2020-2021

5COSC002W DATABASE SYSTEMS
Lecture 02

CONCEPTUAL DATABASE DESIGN
Enhanced Entity-Relationship modelling

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Lecture 02 – Outline

- *Additional semantic modelling concepts*
- *Generalisation/specialisation*
- *Attribute inheritance*
- *Structural constraints on generalisations*
- *Systematic approach to develop a conceptual data model*

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Database Design Methodology – Step 1

CONCEPTUAL DESIGN

Produce a Conceptual Data Model

(model of the data used in a firm, independent of physical considerations)

- Step 1.1 Identify entity types
- Step 1.2 Identify relationship types
- Step 1.3 Identify and associate attributes with entity or relationship types
- Step 1.4 Determine attribute domains
- Step 1.5 Determine candidate, primary, and alternate key attributes
- Step 1.6 Consider use of enhanced modelling concepts
- Step 1.7 Check model for redundancy
- Step 1.8 Validate conceptual model against user transactions
- Step 1.9 Review conceptual data model with user

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The Enhanced Entity-Relationship Model

- Basic concepts of ER modelling not sufficient to represent requirements of newer, more complex applications.
- Response is development of additional ‘semantic’ modelling 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.

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Specialisation / Generalisation

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

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

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Superclasses and subclasses

- **Superclass or Generalised Entity**
  - An entity that includes one or more distinct subgroupings of its occurrences.
- **Subclass or Specialised Entity**
  - A distinct subgrouping of occurrences of an entity.
- **Superclass/subclass relationship is 1:1.**
- **Superclass may contain overlapping or distinct subclasses.**
- **Not all members of a superclass need be a member of a subclass.**

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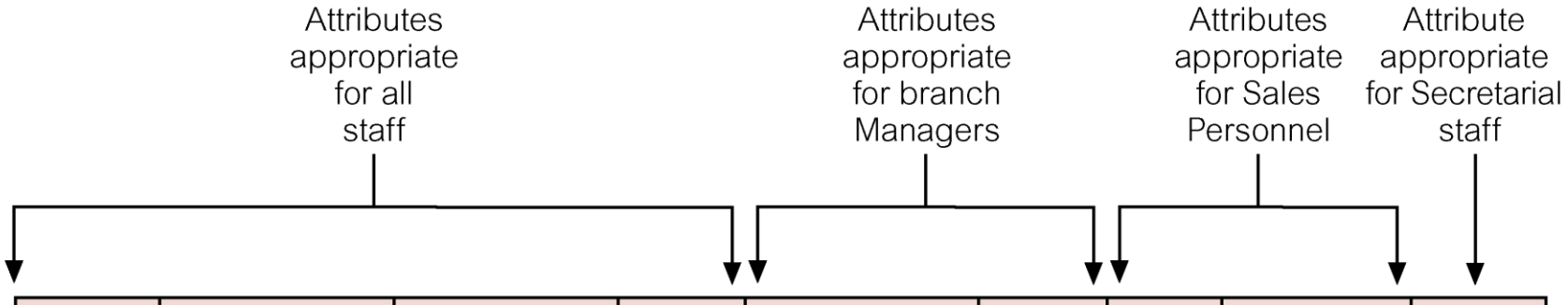
Attribute Inheritance

– **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.**



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			

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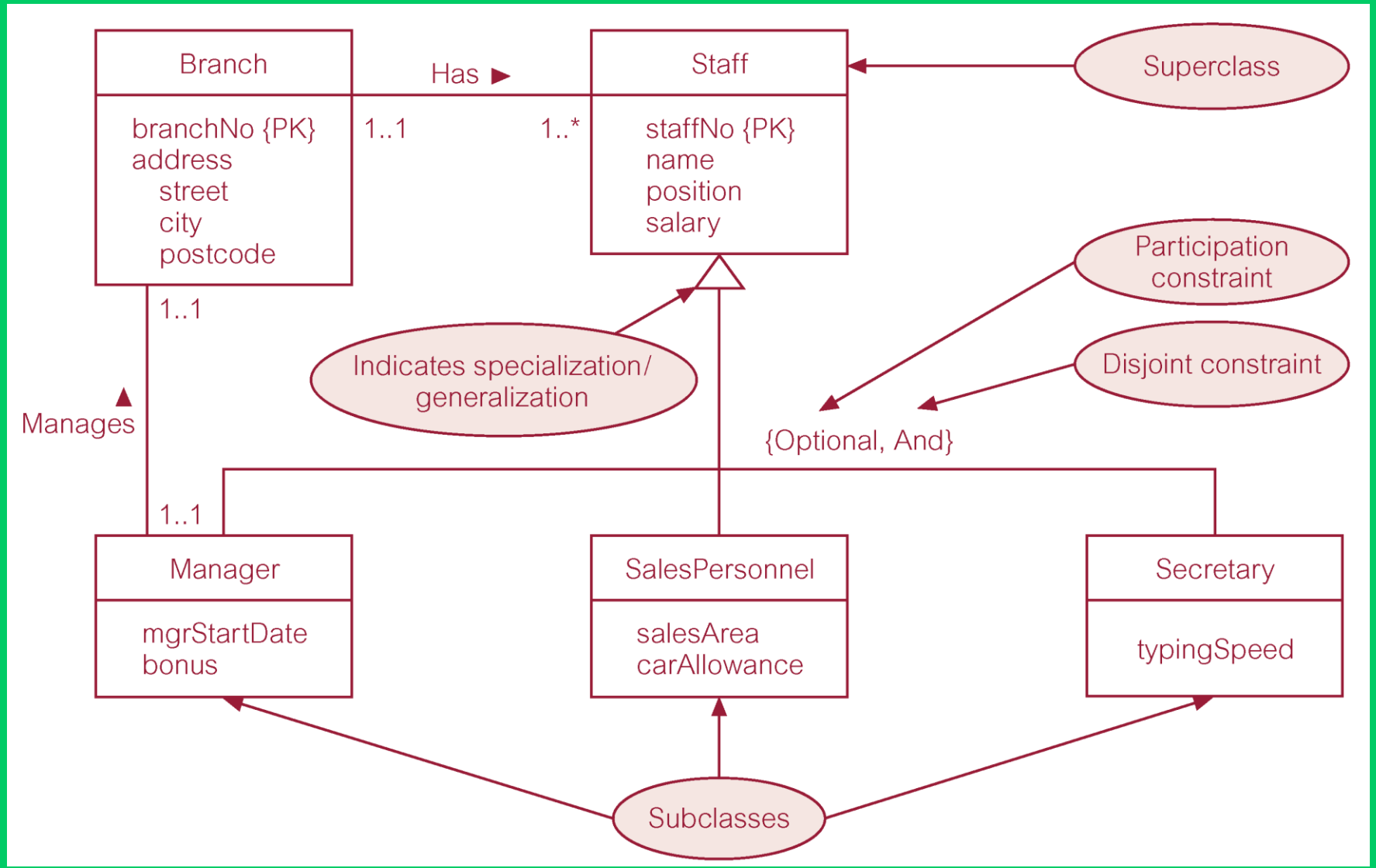
Example of EERD with one Specialisation / Generalisation



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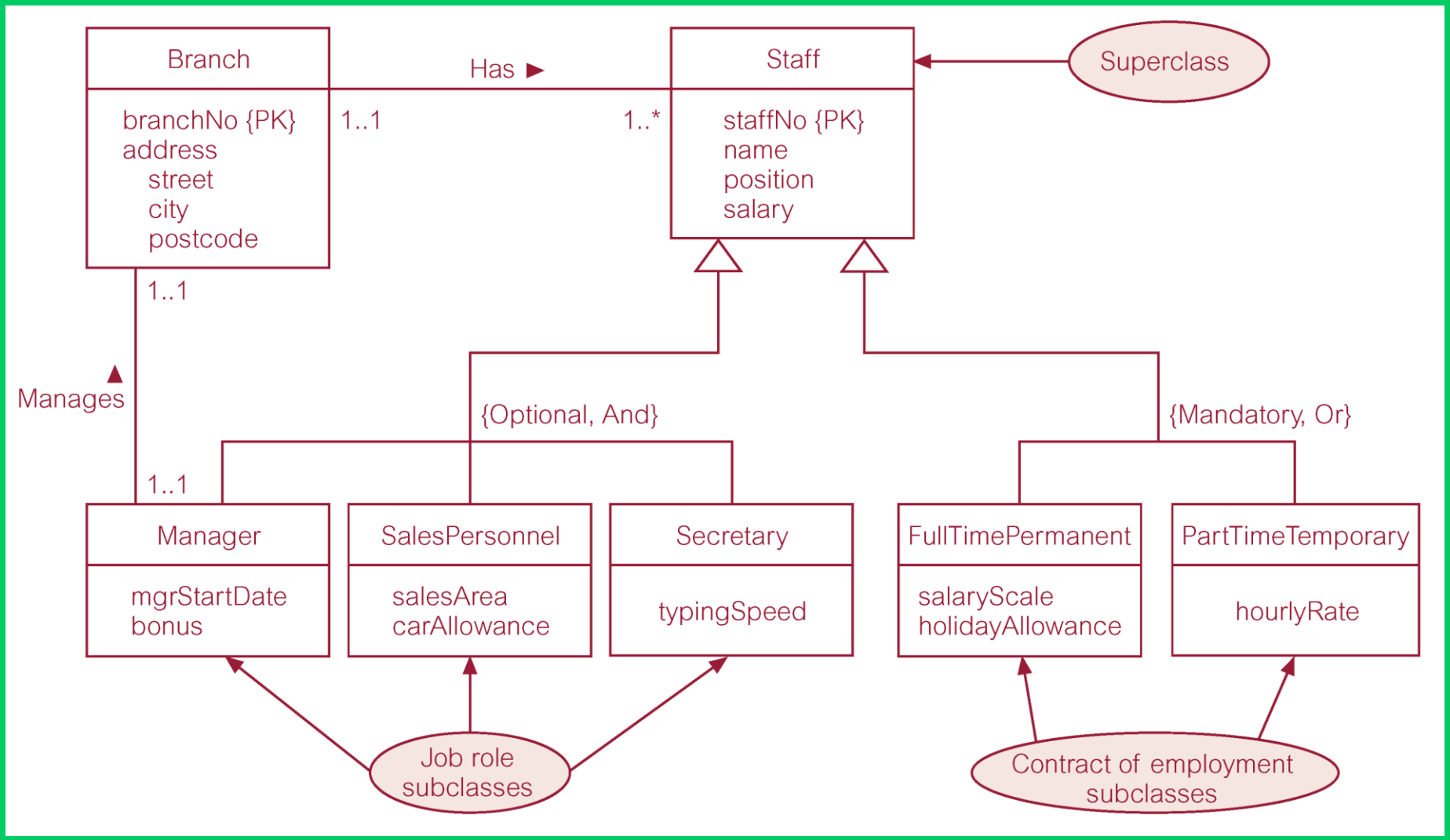
Example of EERD with two Specialisations / Generalisations



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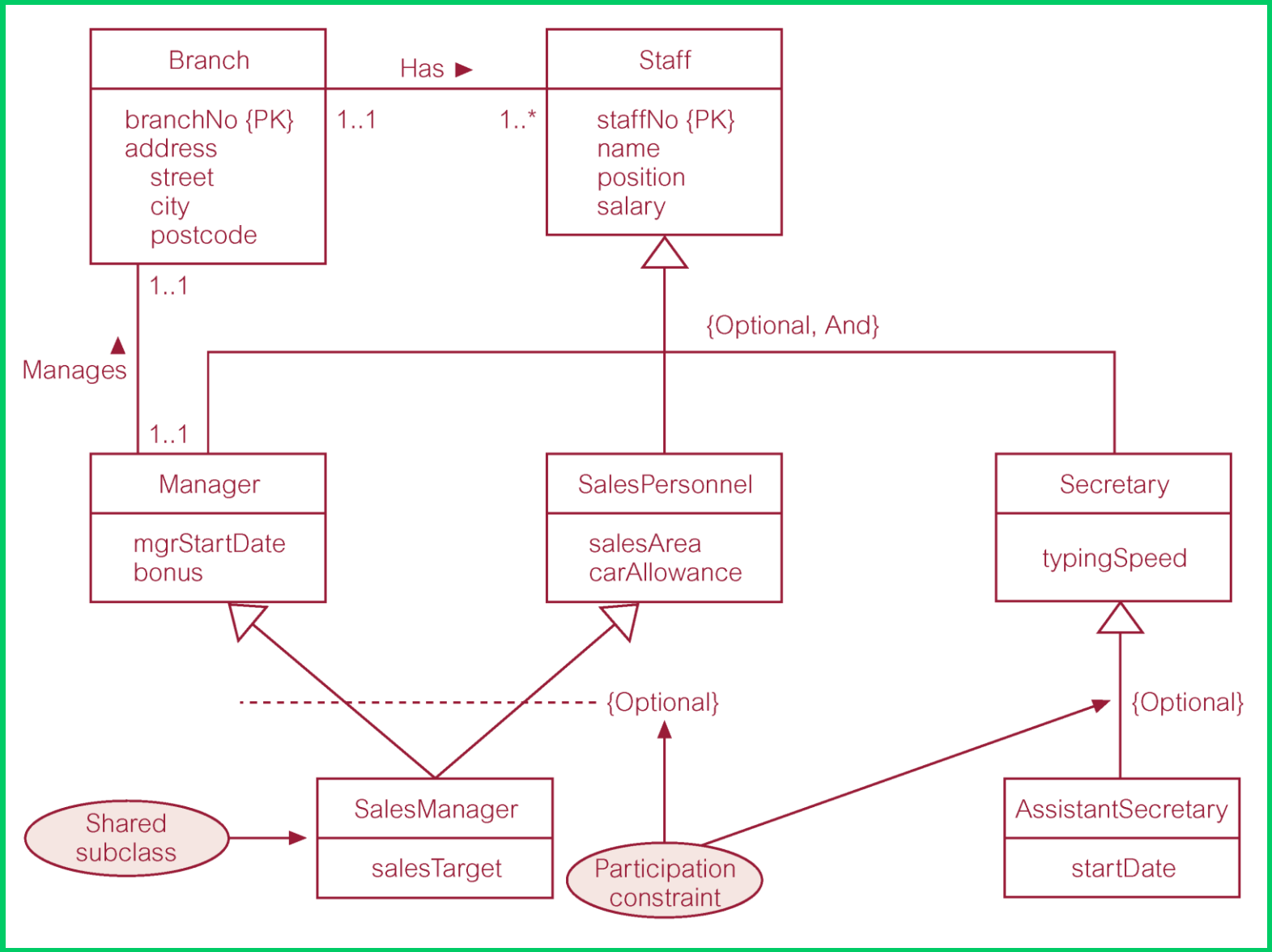
Example of EERD with several levels of Specialisation / Generalisation



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Constraints on Specialisation / Generalisation

- **Participation constraint**
  - Determines whether every member in superclass must participate as a member of a subclass.
  - May be mandatory or optional.

- **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 disjoint or nondisjoint.

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Categories of constraints on Specialisation / Generalisation

- **Four categories of specialisation and generalisation:**
  - **(mandatory, or):** mandatory and disjoint
  - **(mandatory, and):** mandatory and non-disjoint
  - **(optional, or):** optional and disjoint
  - **(optional, and):** optional and non-disjoint.

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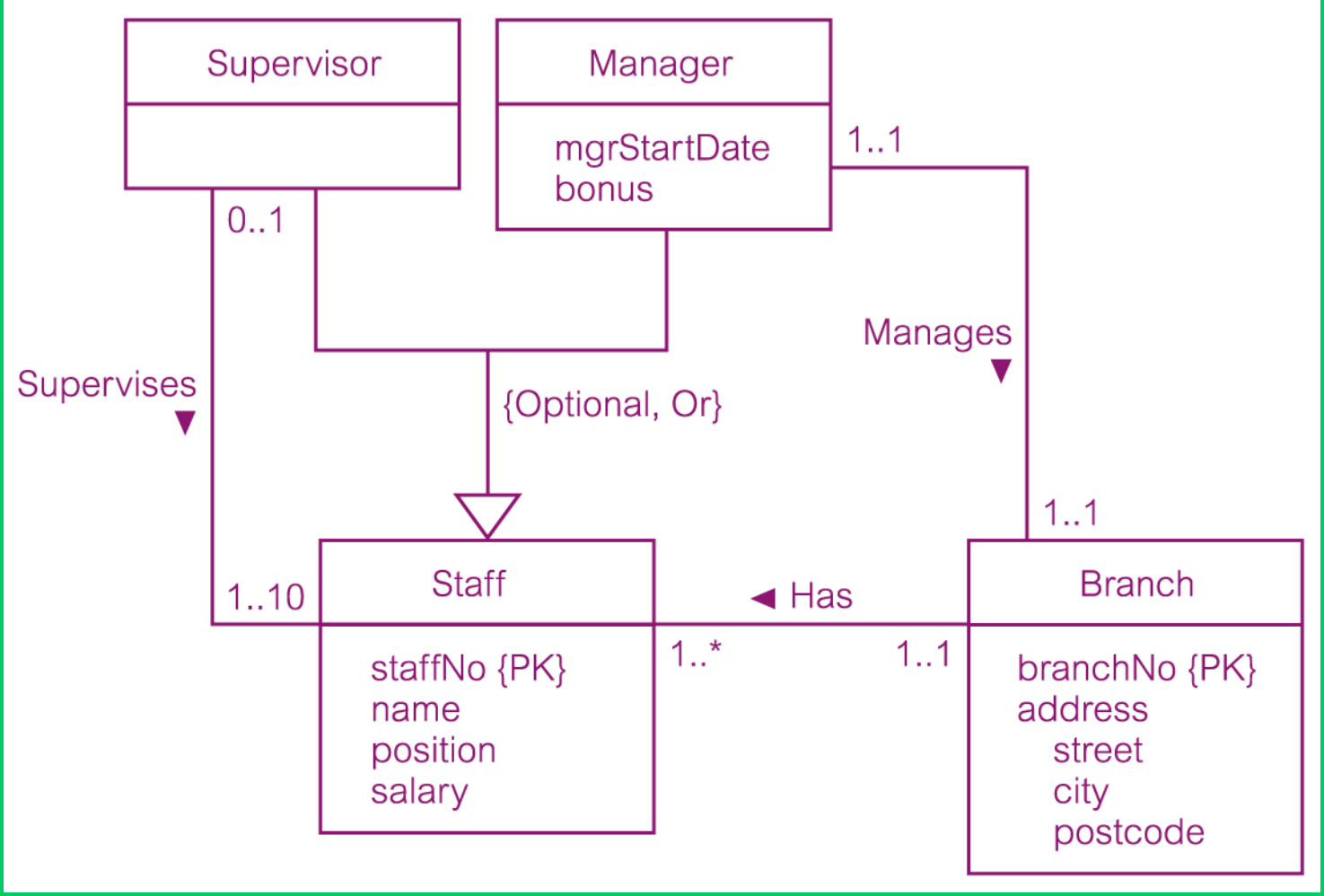
Example of {Optional, Or} constraint



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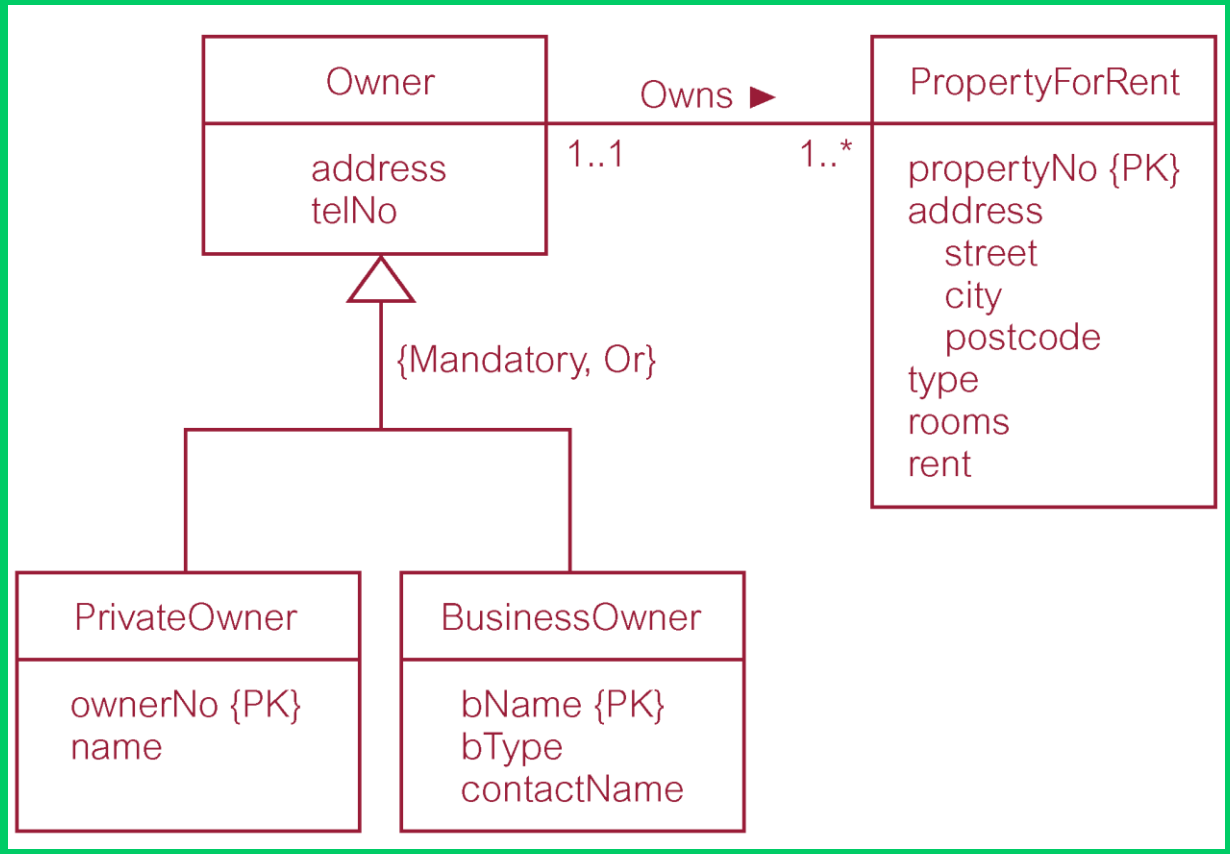
Example of {Mandatory, Or} constraint



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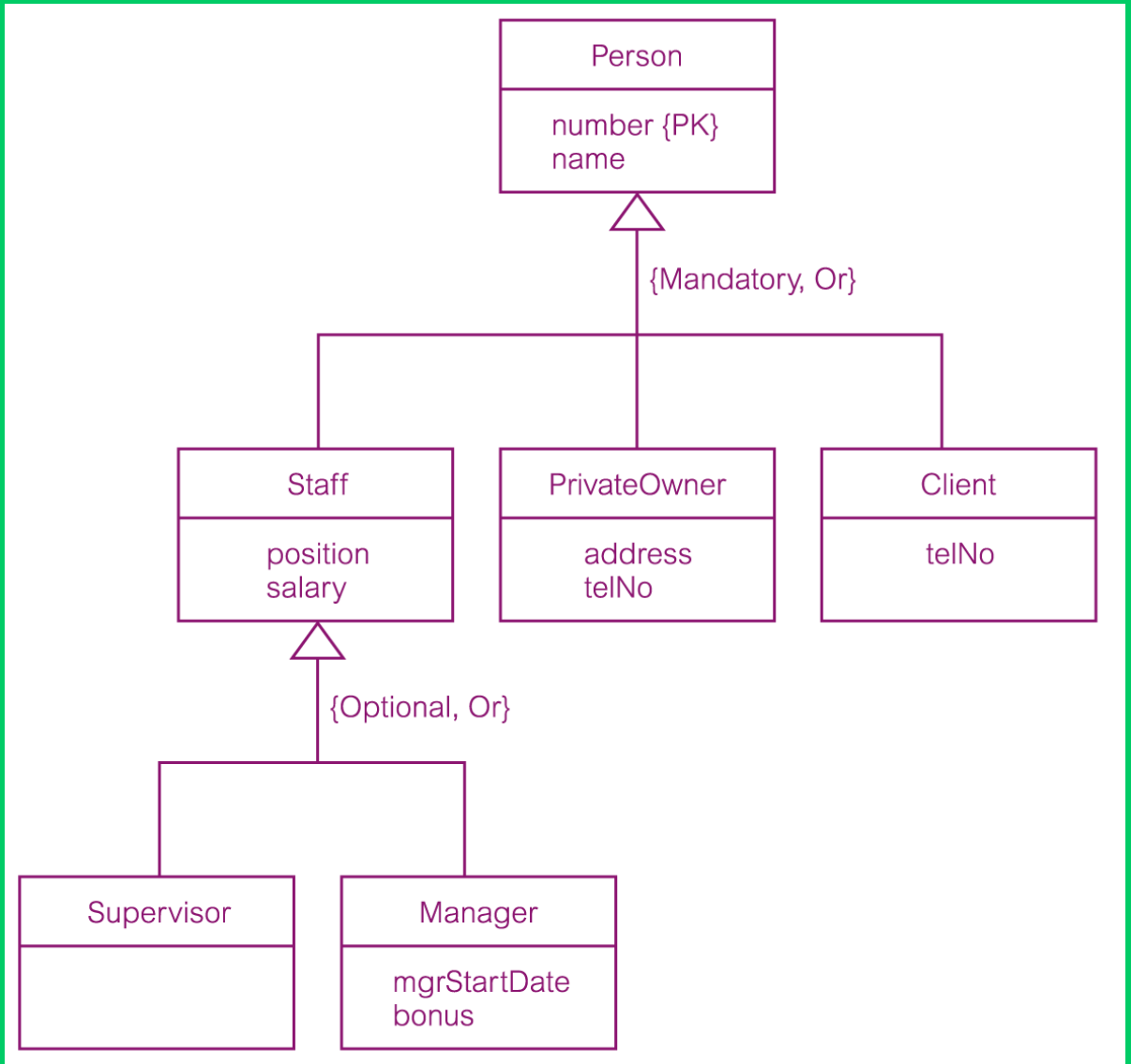
Example of {Mandatory, Or} and {Optional, Or} constraints



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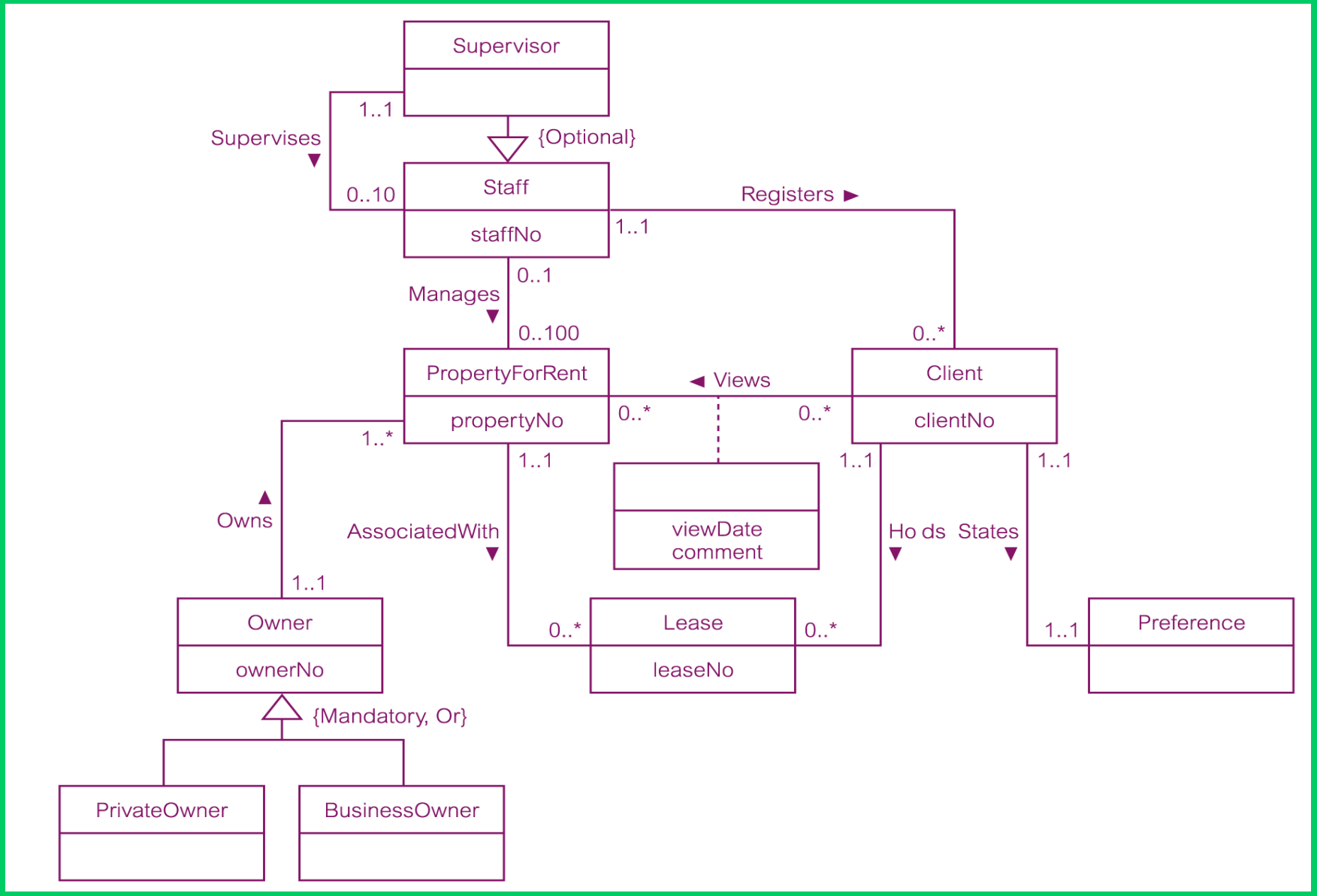
DreamHome Conceptual ERD (staff view with specialisations)



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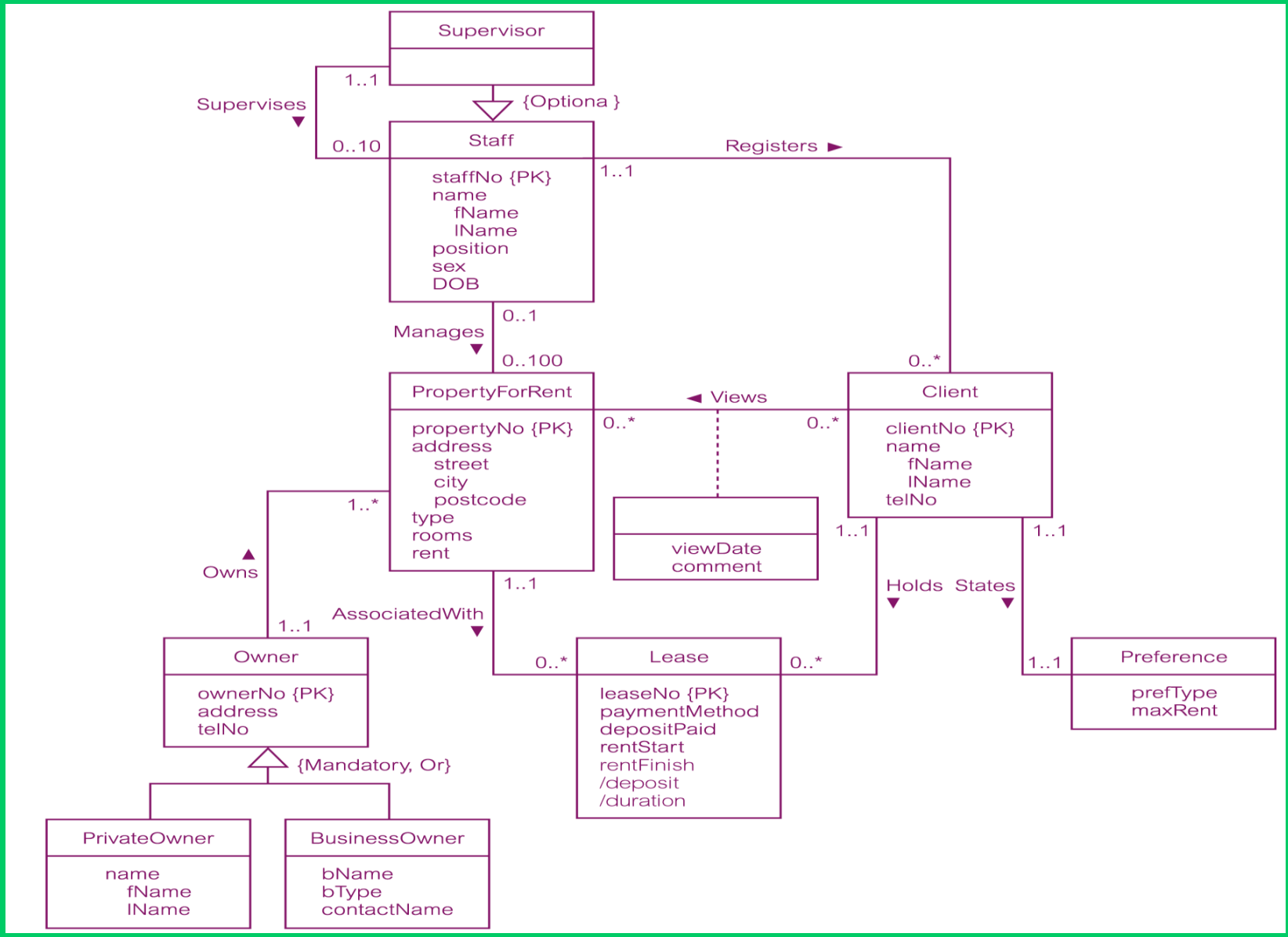
DreamHome Conceptual ERD (staff view with specialisations & attributes)



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Data dictionary to document description of entities

Entity name	*Description*	*Aliases*	*Occurrence*
Staff	General term descr bing al staff employed by *DreamHome*.	Employee	Each member of staff works at one particular branch.
PropertyForRent	General term descr bing all property for rent.	Property	Each property has a s ngle owner and is available at one specific branch, where the property is managed by one member of staff. A property is viewed by many clients and rented by a single client, at any one time.

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Data dictionary to document description of relationships

Entity name	*Multiplicity*	*Relationship*	*Multiplicity*	*Entity name*
Staff	0..1 0..1	*Manages* *Supervises*	0..100 0..10	**PropertyForRent** **Staff**
PropertyForRent	1..1	*AssociatedWith*	0..*	**Lease**

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Data dictionary to document description of attributes

Entity name	*Attributes*	*Description*	*Data Type & Length*	*Nulls*	*Multi-valued*	. . .
Staff	**staffNo**	Unique y identifies a member of staff	5 variable characters	No	No	
	name					
	fName	First name of staff	15 variable characters	No	No	
	lName	Last name of staff	15 variable characters	No	No	
	position	Job title of member of staff	10 variable characters	No	No	
	sex	Gender of member of staff	1 character (M or F)	Yes	No	
	DOB	Date of birth of member of staff	Date	Yes	No	
PropertyForRent	**propertyNo**	Unique y identifies a property for rent	5 variable characters	No	No	

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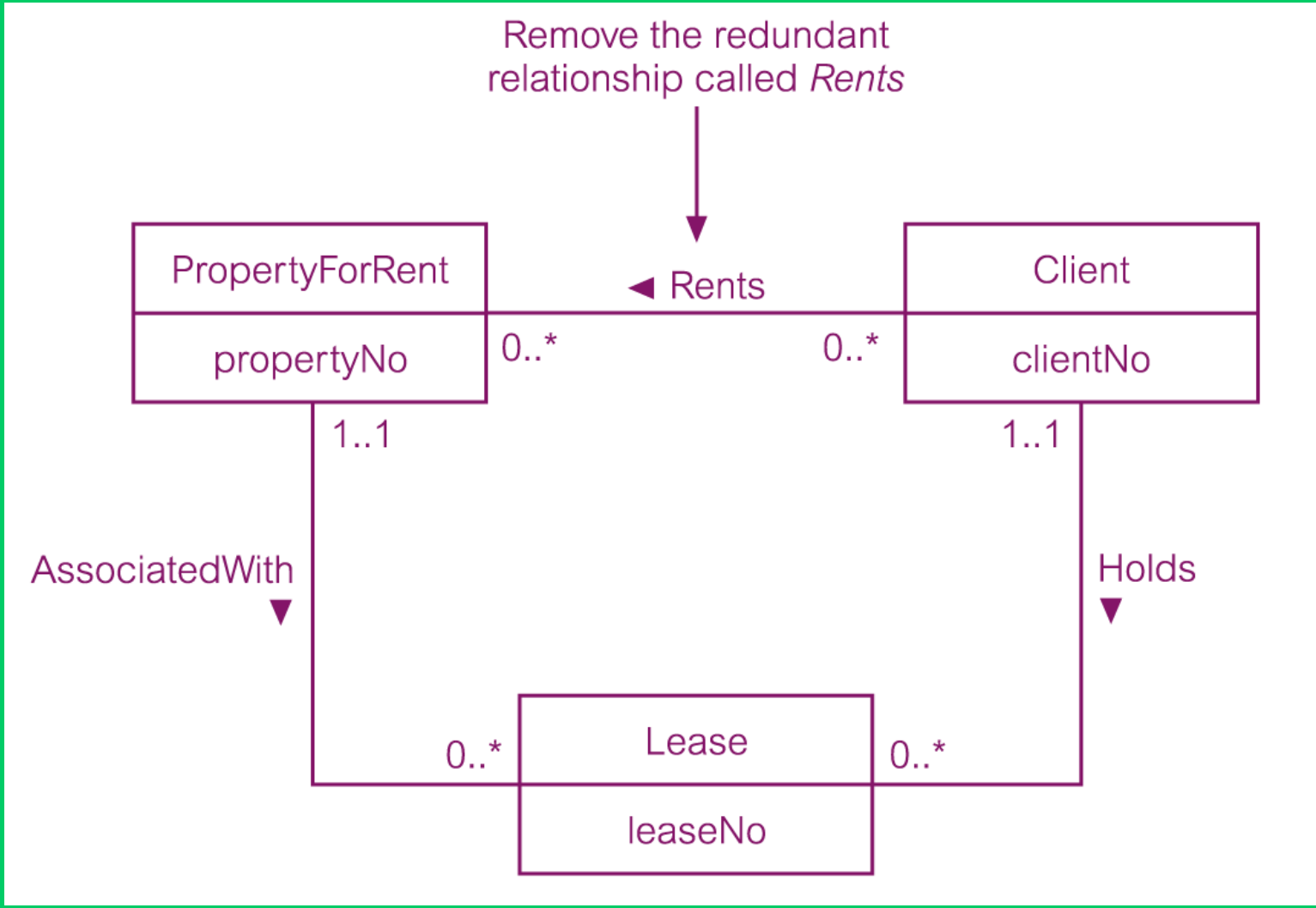
Example of redundant relationship to be removed



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Example of non redundant relationship to be kept