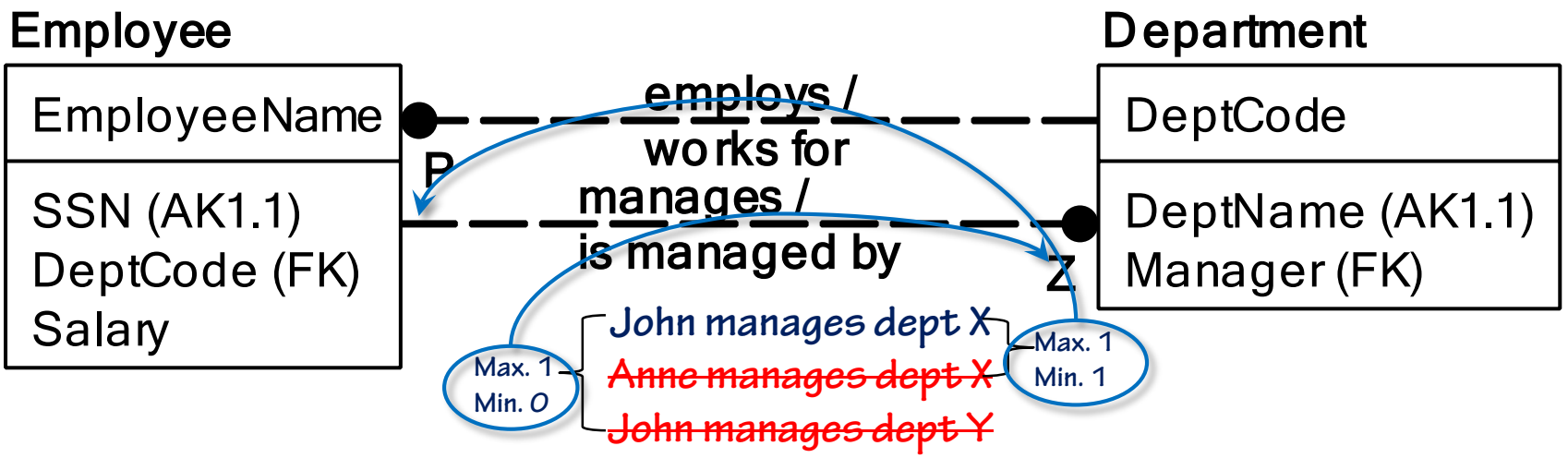
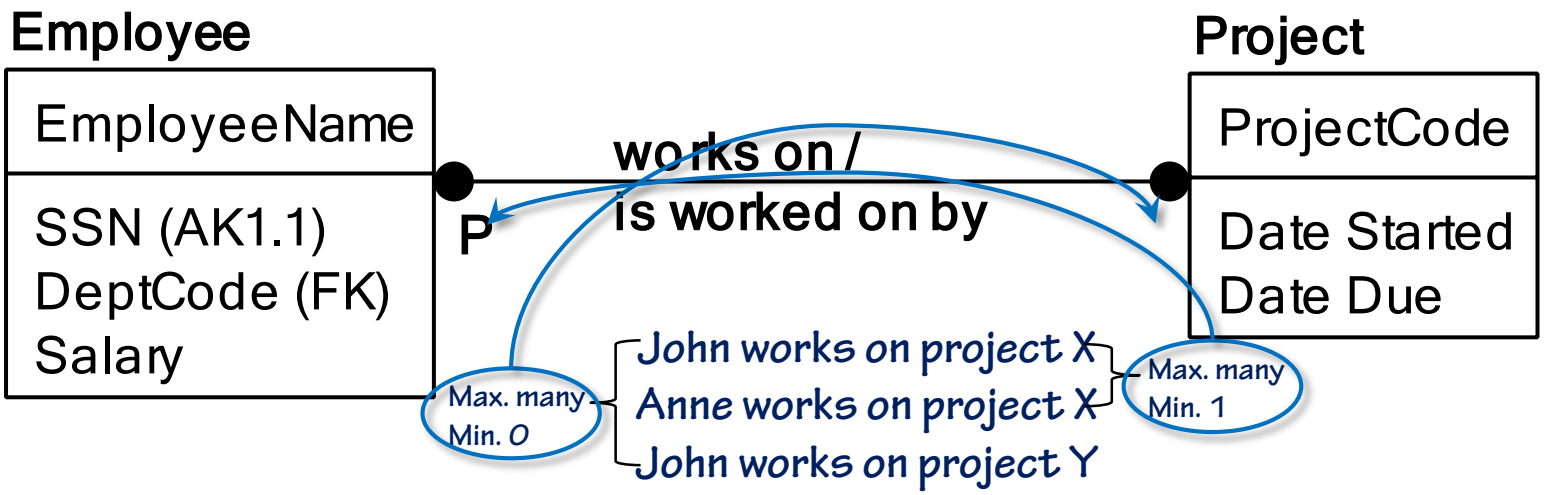


Special relationships

- **One to one**
- **Many to many**
  - Both sides have maximum cardinality *many*
  - No parent or child in the relationship



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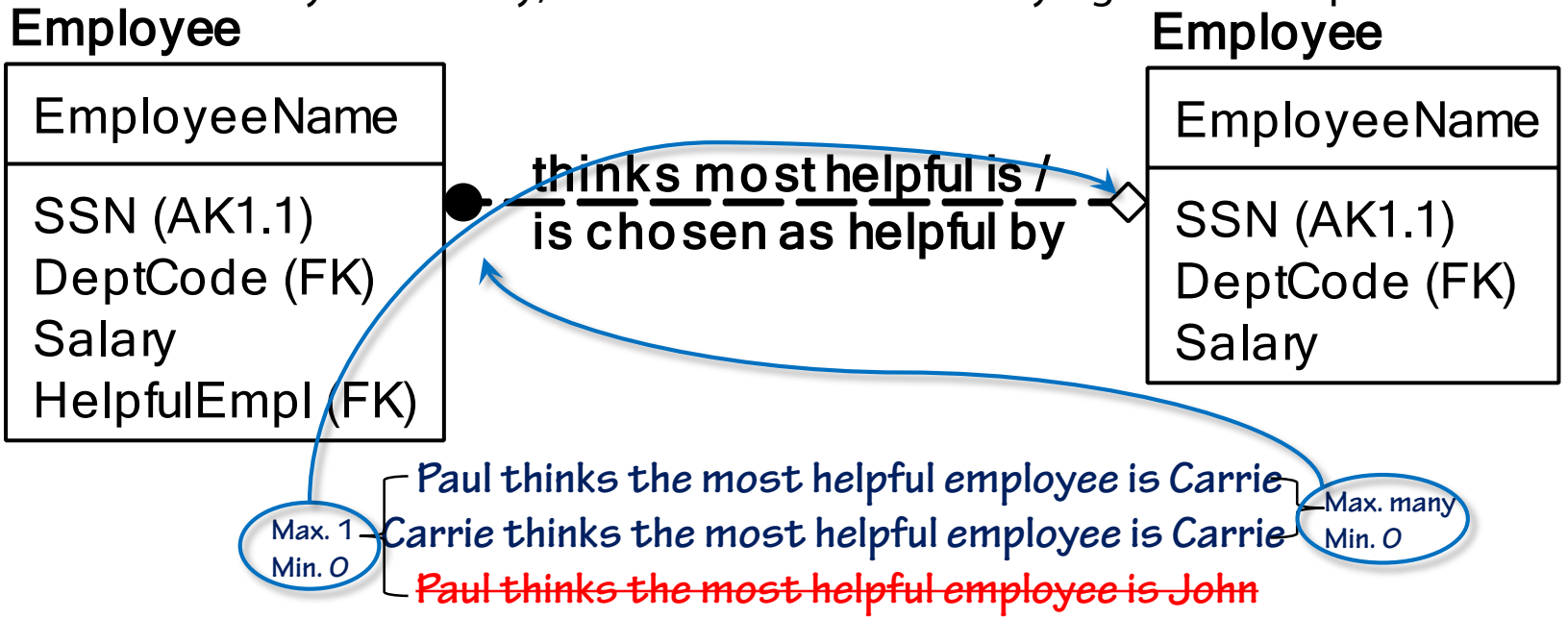
  - Can be any cardinality, but can not be an identifying relationship



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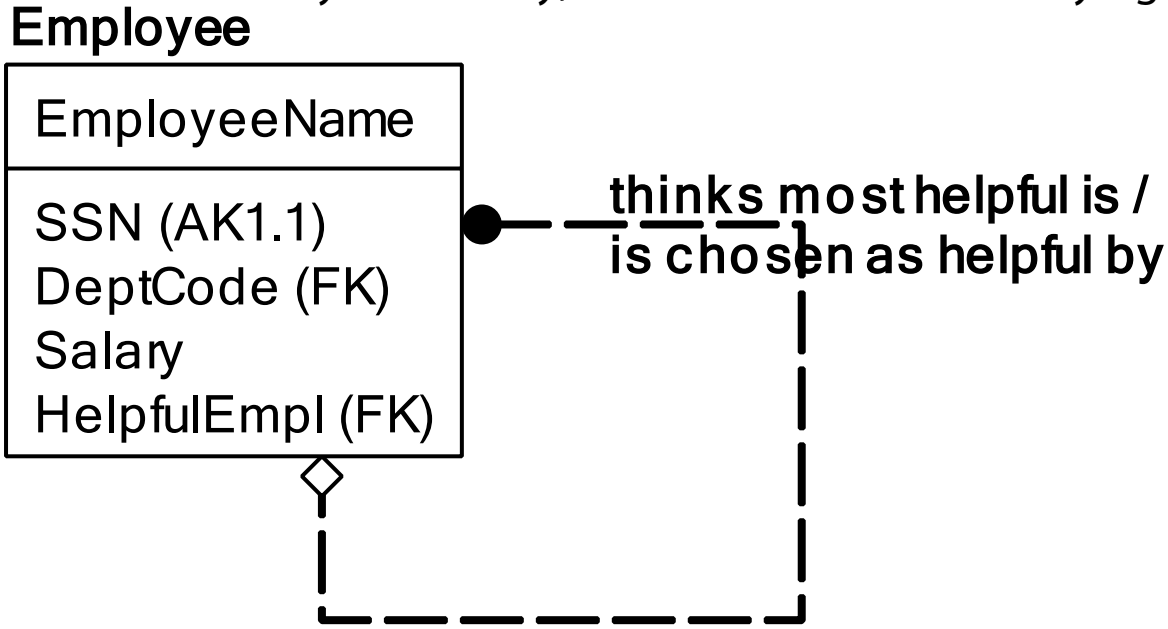

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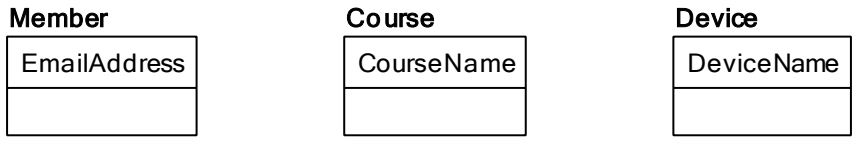
  - Binary (arity 2) relationships: between **two** entity types
  - Ternary (arity 3) relationships: between **three** entity types



Member a@b.c watched Database design on a tablet
Member d@e.f watched Introduction to BI on a smartphone

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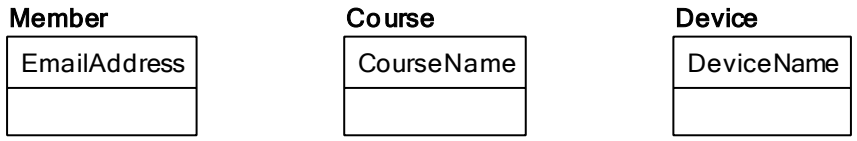

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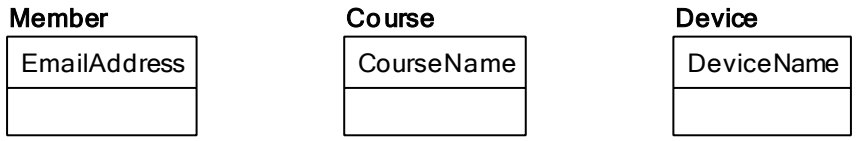

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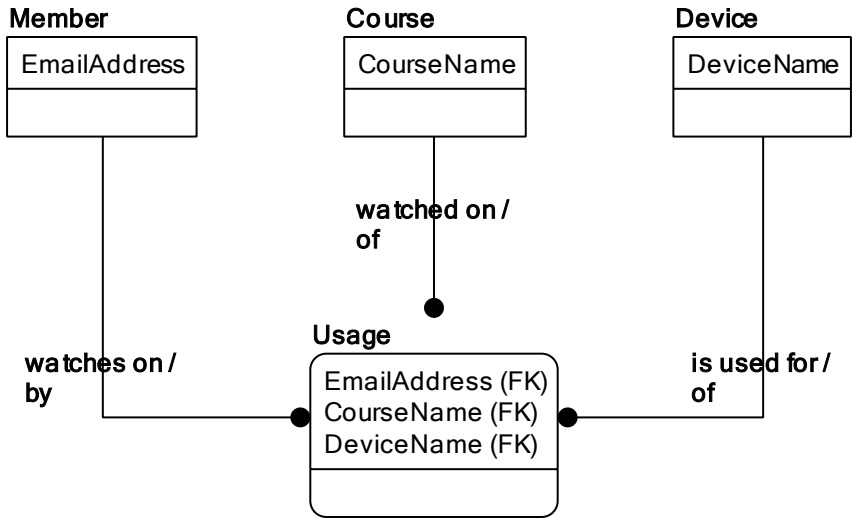
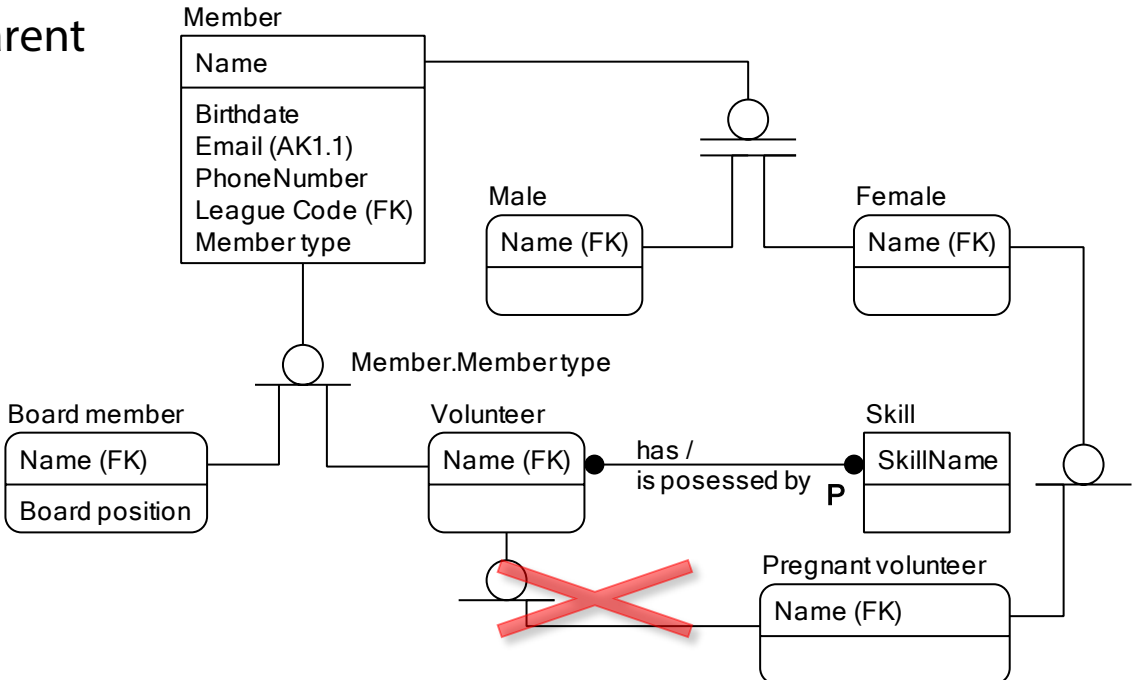
    - Entity type name / relationships readings



Subtypes

- **Subtype / category / specialization**
  - Well-defined subset of the occurrences of another entity type
    - That other entity type is called supertype, generic entity, or generalization
  - Use same symbol if:
    - Mutually exclusive
    - Same discriminator
  - Double bar = complete set of categories
  - Single parent



Summary

- **Benefits and risks of ER modeling**

- **Elements of an ER model**
  - Entity types
    - Dependent (strong) or independent (weak)
  - Attributes
    - Key or non-key
  - Relationships
    - Cardinality
    - Identifying
    - Recursive
    - Transforming higher arity relationships to entity types
  - Subtypes (categories)
    - Complete or incomplete

References

- **Further reading:**
  - IDEF1X method report (the official definition of IDEF1X): http://www.idef.com/pdf/Idef1x.pdf
  - IDEF1X "cheat sheet" (quick reference): http://www.32geeks.com/classes/resources/IDEF1X_Cheat_Sheet.pdf
  - Entity-relationship modeling (generic Wikipedia page) http://en.wikipedia.org/wiki/Entity-relationship_model