Data Modeling Using the Entity-Relationship (ER) Model

Khalid Mahmood

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Entity-Relationship Model Concepts

- Entities
  - Specific ***things*** or ***objects***, e.g. student, course
  - Analogous to *class* of *OOP*
  - Holds Set/Collection of objects: *Entity set*
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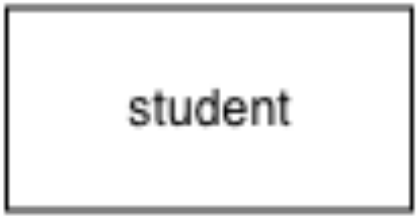

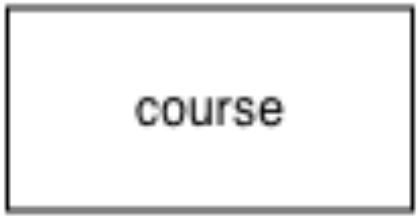

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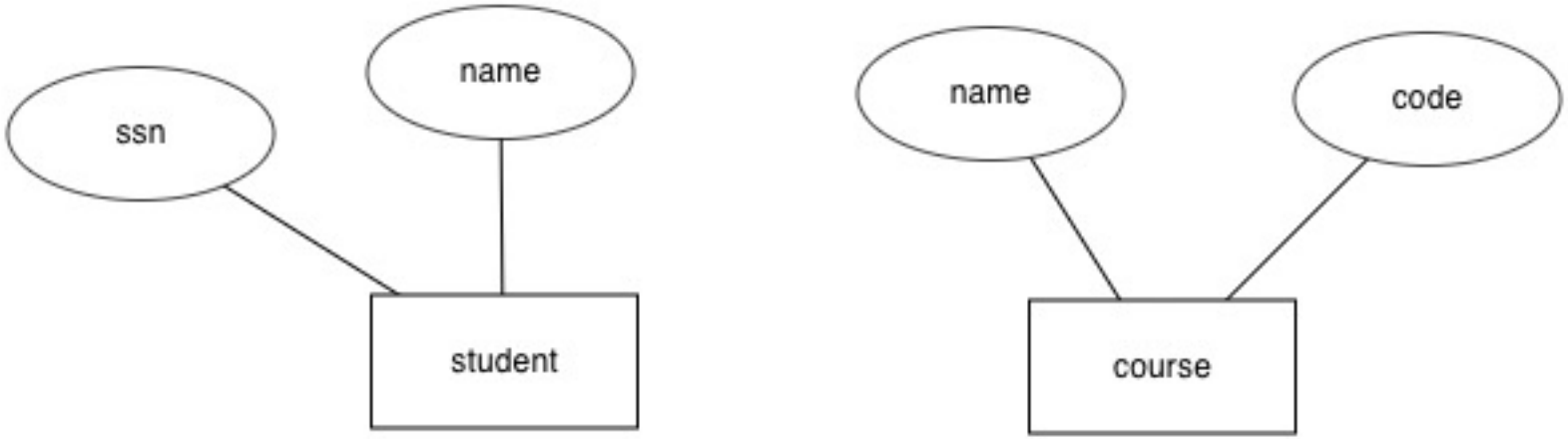

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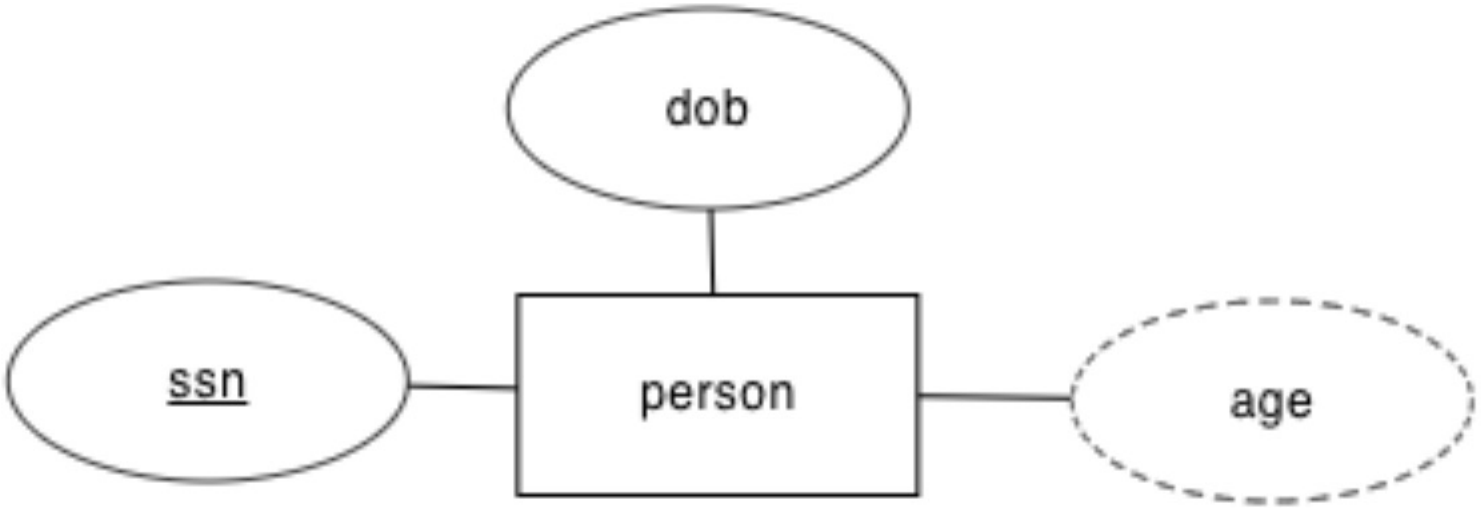

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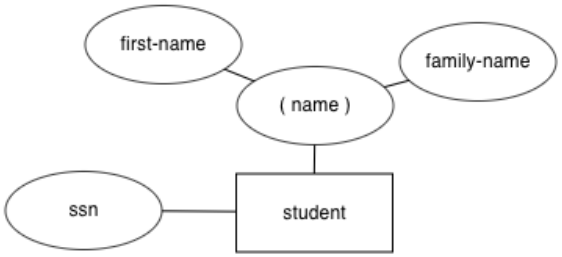
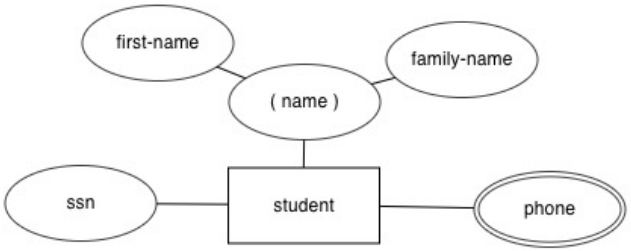


- Multi-valued: *Multiple values* for a attribute. E.g., *phone*



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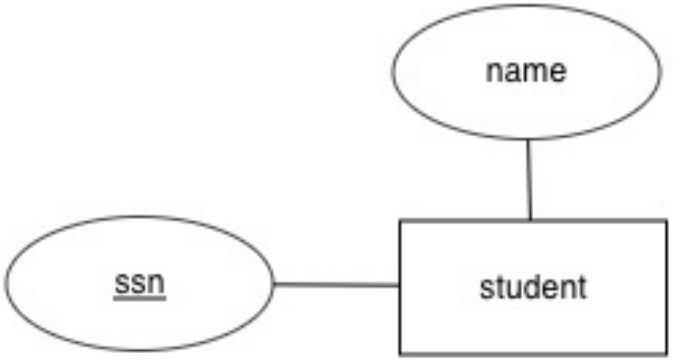

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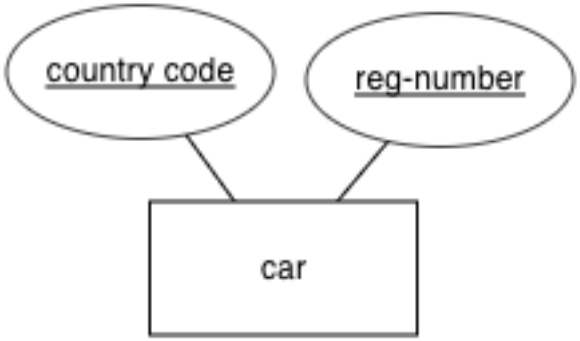

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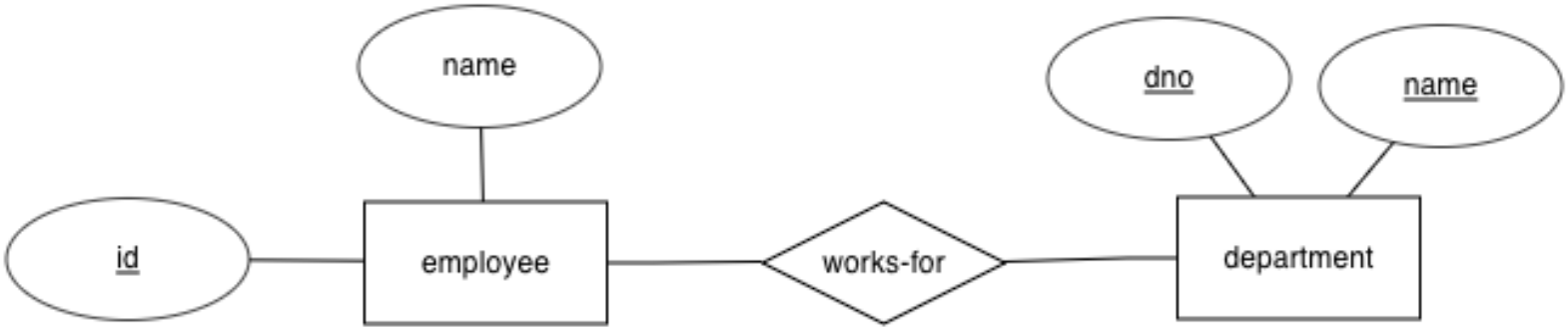

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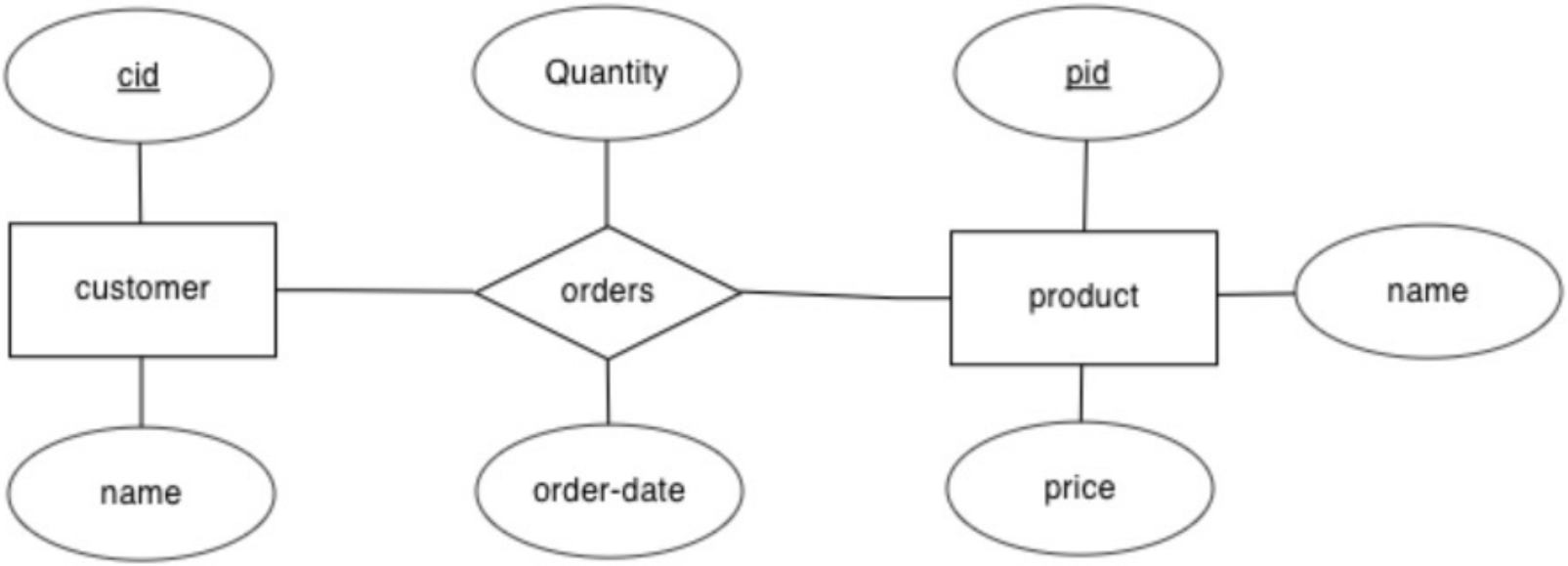

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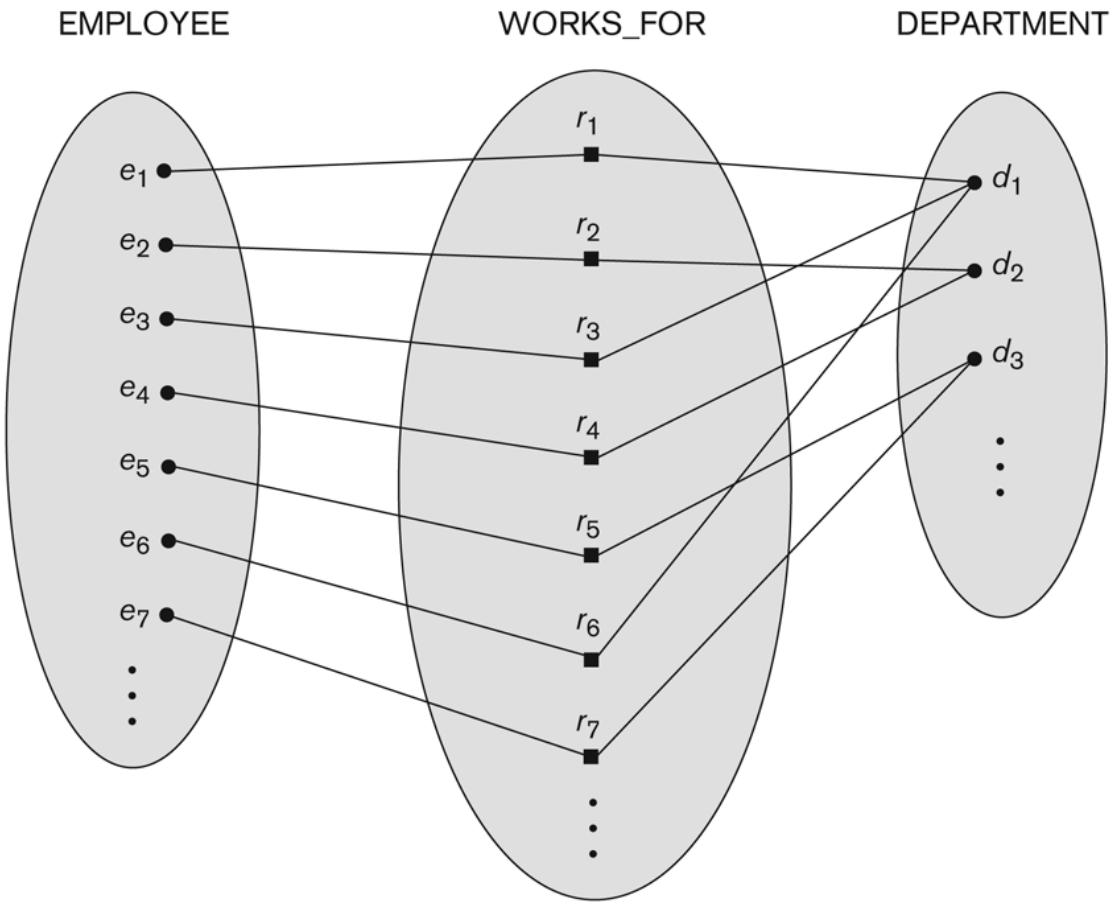

Constraints on Relationships

- **Cardinality Ratio** / Ratio constraints
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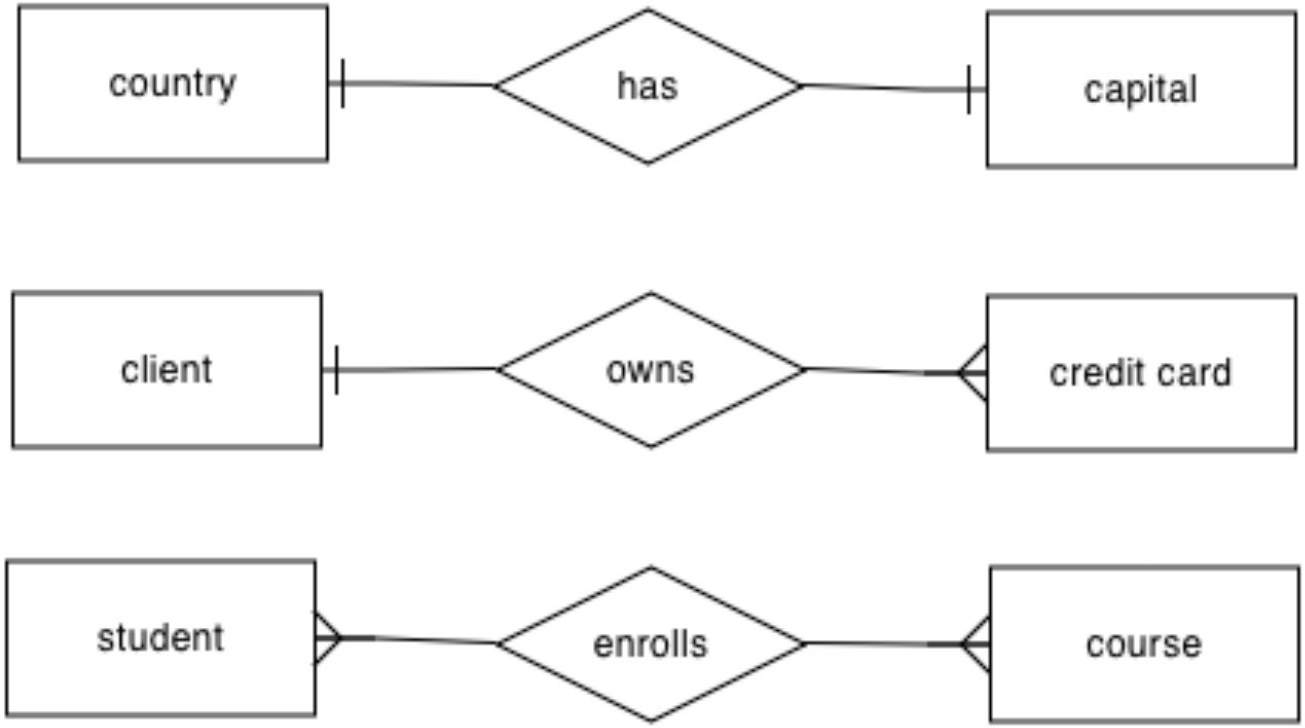
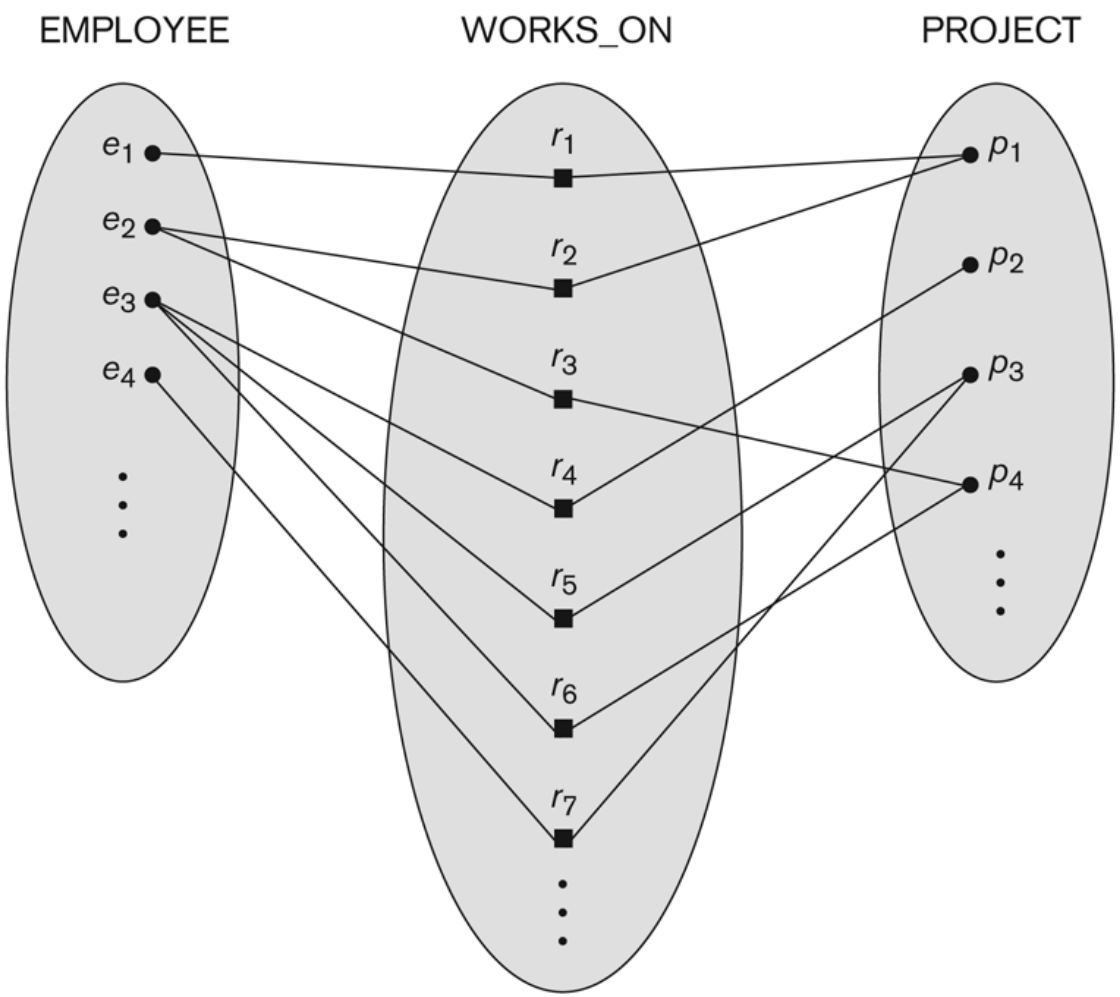


Many-to-Many Relationship



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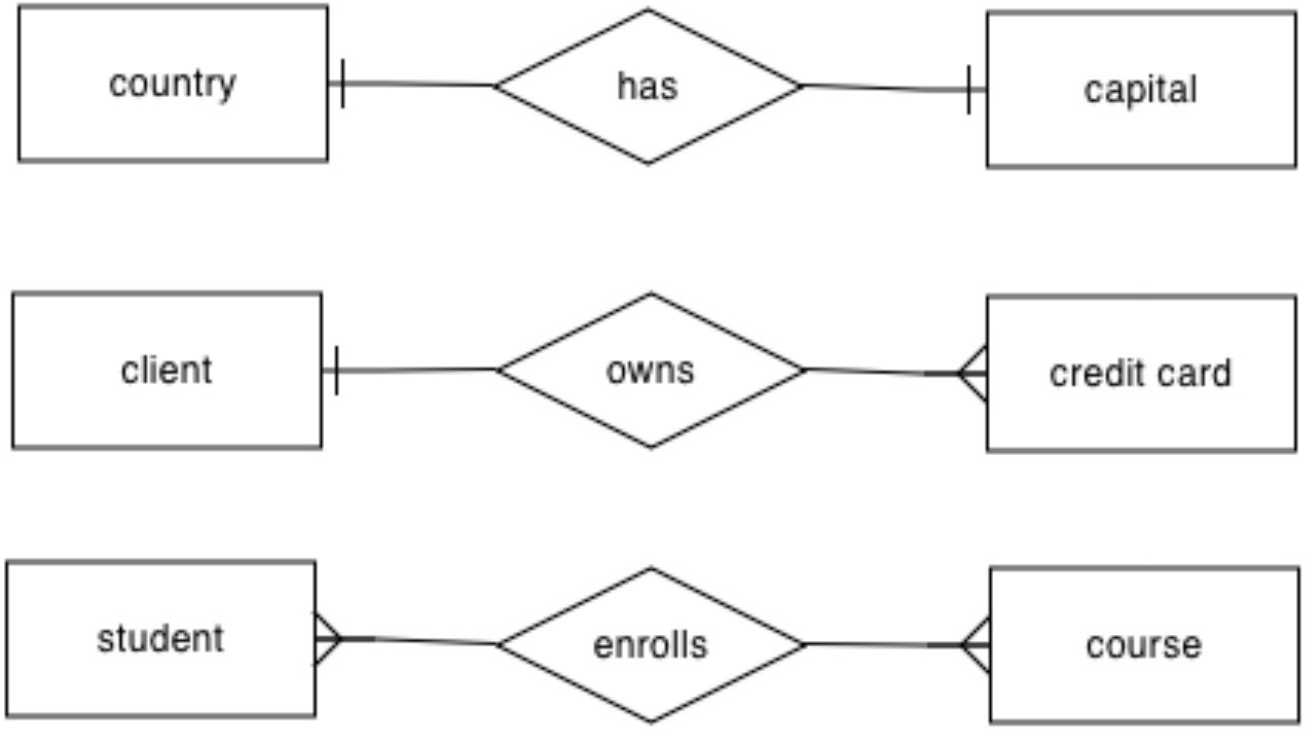

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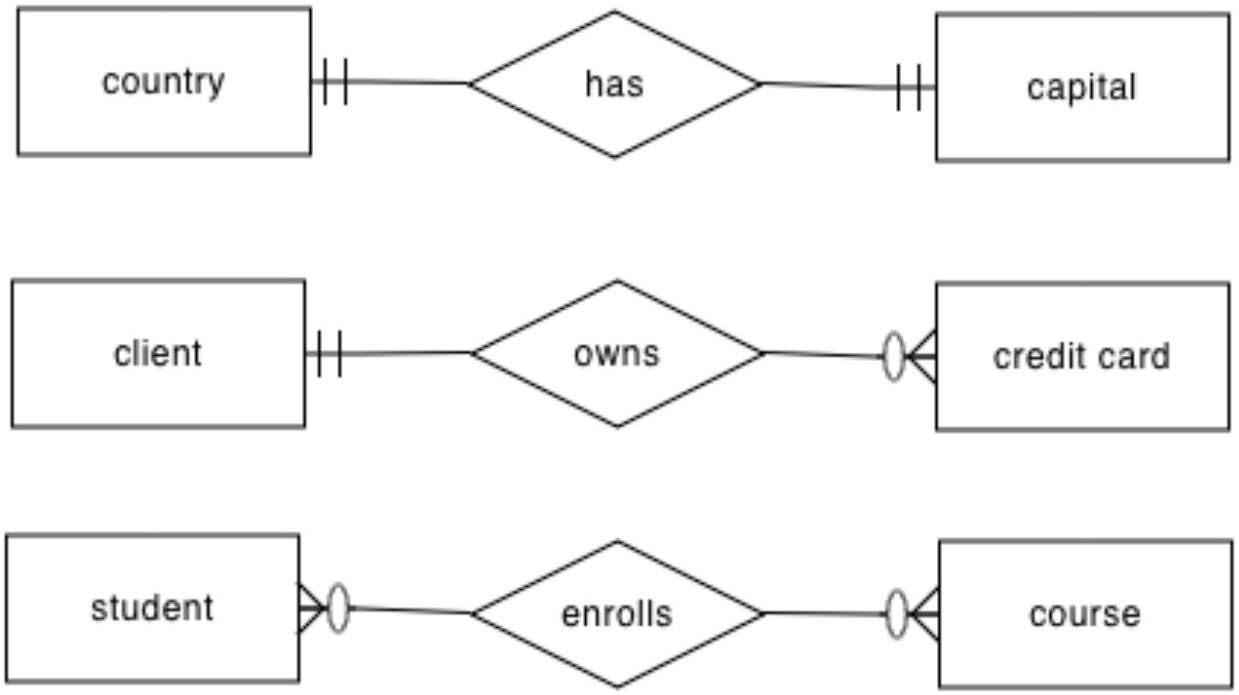

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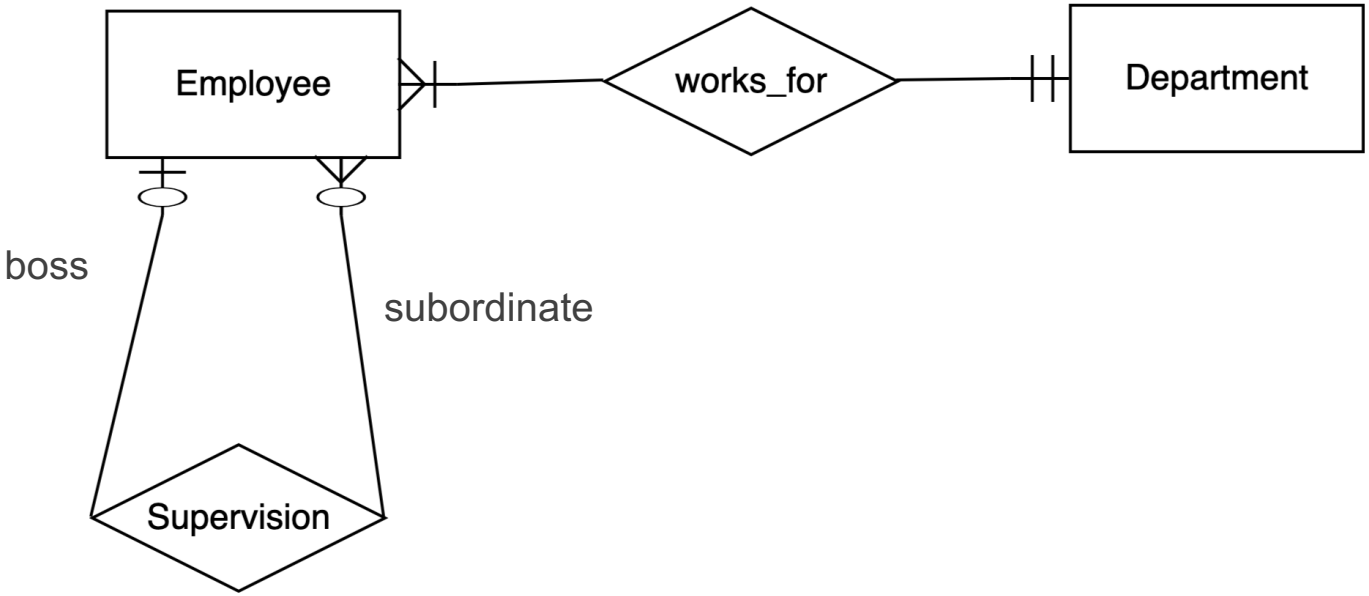

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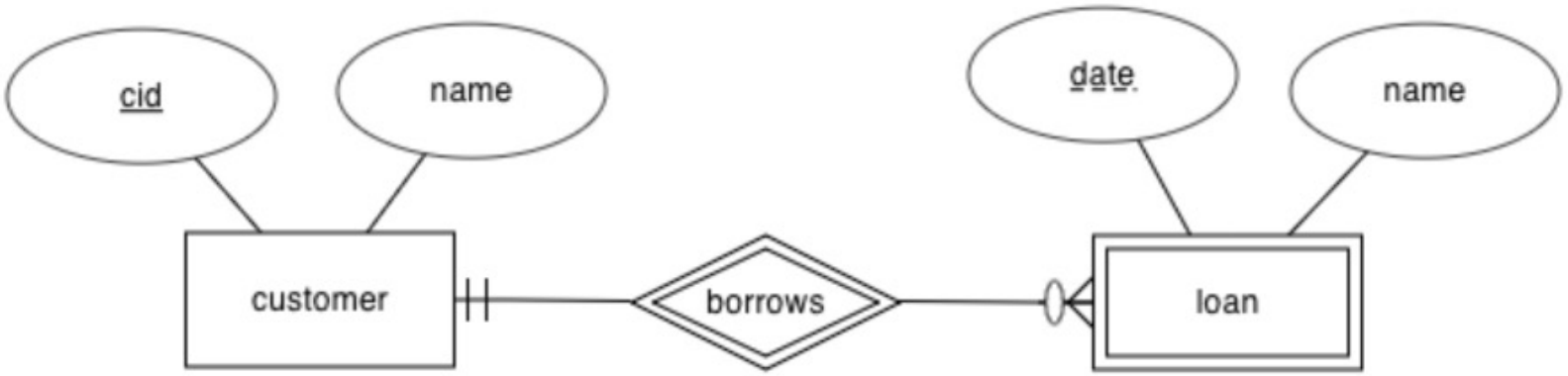

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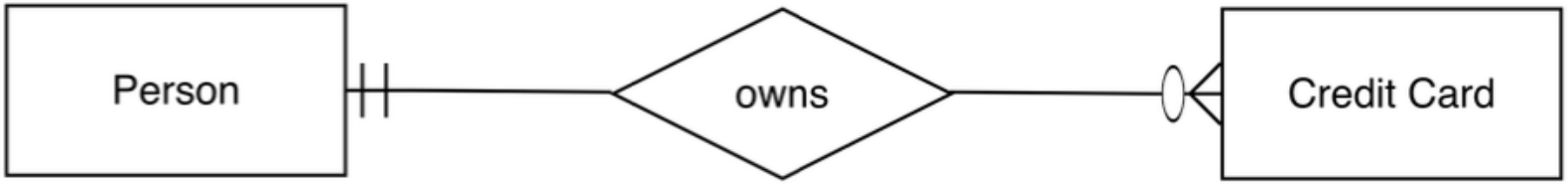

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Exercise 4:

The company is organized into DEPARTMENTs. Each department has a name, number and an employee who *manages* the department and a number of other people working for it. We keep track of the start date of the department manager. A department may have several locations.

Each department *controls* a number of PROJECTs. Each project has a unique name, unique number and is located at a single location.

For each employee, the following information is kept: name, social security number, address, salary and sex. Each employee may *have* a number of DEPENDENTs. For each dependent, the DB keeps a record of name, sex, birthdate, and relationship to the employee.

Each employee *works for* one department but may *work on* several projects. The DB will keep track of the number of hours per week that an employee currently works on each project. It is required to keep track of the *direct supervisor* of each employee.

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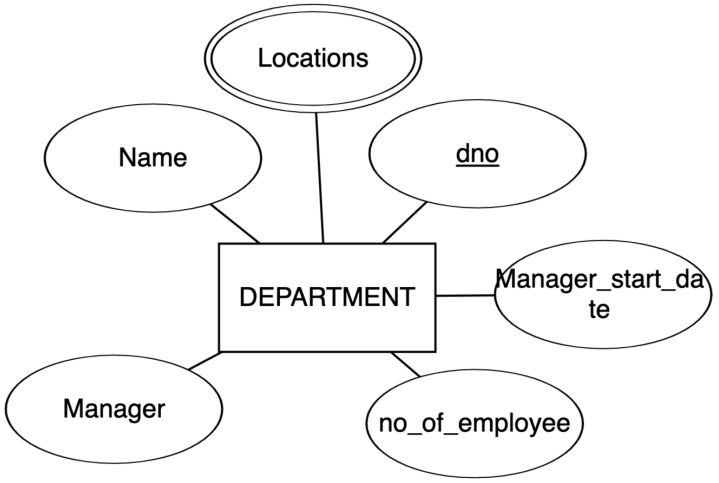

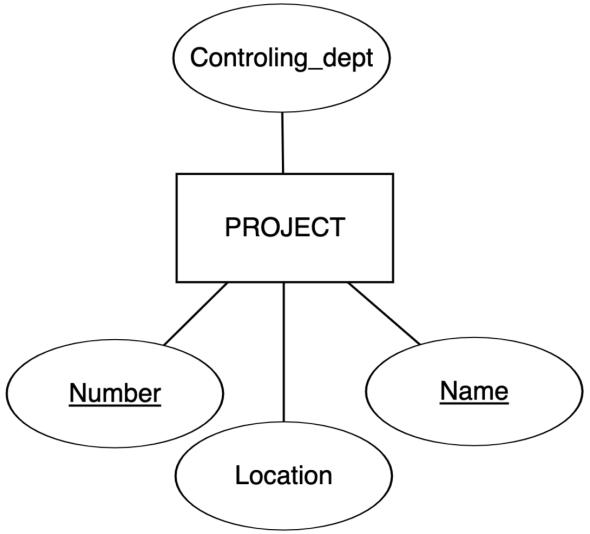

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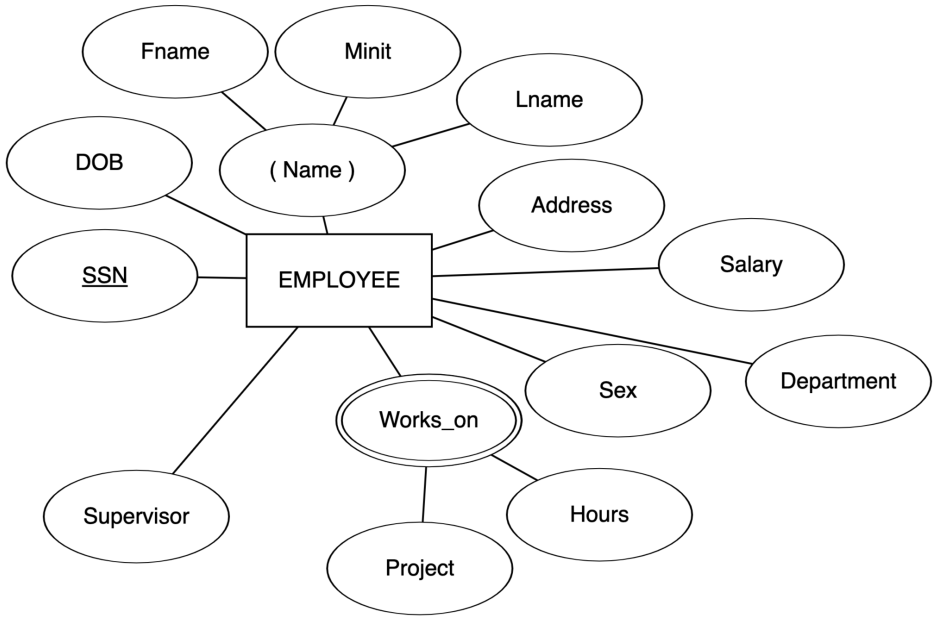

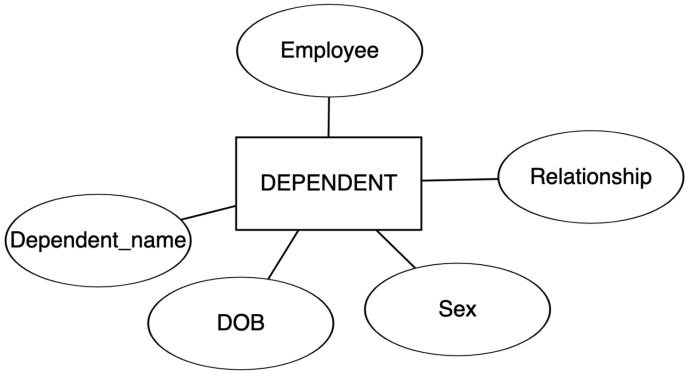

Exercise 4 (Using Different notation):

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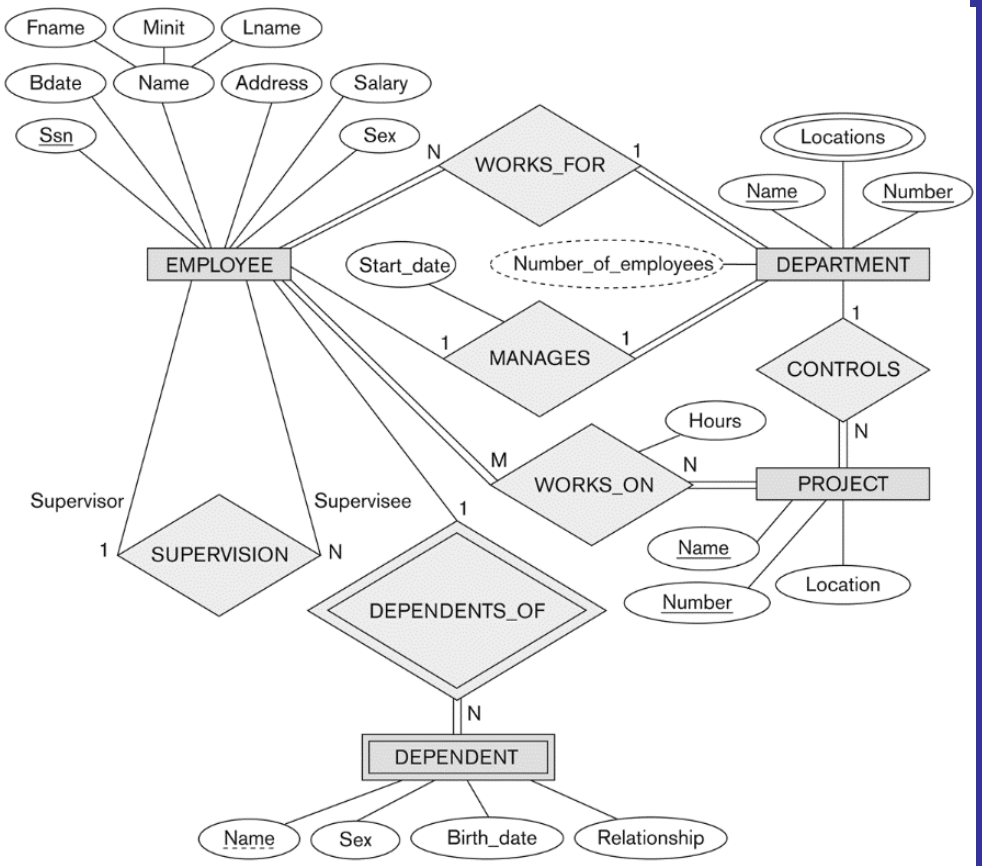
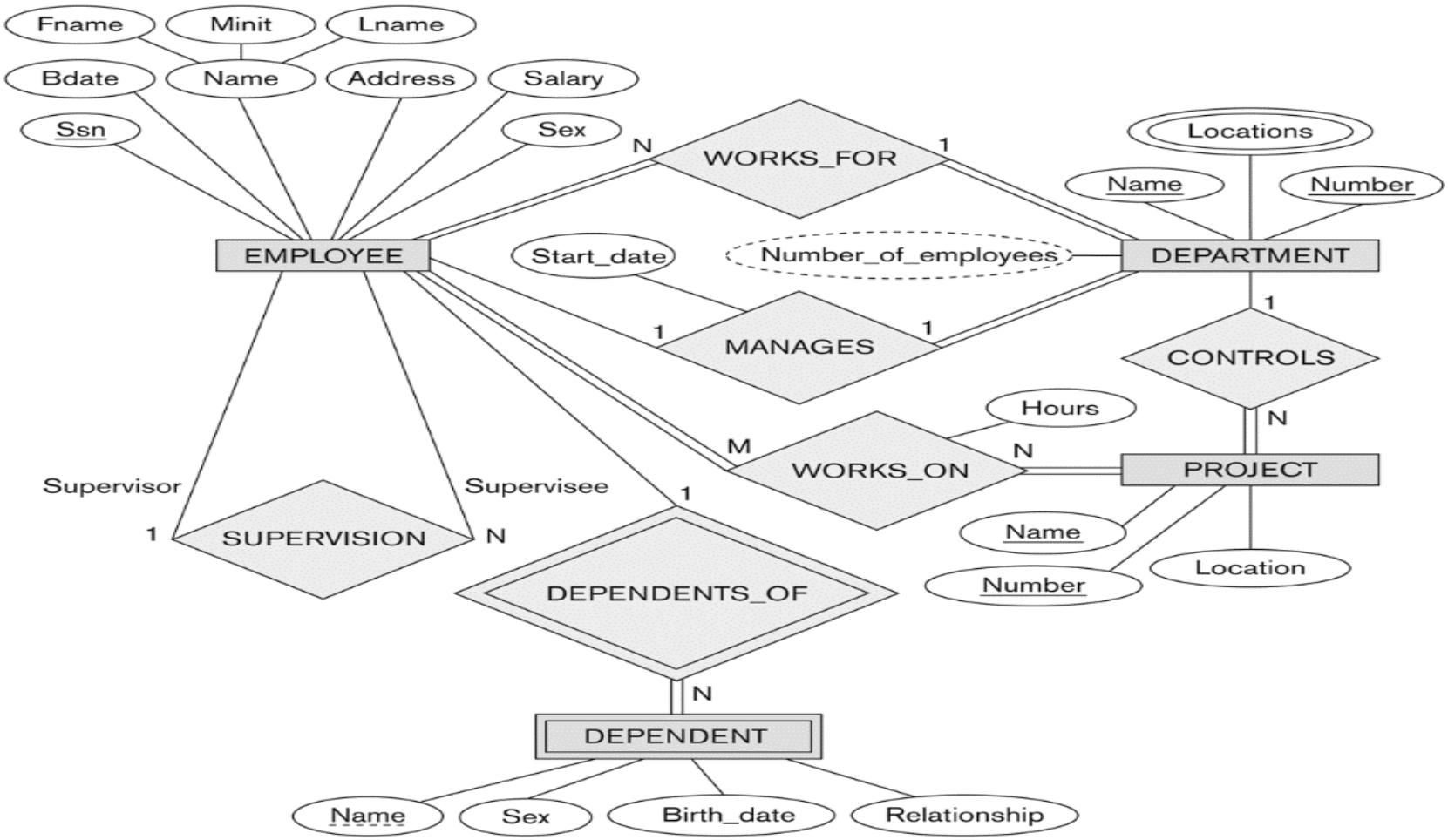
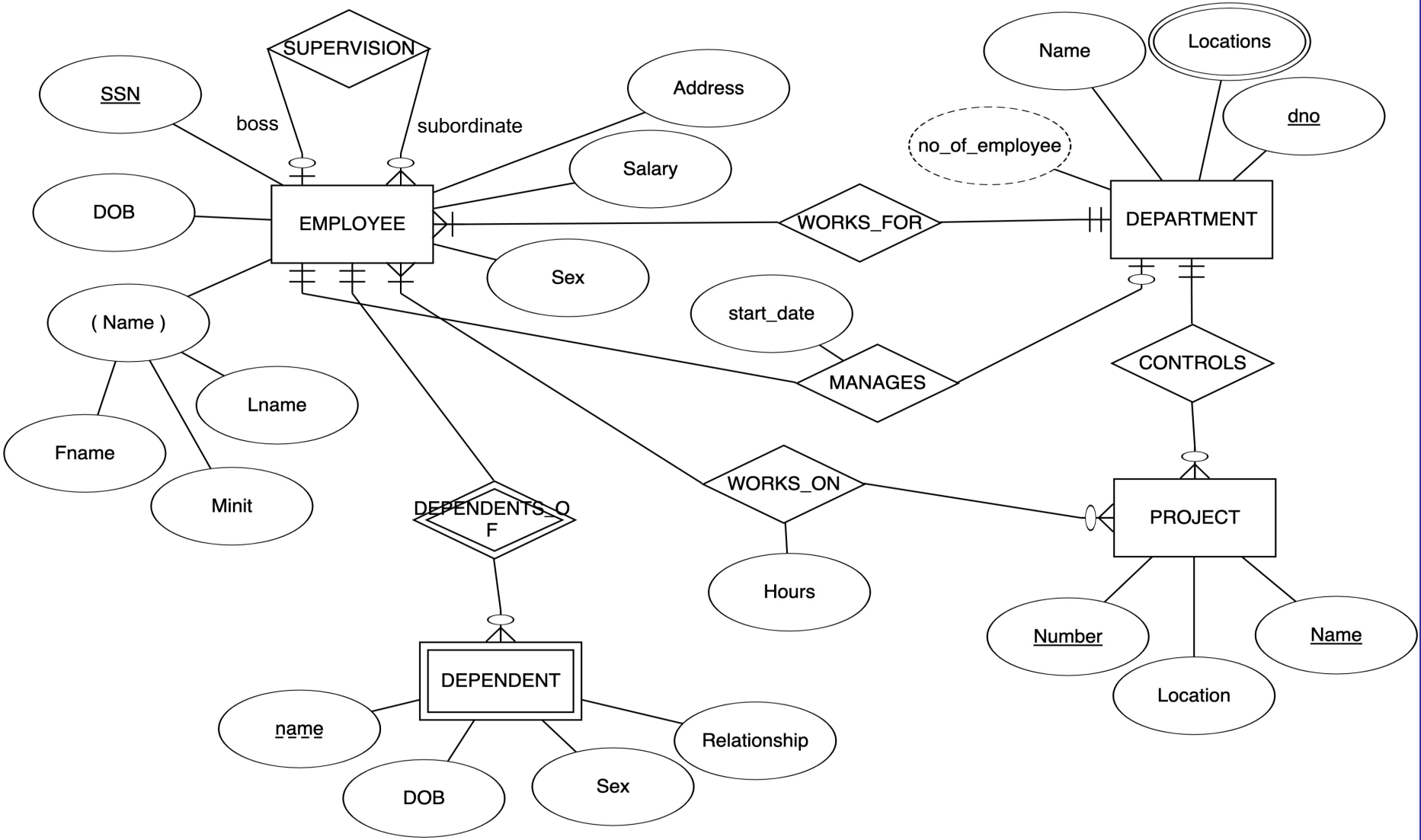


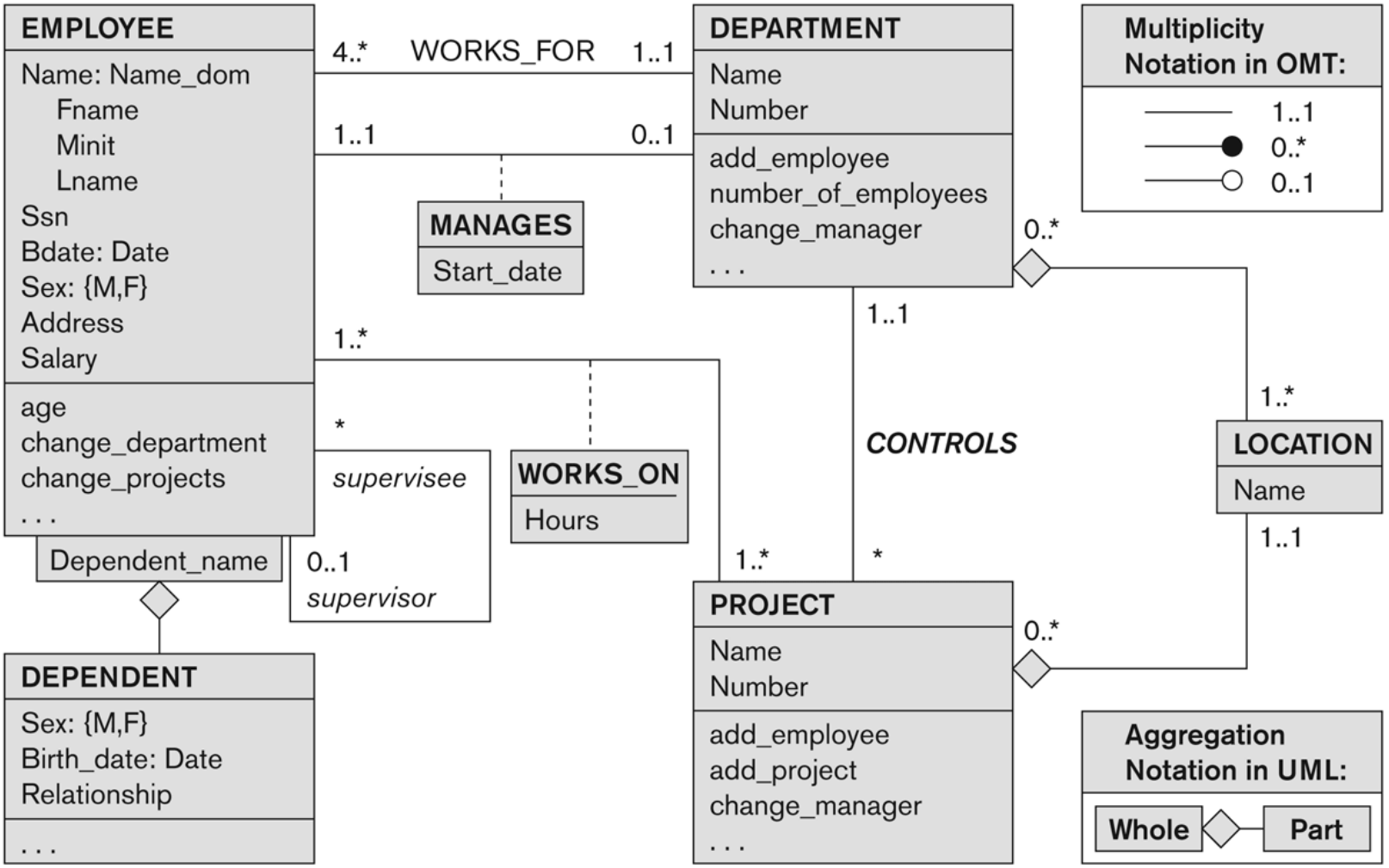
Exercise 4 (model from prev slide)



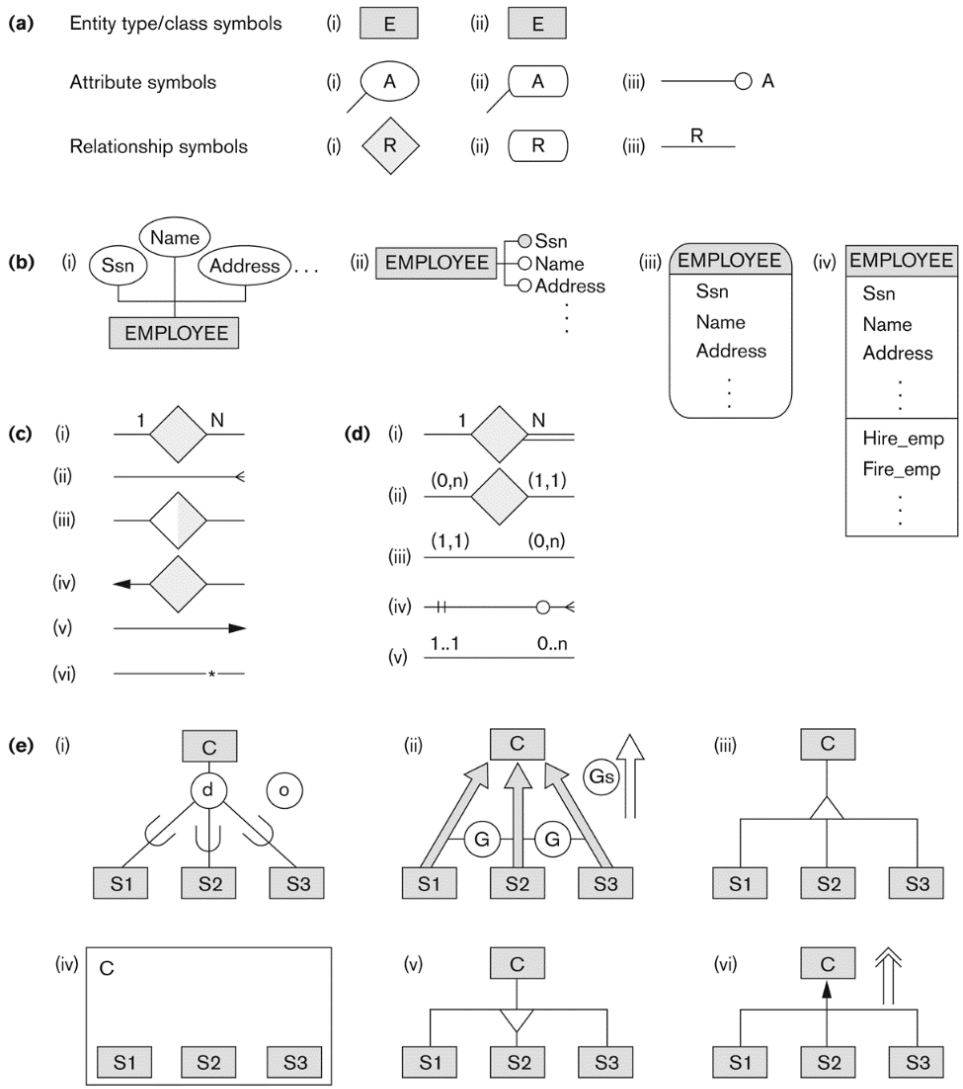
Exercise 4 (Another notation):



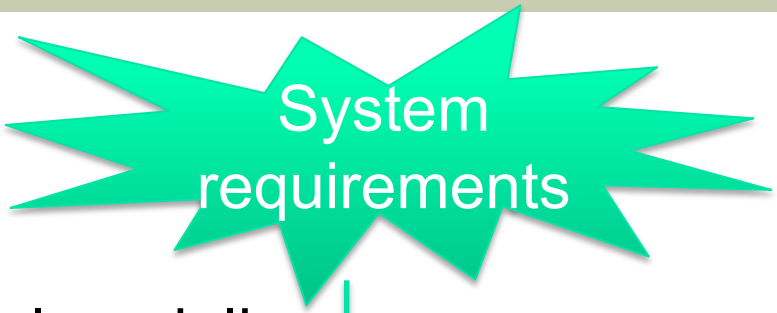
UML class diagram for COMPANY database schema



Other alternative diagrammatic notations



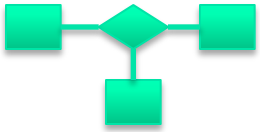
Database design: full picture



A university offers courses to students.
For every student we register name, surname, address, year and student ID.
Every course instance is given on a specific year by a professor,
for whom we store the income and the supervisor.
For each exam we save the date and the grade of the student.

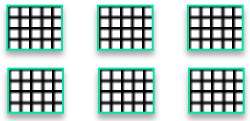
Natural language

Conceptual modeling



More formal
Not ambiguous

Logical modeling



Entity-Relationship diagram

No implementation or DBMS specific details

Physical design

Relational model

Why a conceptual model (e.g. ER)?

- More formal than natural language.
  - Avoid misconceptions/multiple interpretations.
- Implementation independent (of DBMS).
  - Less technical details.
- High-level description.
  - Easier for people without a technical background
- Documentation.
- Comes with model transformations to be mapped to an implementation data model.
- CASE Tools automates ER to DB design

Published: Ex-1.1-ER Diagrams.pdf

For drawing ER-Models: www.erdplus.com

Full slide from book authors:

Chapter03.pdf

May be useful for revision/exam for exam (?)