SECD2523 DATABASE

TOPIC 5
ENHANCED ENTITY RELATIONSHIP
MODELLING

Content adapted from Connolly, T., Begg, C., 2015. Database Systems: A Practical Approach to Design, Implementation, and Management, Global Edition. Pearson Education.

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LECTURE LEARNING OUTCOME

By the end of this lecture, students should be able to:

01	Define basic concepts associated with EER diagram

02	Produce EER model to represent information to application system

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Introduction

- Limitations of basic concepts of the ER model and requirements to represent more complex applications using additional data modeling concepts.

- Most useful additional data modeling concept of Enhanced ER (EER) model is called specialization/generalization.

- A diagrammatic technique for displaying specialization/generalization in an EER diagram using UML.

Enhanced Entity-Relationship Model

- To respond to increase requirements of more complex applications

- Basic concepts of ER modeling are not sufficient to represent requirements of newer, more complex applications.

- Response is development of additional 'semantic' modeling concepts.

- Semantic concepts are incorporated into the original ER model and called the Enhanced Entity-Relationship (EER) model.

- Examples of additional concept of EER model is called **specialization** / **generalization**.

Specialization / Generalization

- **Superclass**
  - An entity type that includes one or more distinct subgroupings of its occurrences, which must be represented in a data model.

- **Subclass**
  - A distinct subgrouping of occurrences of an entity type, which must be represented in a data model.

Specialization / Generalization

- Superclass-subclass relationship is **one-to-one** (1:1).

- Superclass may contain overlapping or distinct subclasses.

- Not all members of a superclass need be a member of a subclass.

Specialization / Generalization

- **Attribute Inheritance**
  - An entity in a subclass represents same 'real world' object as in superclass, and may possess subclass-specific attributes, as well as those associated with the superclass.

- **Specialization**
  - Process of maximizing differences between members of an entity by identifying their distinguishing characteristics.

- **Generalization**
  - Process of minimizing differences between entities by identifying their common characteristics.

Example: AllStaff relation holding details of all staff

|	Attributes appropriate for all staff			Attributes appropriate for branch Managers		Attributes appropriate for Sales Personnel		Attribute appropriate for Secretarial staff
staffNo	name	position	salary	mgrStartDate	bonus	sales Area	car Allowance	typing Speed
SL21	John White	Manager	30000	01/02/95	2000			
SG37	Ann Beech	Assistant	12000					
SG66	Mary Martinez	Sales Manager	27000			SA1A	5000	
SA9	Mary Howe	Assistant	9000					
SL89	Stuart Stern	Secretary	8500					100
SL31	Robert Chin	Snr Sales Asst	17000			SA2B	3700	
SG5	Susan Brand	Manager	24000	01/06/91	2350			

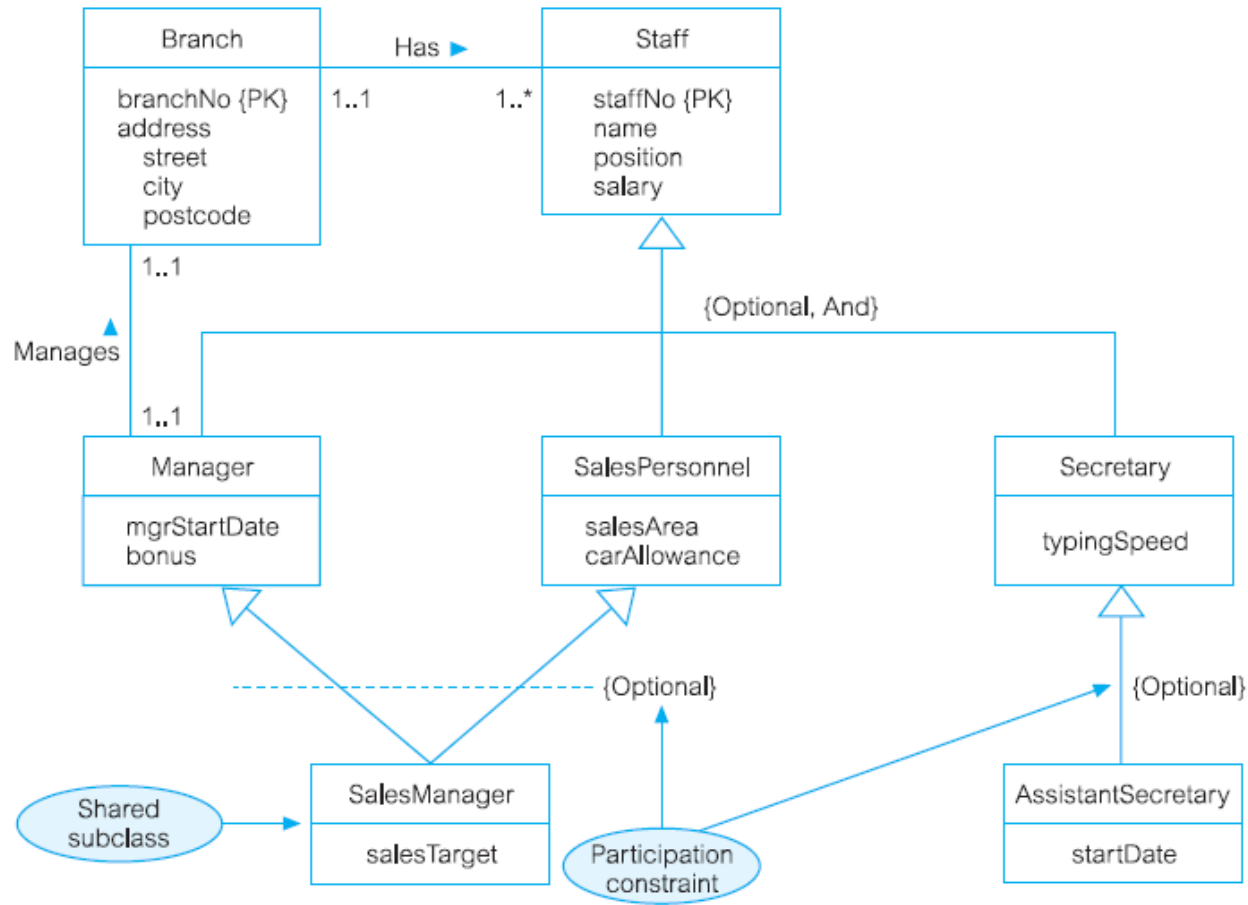**Figure 13.1** The AllStaff relation holding details of all staff.

Specialization/generalization of Staff into subclasses representing job roles
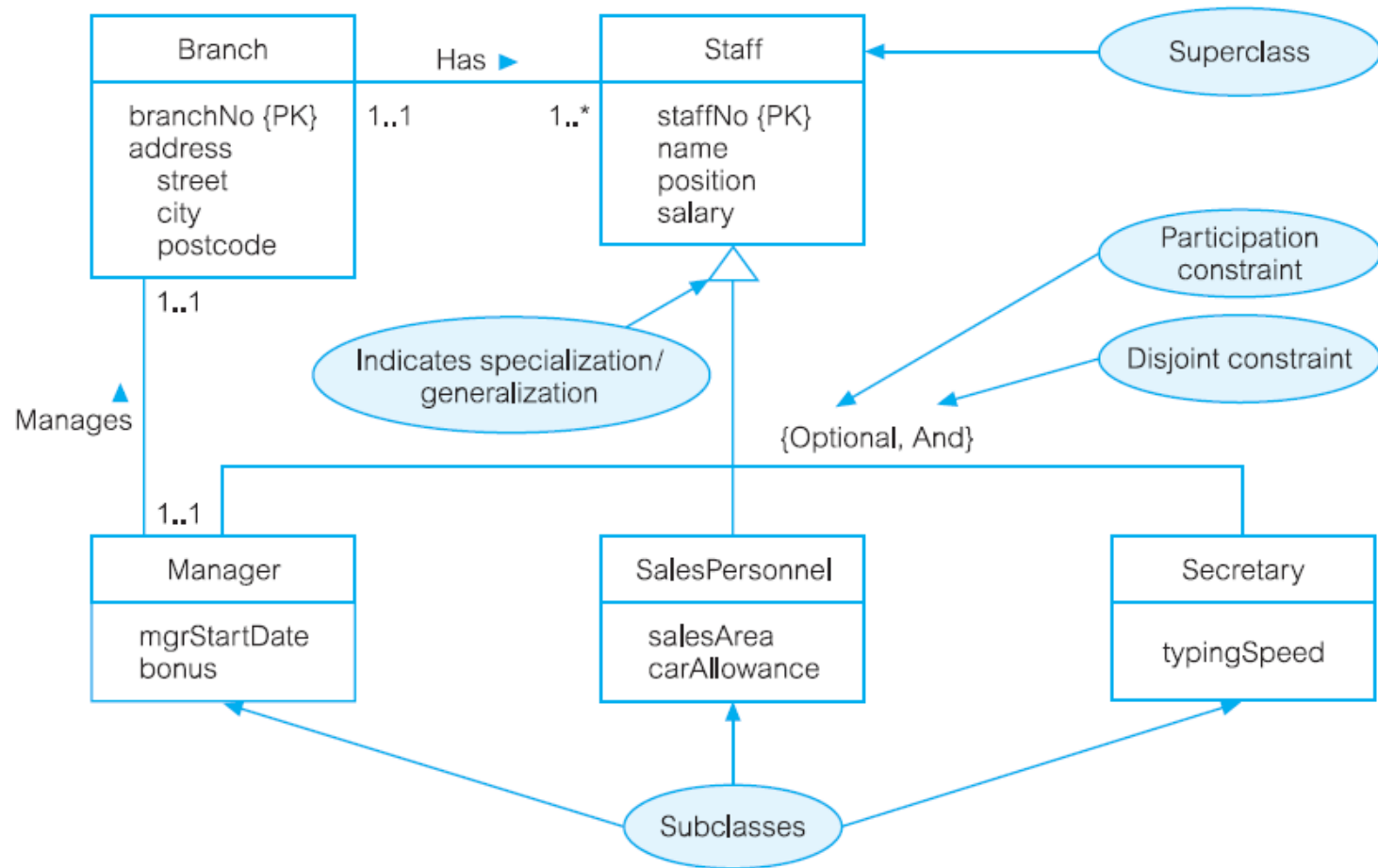
Specialization/generalization of Staff into job roles and contracts of employment
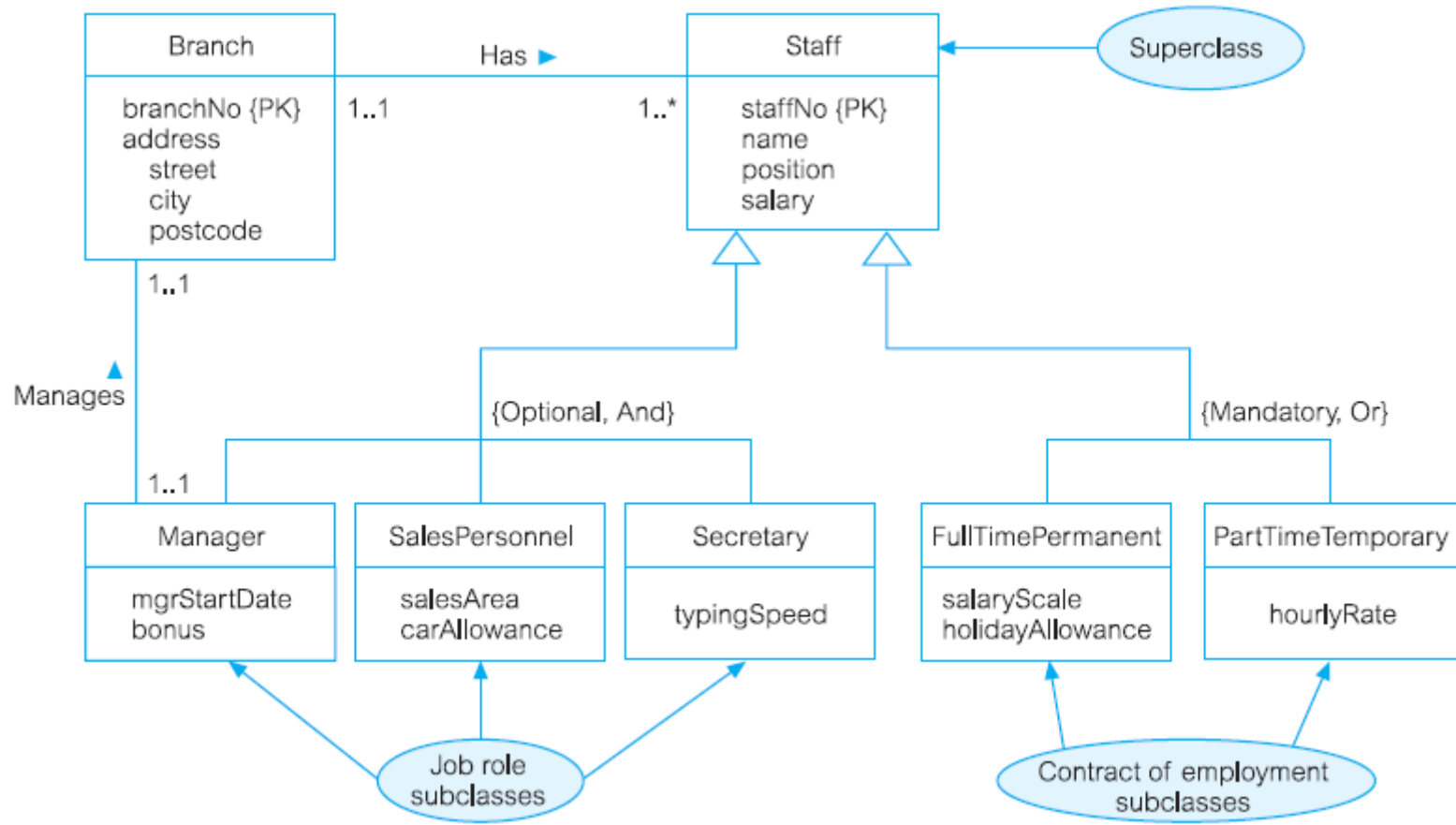
EER diagram with shared subclass and subclass with its own subclass

Constraints on Specialization/Generalization

- Two constraints that may apply to a specialization/ generalization:
  - participation constraints
  - disjoint constraints.

- **Participation constraint**
  - Determines whether every member in superclass must participate as a member of a subclass.
  - May be <u>mandatory</u> or <u>optional</u>.
  - **Mandatory**: Every member of superclass must be a member of a subclass
  - **Optional**: Every member of superclass need not belong to any of its subclasses

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Constraints on Specialization/Generalization

- **Disjoint constraint**
    - Describes relationship between members of the subclasses and indicates whether member of a superclass can be a member of one, or more than one, subclass.
    - May be <u>disjoint</u> (OR) or <u>non-disjoint</u> (AND)
    - **Disjoint**: An entity occurrence can be a member of only one of the subclass
    - **Non-disjoint**: An entity occurrence can be a member of more than a subclass

Constraints on Specialization/Generalization

- There are four categories of constraints of specialization and generalization:
  - **mandatory and disjoint** {mandatory, or}
    - E.g.: Any member of staff must be attached to a department, but it is possible for a department to have no staff allocated.
  - **optional and disjoint** {optional, or}
    - E.g.: A member of staff does not have to be placed in a department, but all departments must have at least one member of staff.

Constraints on Specialization/Generalization

- There are four categories of constraints of specialization and generalization:
  - **mandatory and non-disjoint** {mandatory, and}
    - E.g.: A member of staff must be assigned to a given department, and any department must have staff. There can be no unassigned staff, and it is not possible to have an 'empty' department
  - **optional and non-disjoint** {optional, and}
    - E.g.: A member of staff might be assigned to work in a department, but this is not compulsory. A department might, or might not, have staff allocated to work within it

Constraints on Specialization/Generalization

| Participation constraint	Disjoint constraint	Tables required
Mandatory	Nondisjoint {And}	Single table
Optional	Nondisjoint {And}	Two tables: one table for superclass and one table for all subclasses
Mandatory	Disjoint {Or}	Many tables: one table for each combined superclass/subclass
Optional	Disjoint {Or}	Many tables: one table for superclass and one table for each subclass

DreamHome example - Staff Superclass with Supervisor and Manager subclasses
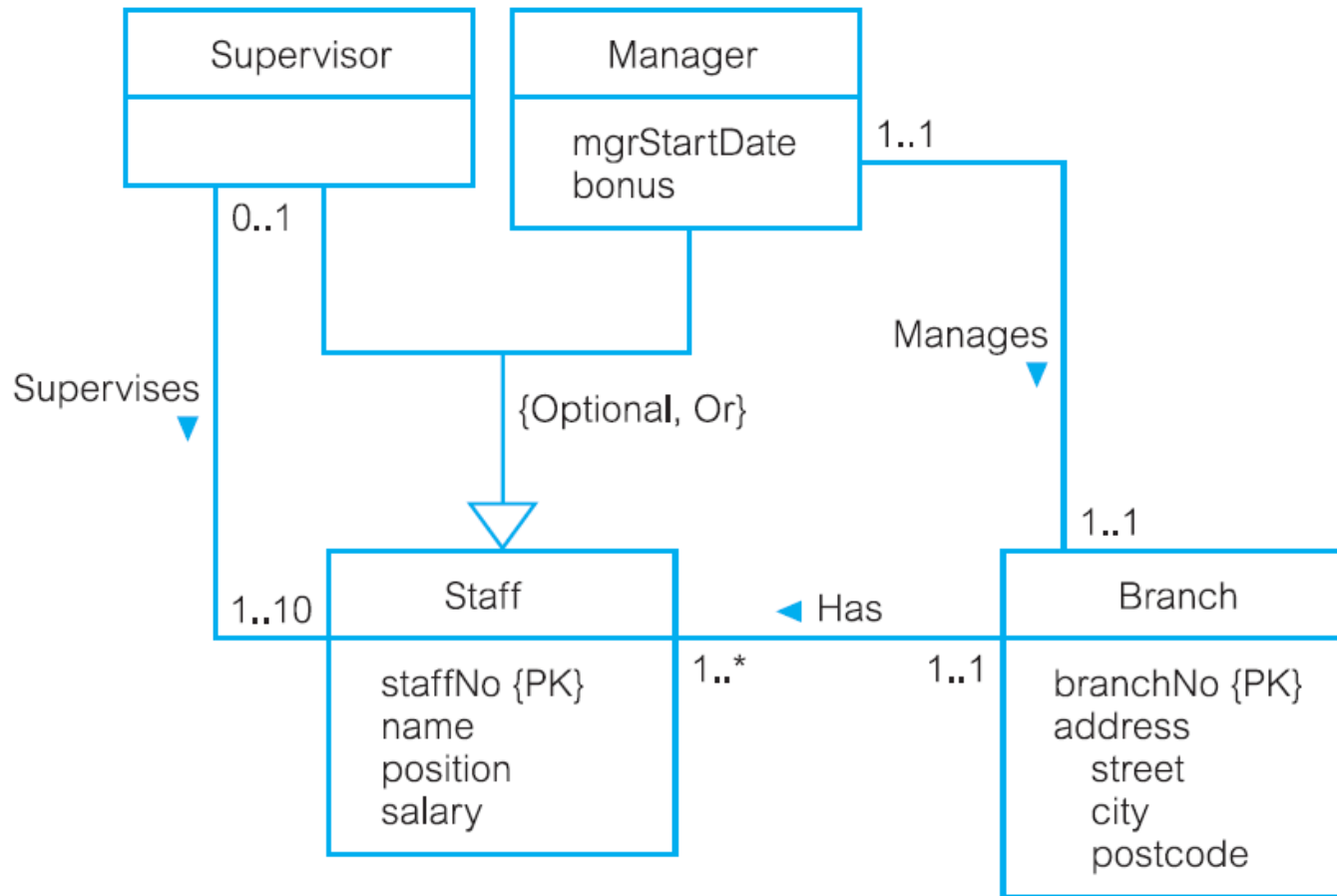
DreamHome example - Owner Superclass with PrivateOwner and BusinessOwner subclasses
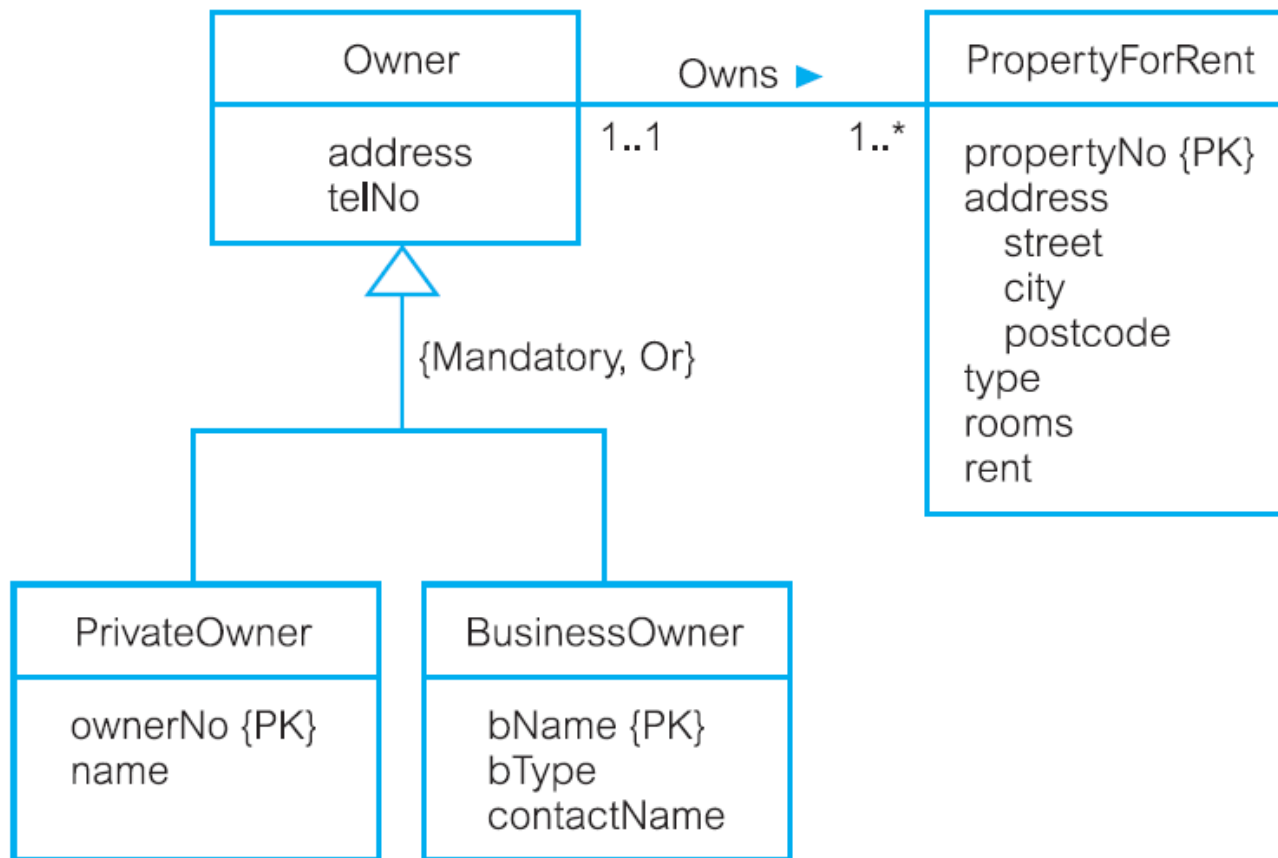
DreamHome example - Person superclass with Staff, PrivateOwner, and Client subclasses
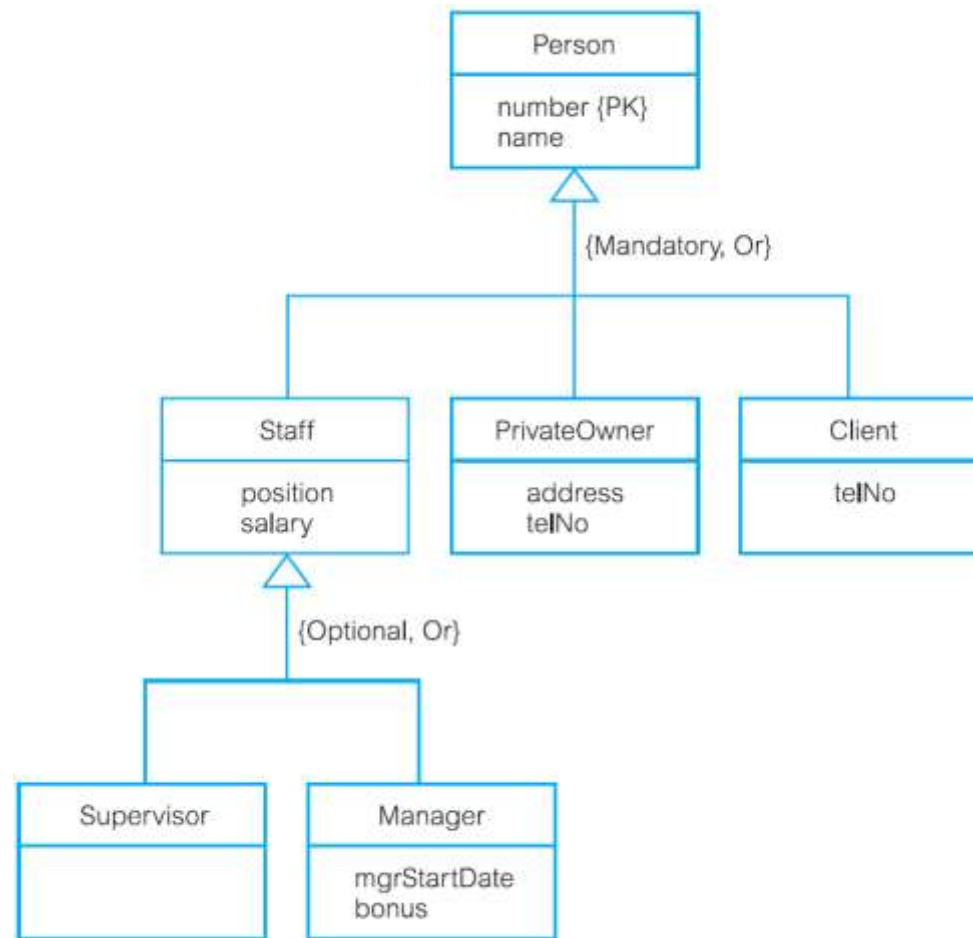
Problem 1: EERM

- A car dealership wishes to maintain data about the customers who purchase a car. Each customer may purchase one or more vehicles and each vehicle can be purchased by many different customers over time (for example, a customer may purchase a new vehicle, trade that vehicle in and someone else can purchase the vehicle traded in.) Data that the dealership wishes to keep regarding customers includes customer identification number, name, address, home phone, work phone, cell phone and e-mail address.

- Information about vehicle includes vehicle identification number, make, model, year, transmission type, engine size and color. Vehicles can be a member of one of the following categories: cars, trucks, minivans or SUVS. A vehicle can be a member of only one category at a given time. Trucks, minivans and SUVS have unique attributes – cars does not. Trucks have the following unique attributes: Cab (example: regular, super or crew) and Driver (for example: 94X2 or (4X4); Minivans have Accessory package and SUVS have SUV style.

- The dealership is interested in the date of Purchase, amount of sale and Salesperson(s) completing each sale.