Tutorial 1

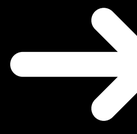
CS4.301: Data and Applications

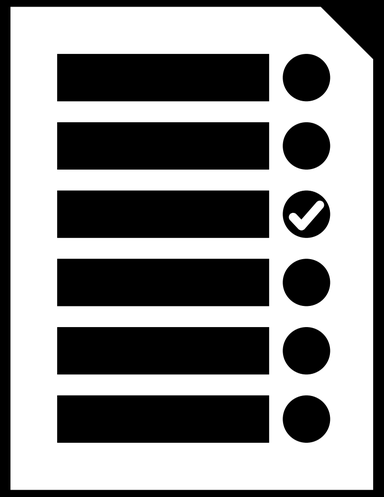
October 1, 2022 — Monsoon 2022 — Priyanshul Govil

Agenda

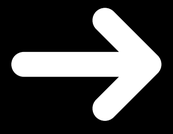
- ER Data Model
- Practice
- HW-1
- Project
- Administrative stuff

Miniworld /
UoD





Data
Requirements



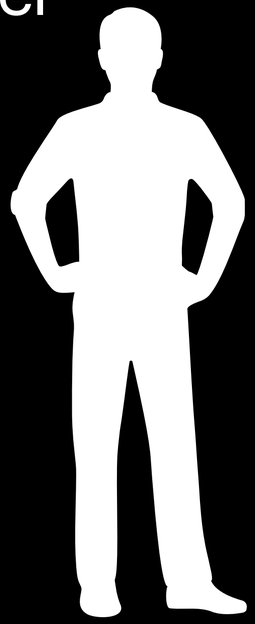
Conceptual
Design

Entity-relationship (ER) Model

ER Model

- Wikipedia: *“Describes interrelated things of interest in a specific domain of knowledge”*
- Designed by Peter Chen and published in a paper in 1976
  - https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.523.6679&rep=rep1&type=pdf
- Different sources might have slight variations, try to follow the course’s book (Elmasri) for this course

Teacher



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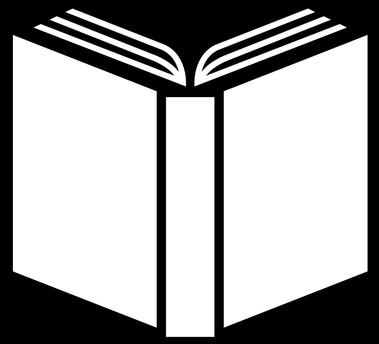

Book

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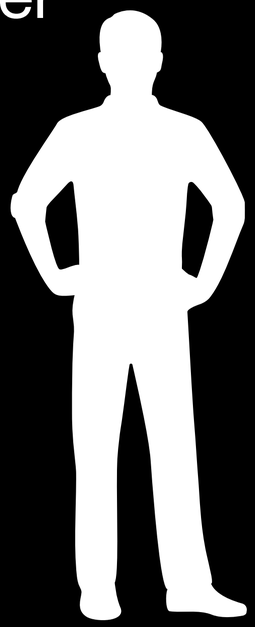

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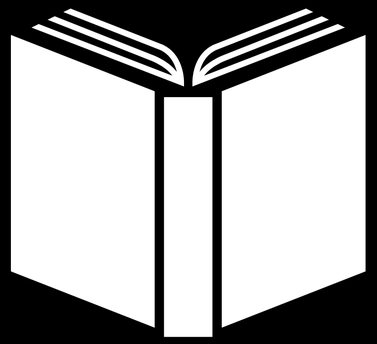

Book

Components of an ER Model

- Entity sets (all entities of the same entity type)
- Relationship sets (all relationships of the same relationship type)
- Attributes

Entity & Entity type

Entity vs Entity Type

- Wikipedia: *“thing capable of an independent existence that can be uniquely identified”*
- *C*an be physical or logical
  - house/ car
  - house sale/ car service

Entity vs Entity Type

- Although the term is *entity* is most commonly used, we must distinguish between an **entity** and an **entity-type**
- **Entity-type** is a category
- **Entity** is an instance of a given entity-type
  - many such instances generally exist

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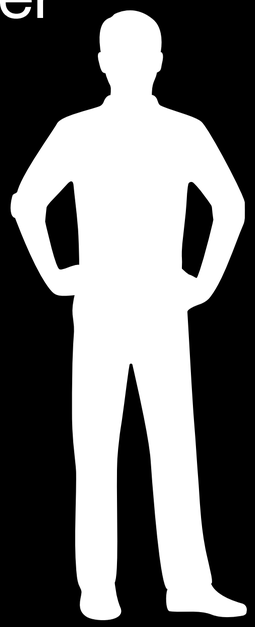

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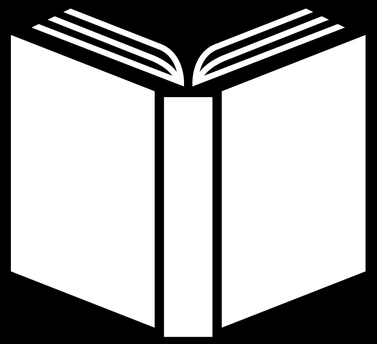

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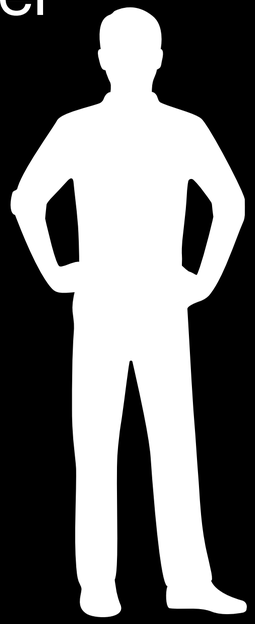
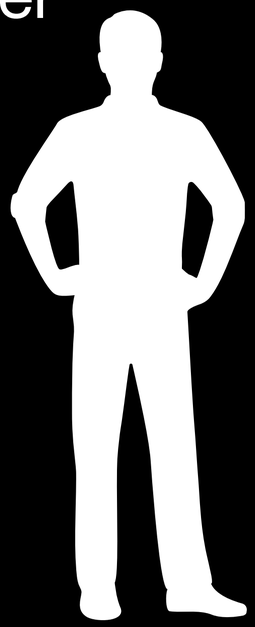


- Name
- Date of Birth
- Age
- Phone number
- Salary

Teacher



- Name
  - First Name
  - Last Name
- Date of Birth
- Age (can be derived from DoB)
- Phone number (can have multiple)
- Salary

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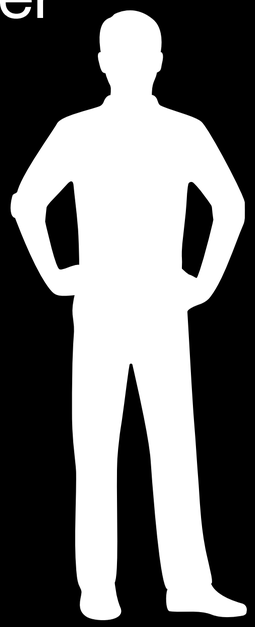
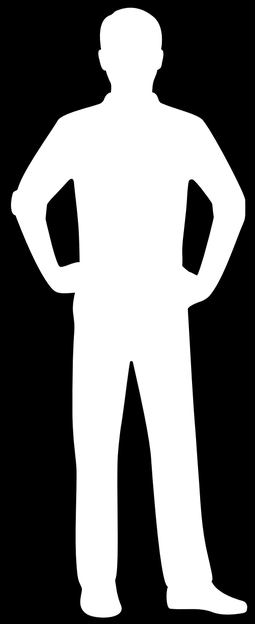
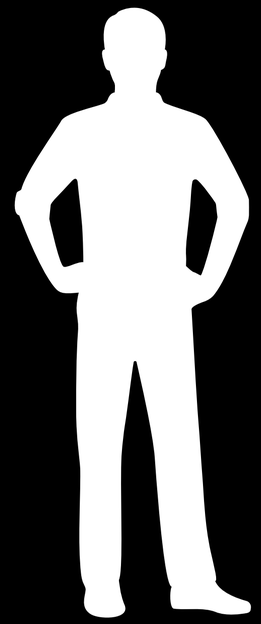


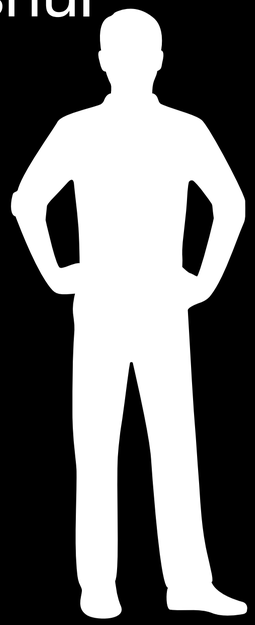
- Name [Composite Attribute]
  - First Name
  - Last Name
- Date of Birth
- Age (can be derived from DoB) [Derived Attribute]
- Phone number (can have multiple) [Multivalued Attribute]
- Salary





- How do we identify who is who?
- We need something to differentiate (uniquely identify) an entity

Priyanshul



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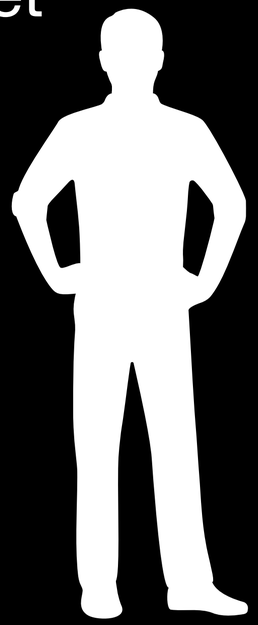
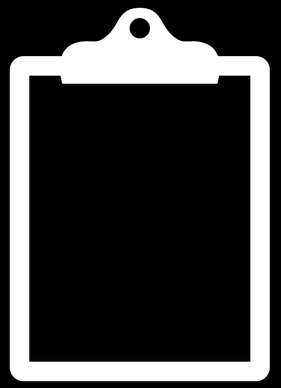


- How do we identify who is who?
- We need something to differentiate (uniquely identify) an entity

[Key Attribute] Can use phone number/ email ID/ employee ID, et cetera

Weak Entity type

- Cannot be uniquely identified
- Needs another entity type to identify it



Course
(eg: CS4.301: D&A)

Problem is that this same course is taught every year

Weak Entity type

- Cannot be uniquely identified
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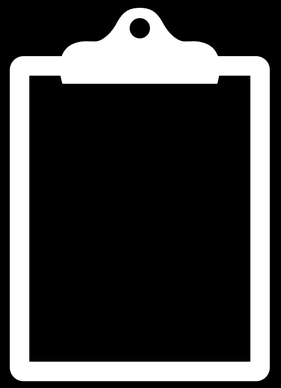
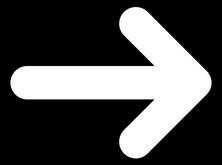


Course
(eg: CS4.301: D&A)



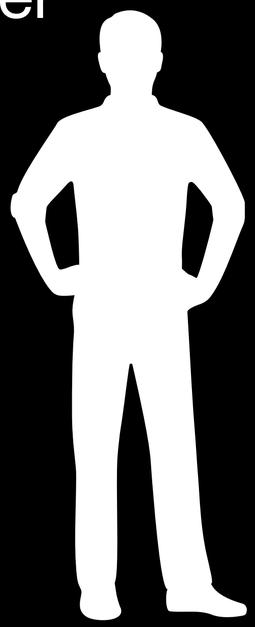
Semester
(eg: Monsoon 2022)

Relationship & Relationship type

yes please & toxic

- Similar to entity vs entity-type: relationship-type is a category and relationship is an instance of a relationship-type
- A relationship-type gives a relationship between two (or more) entity-types
  - The entity-types are called as **roles** in this relationship-type

Teacher



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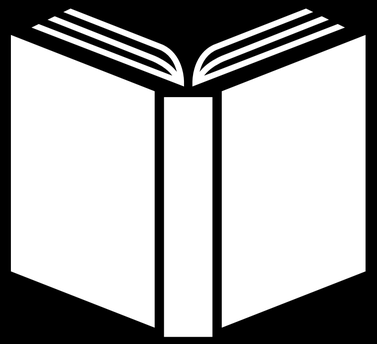

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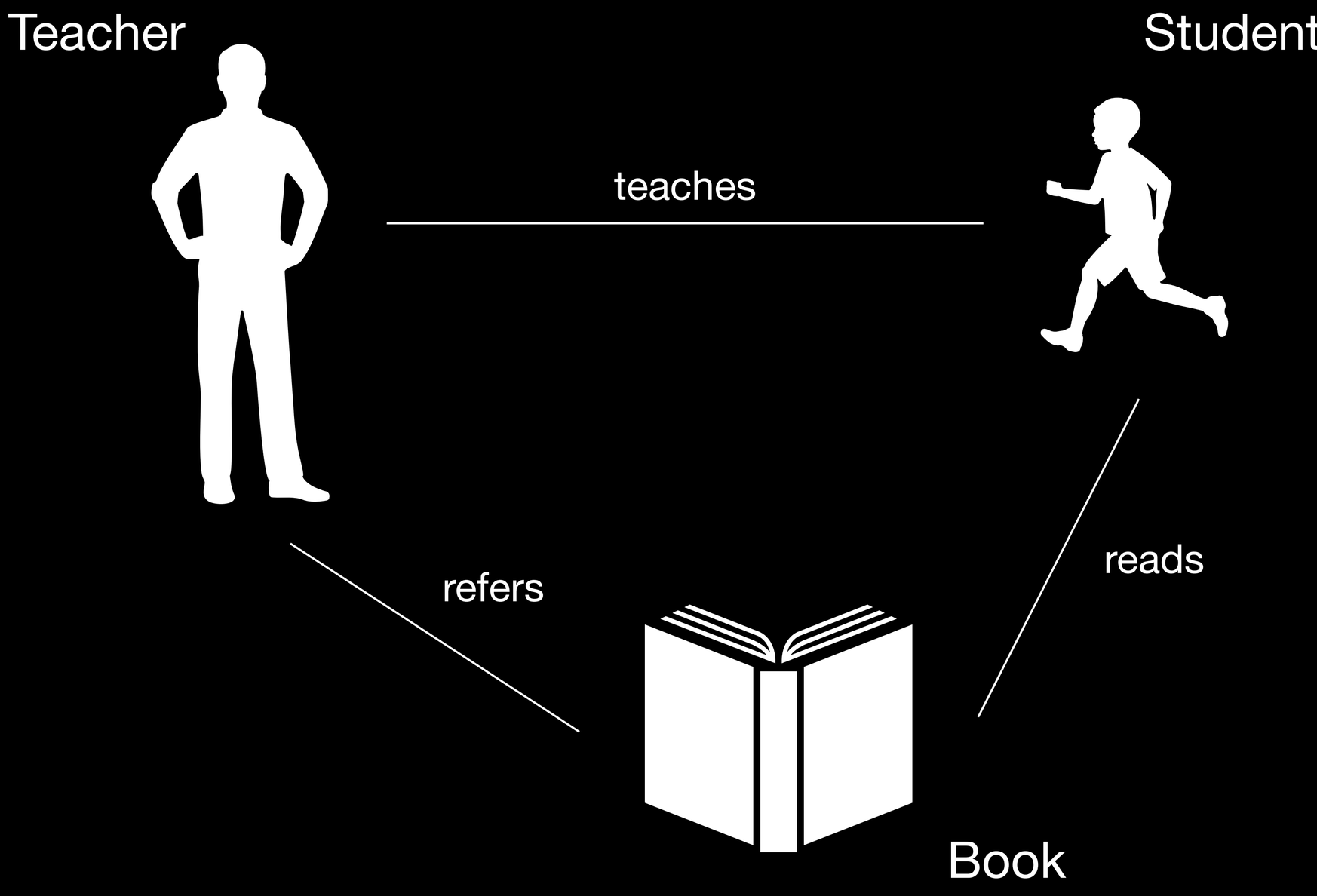
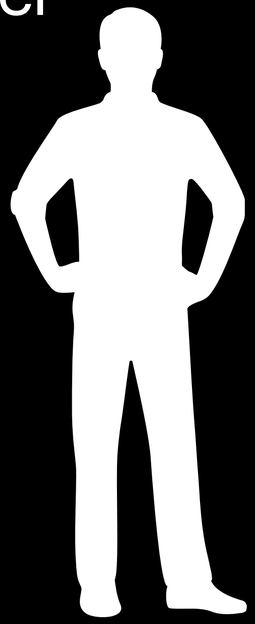
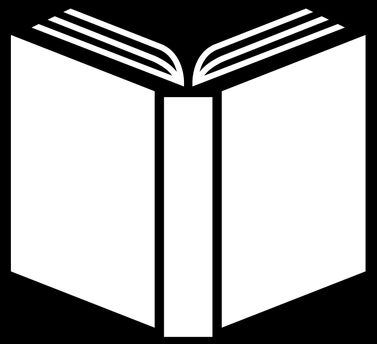

Teacher
Student
teaches
refers
reads
Book

Teacher



Student

teach



Book

Notations

Entity

Weak Entity

Relationship

Indentifying Relationship

Attribute

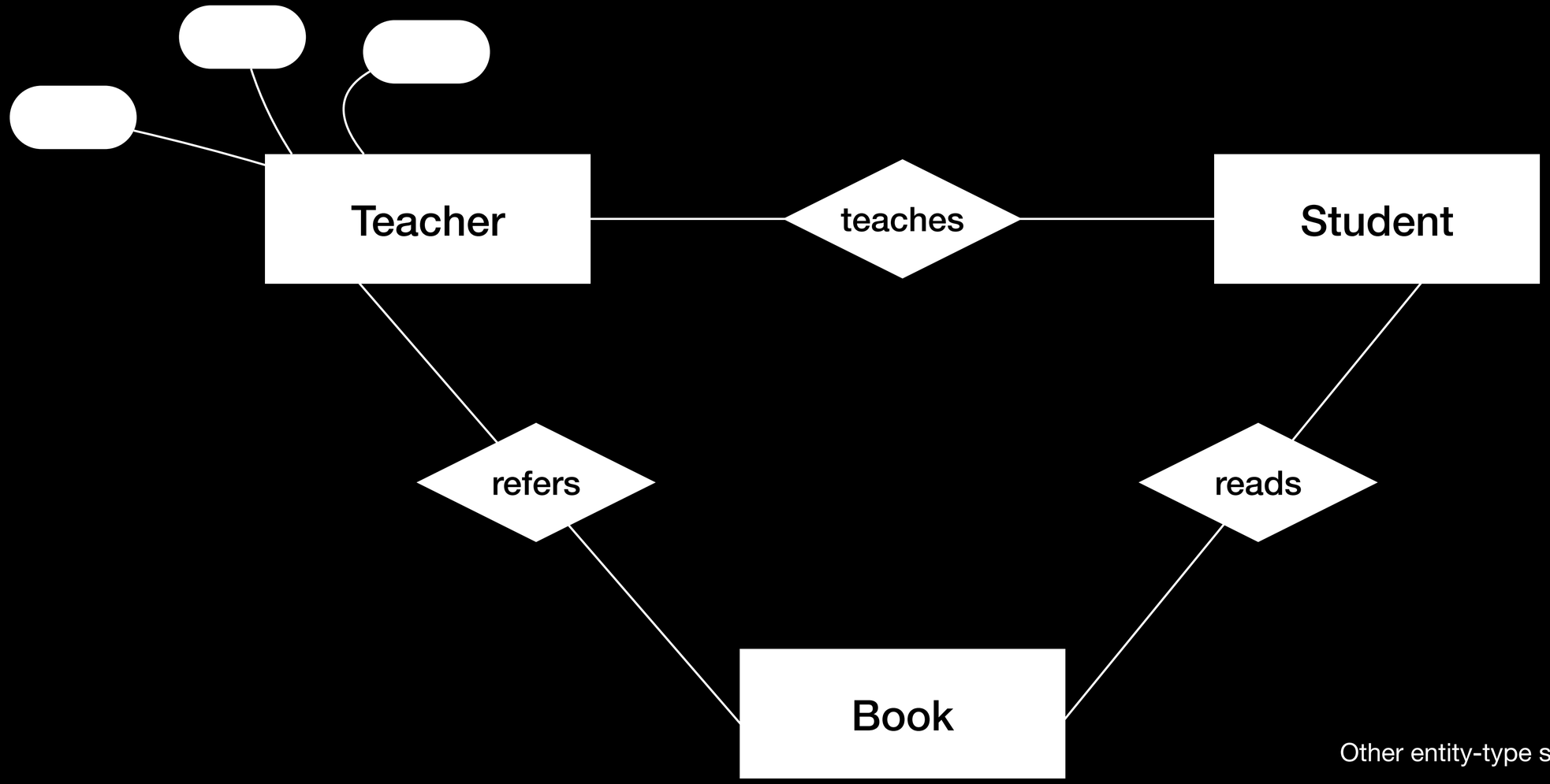
Key Attribute

Multivalued Attribute

Composite Attribute

Derived Attribute

Binary Relationships



Other entity-type sets will have attributes too

Ternary Relationship

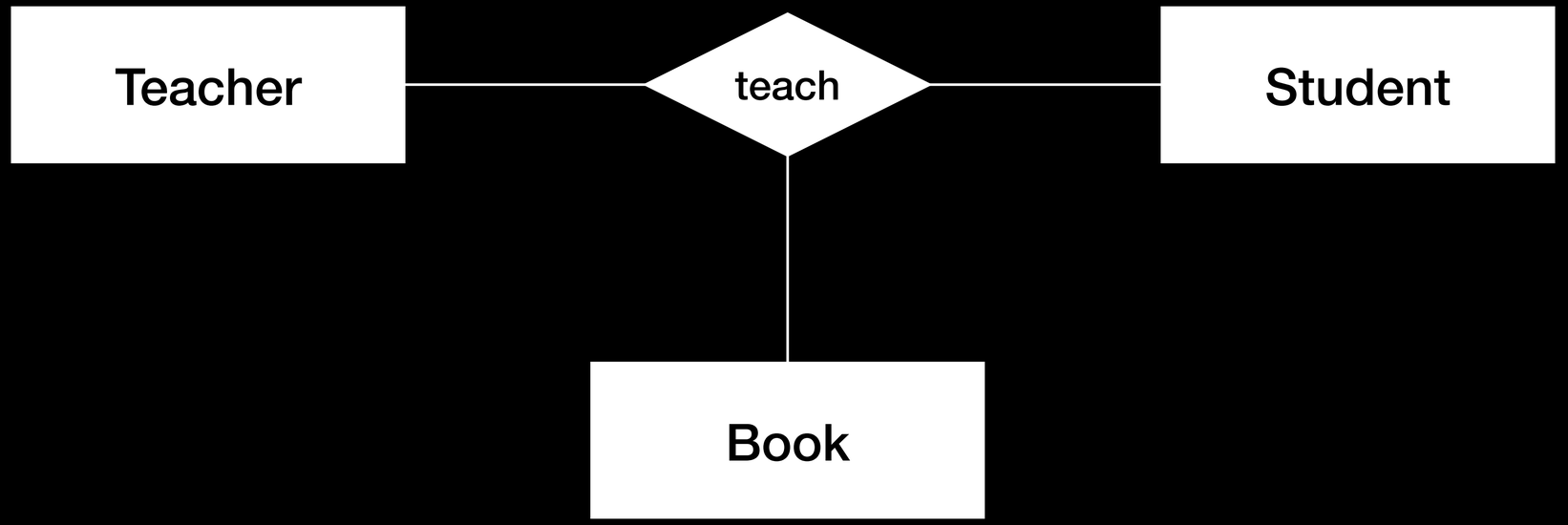
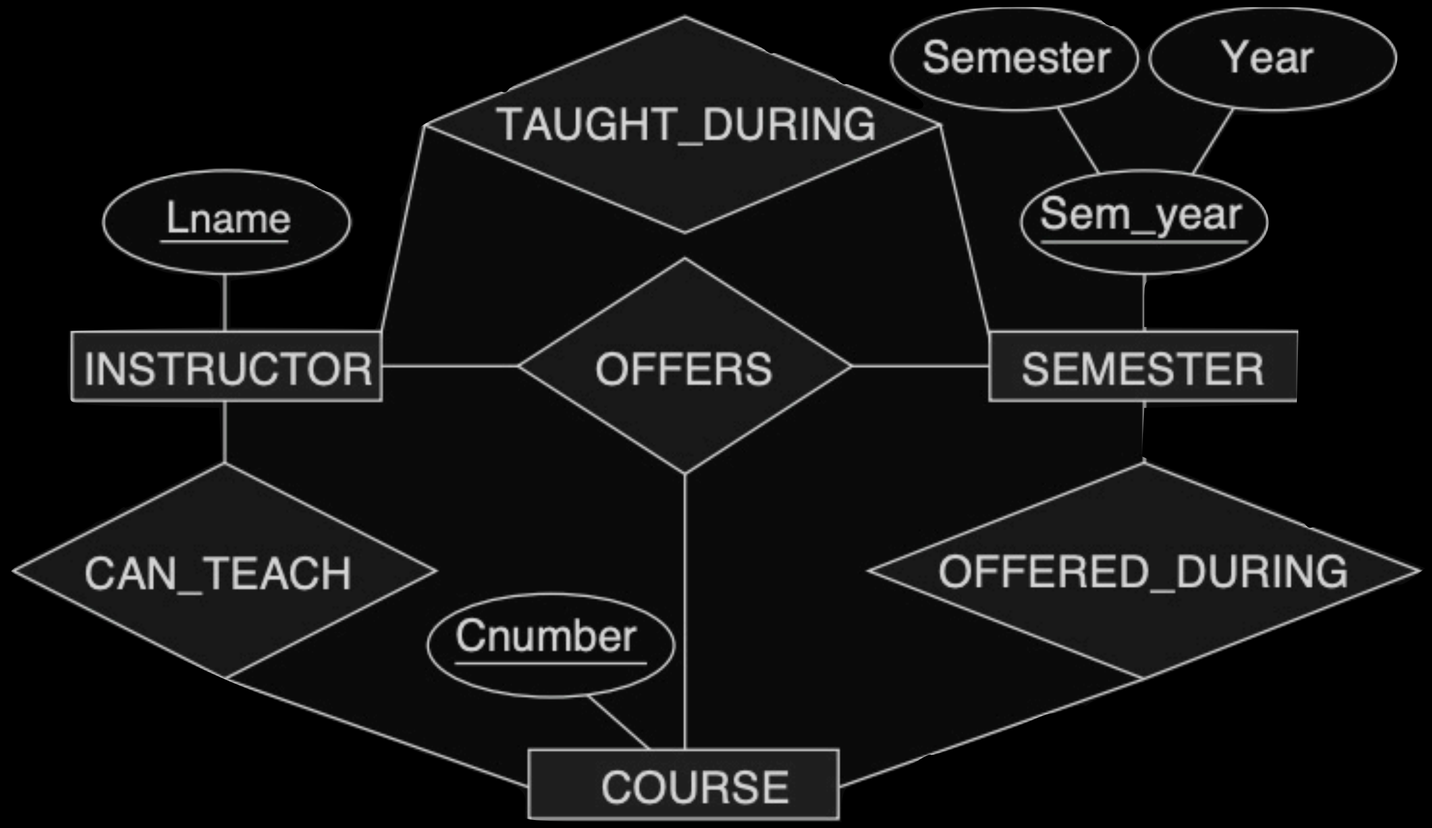
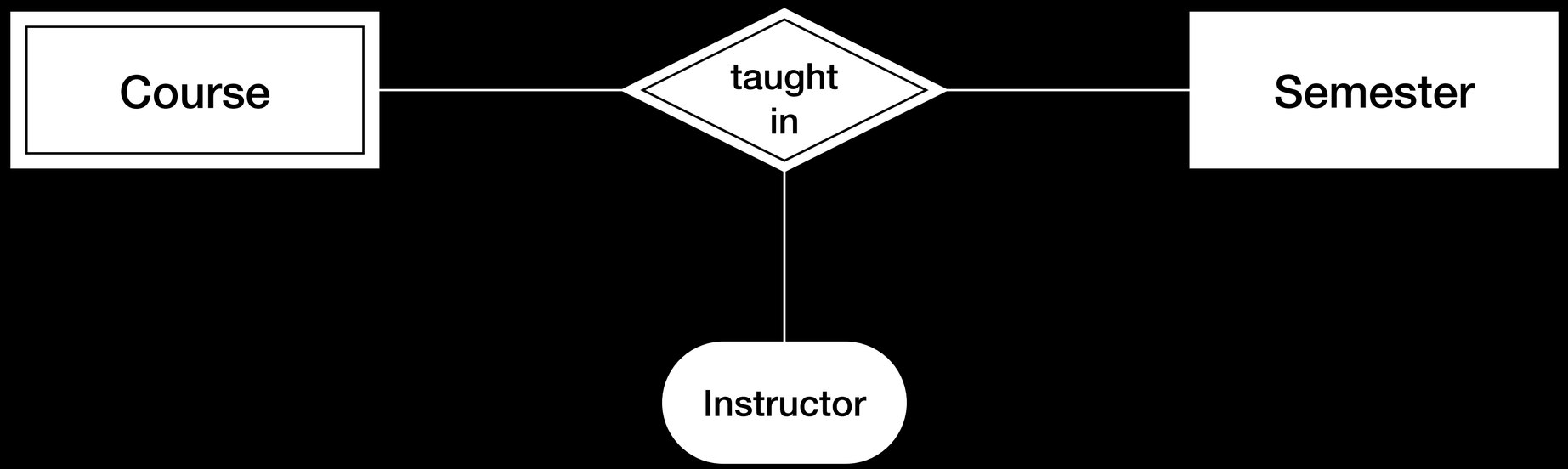


Figure 3.18
Another example of ternary versus binary relationship types.



Identifying Relationship

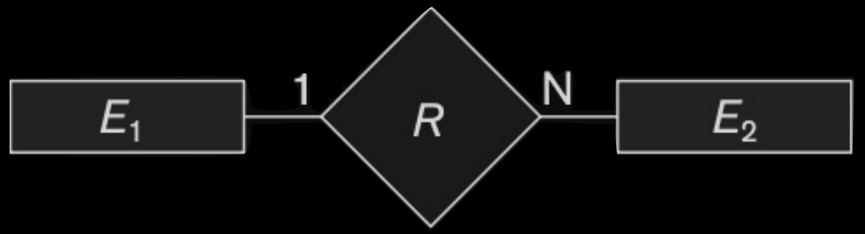
Relationship-types can have attributes!



Constraints on Relationship types

Cardinality Ratio

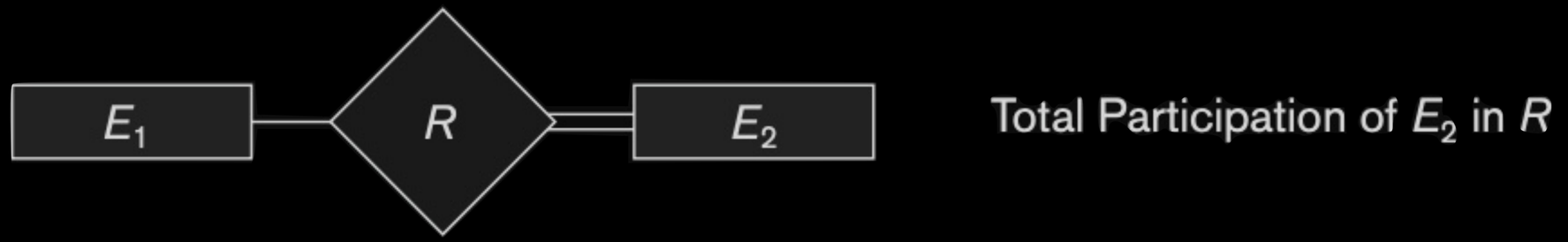
- Specifies the *maximum* number of relationship instances that an entity can participate in
  - 1:1
  - 1:N
  - N:1
  - M:N



Cardinality Ratio 1: N for $E_1 : E_2$ in R

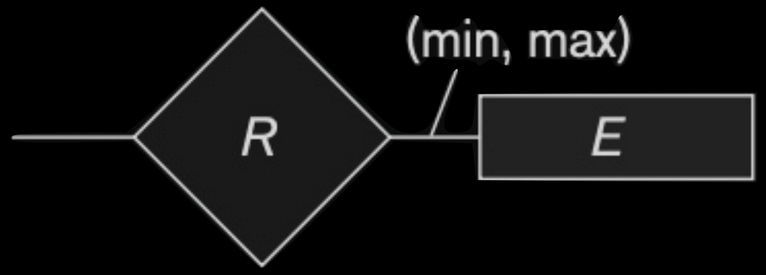
Participation Constraint

- Specifies whether the existence of an entity depends on its being related to another entity via the relationship type
- Specifies the *minimum* number of relationship instances that each entity must participate in
  - **total**: must participate in at least one relationship
  - **partial**: may/ may not participate in a relationship



Alternative notation

- Problem arises that you can only mention min=1 and max=N with both cardinality ratios and partial/total participation
- Can user ***(min, max)*** notation
  - Each entity must participate in *min* and at most *max* relationships



Structural Constraint (min, max) on Participation of *E* in *R*

Example of a special type of relationship called **Self Relationship**

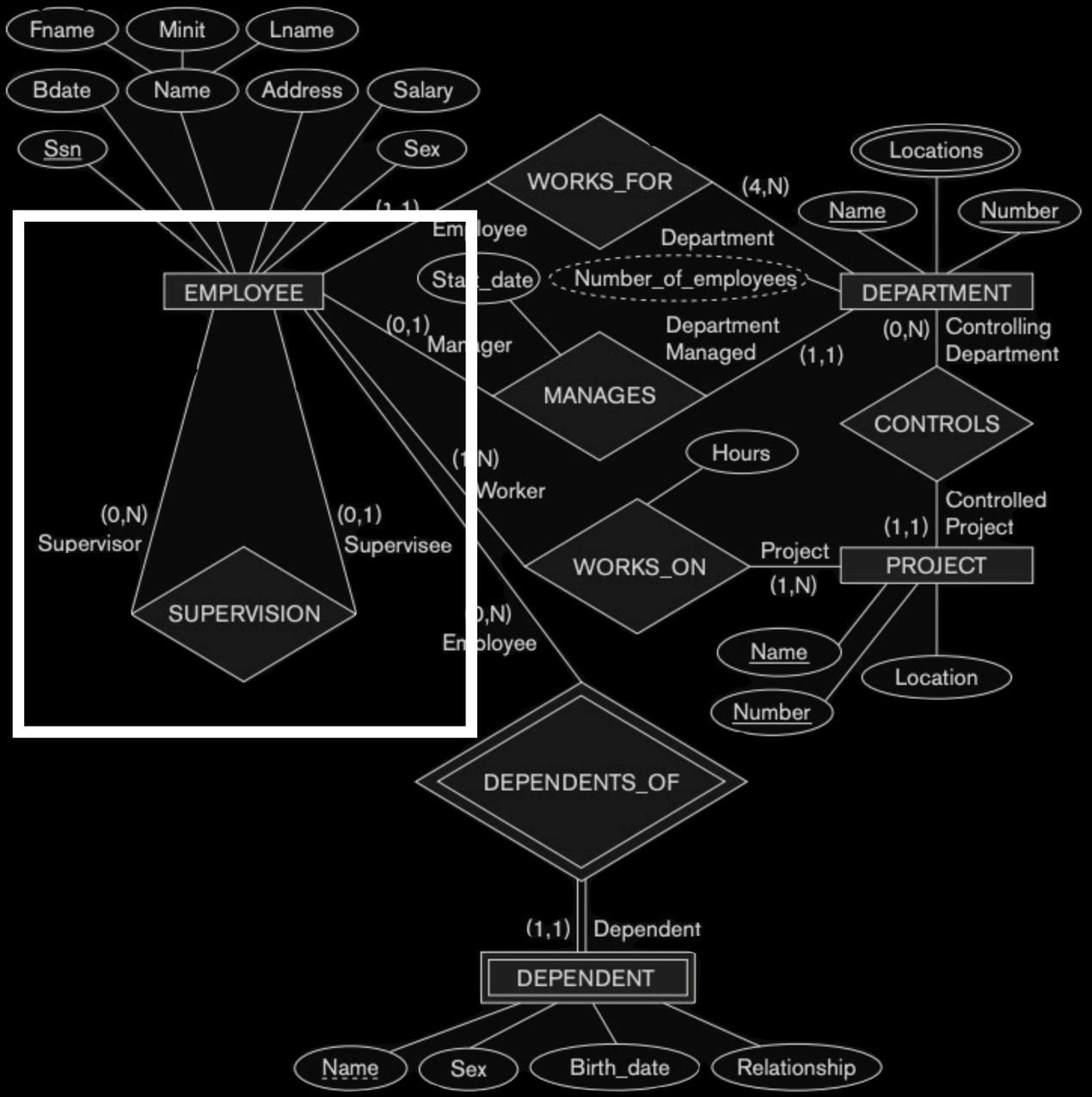


Figure 3.15
ER diagrams for the company schema, with structural constraints specified using (min, max) notation and role names.

Let’s Practice

Homework 1

Requirements Documents

Objectives

- Define a mini-world
- Define the entity types of the mini-world
- Understand how they interact with each other
- Translate these interactions into relationships
- Define boundaries
- Define basic system behavior

Requirements Documents

Sections

- Introduction
  - define your mini-world, set boundaries
- Purpose of the DB
  - why does the DB exist? what does it offer that non-DB solutions don’t?
- Users of the DB
  - who uses it? what do they do with it?
- Applications of the DB
  - what all applications exist for your DB in the given mini-world?

Requirements Documents

Sections

- Database Requirements
- Functional Requirements
  - Descriptions of data to be entered into the system
  - Descriptions of system reports or other outputs
  - Access control
  - For this course, functional requirements should relate to the tasks that the database system will perform — usually in the form of **access**, **searching**, **reports** and **sorting** (queries). FRs may also provide details around the data that must be stored in the DB.

Project

1
Requirements
Document

2
ER Diagram

3
Normalisation

4
Coding

Tips and Suggestions

- Brevity is king
  - Be precise, concise and well-rounded
  - More does not imply better
- Separate requirements from rationale
  - Requirement is a statement of one thing a product must do or a quality it must have
  - Justify your assertions later
- Manage your expectations
  - DO NOT choose a project that you will regret coding
  - DO NOT choose a project with minimal complexity
- Keep revisiting the requirements document during phases. DO NOT deviate from your requirements

Administrative stuff

- Teams
  - 3 people in a team— already released on Moodle
  - will remain same throughout this course
- Approaching TAs
  - TA office hours shared on Moodle
  - mailing list shared on Moodle
  - be formal — WhatsApp messages will be ignored (each TA’s MMV)
- Late Days
  - 8 late days in total, 8 submissions (4 HW + 4 Project phases) in total
  - Max of 2 can be used on 1 submission

I Heard you like requirements
SO I gave you requirements for your requirements
meme-generator.com

Vacation.