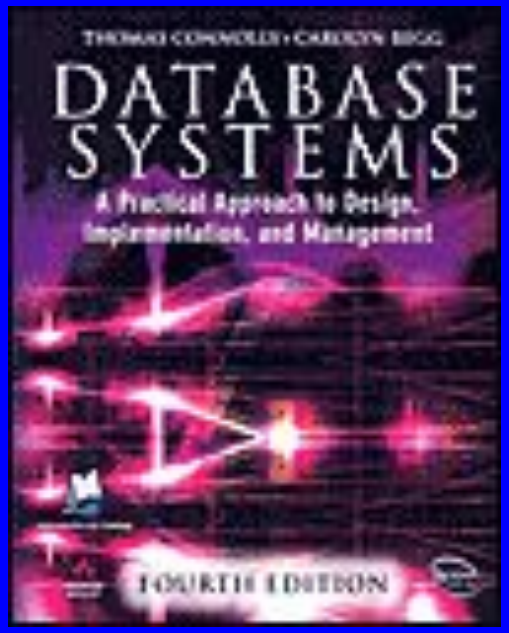
Lecture Twelve

Enhanced Entity-Relationship Modelling

Based on Chapter Twelve of this book:



Database Systems: A Practical Approach to Design, Implementation and Management

International Computer Science S.

Carolyn Begg, Thomas Connolly

Lecture 12 - Objectives

- 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 concepts of Enhanced ER (EER) model called:
  - specialization/generalization
  - aggregation
  - composition.

Lecture 12 - Objectives

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

Enhanced Entity-Relationship Model

- Since 1980s there has been an increase in emergence of new database applications with more demanding requirements.
- Basic concepts of ER modeling are not sufficient to represent requirements of newer, more complex applications.
- Response is development of additional ‘semantic’ modeling concepts.

The Enhanced Entity-Relationship Model

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

- Examples of additional concepts of EER model are:
  - specialization / generalization
  - aggregation
  - composition.

Specialization / Generalization

- **Superclass**
  - **An entity type that includes one or more distinct subgroupings of its occurrences.**
- **Subclass**
  - **A distinct subgrouping of occurrences of an entity type.**

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

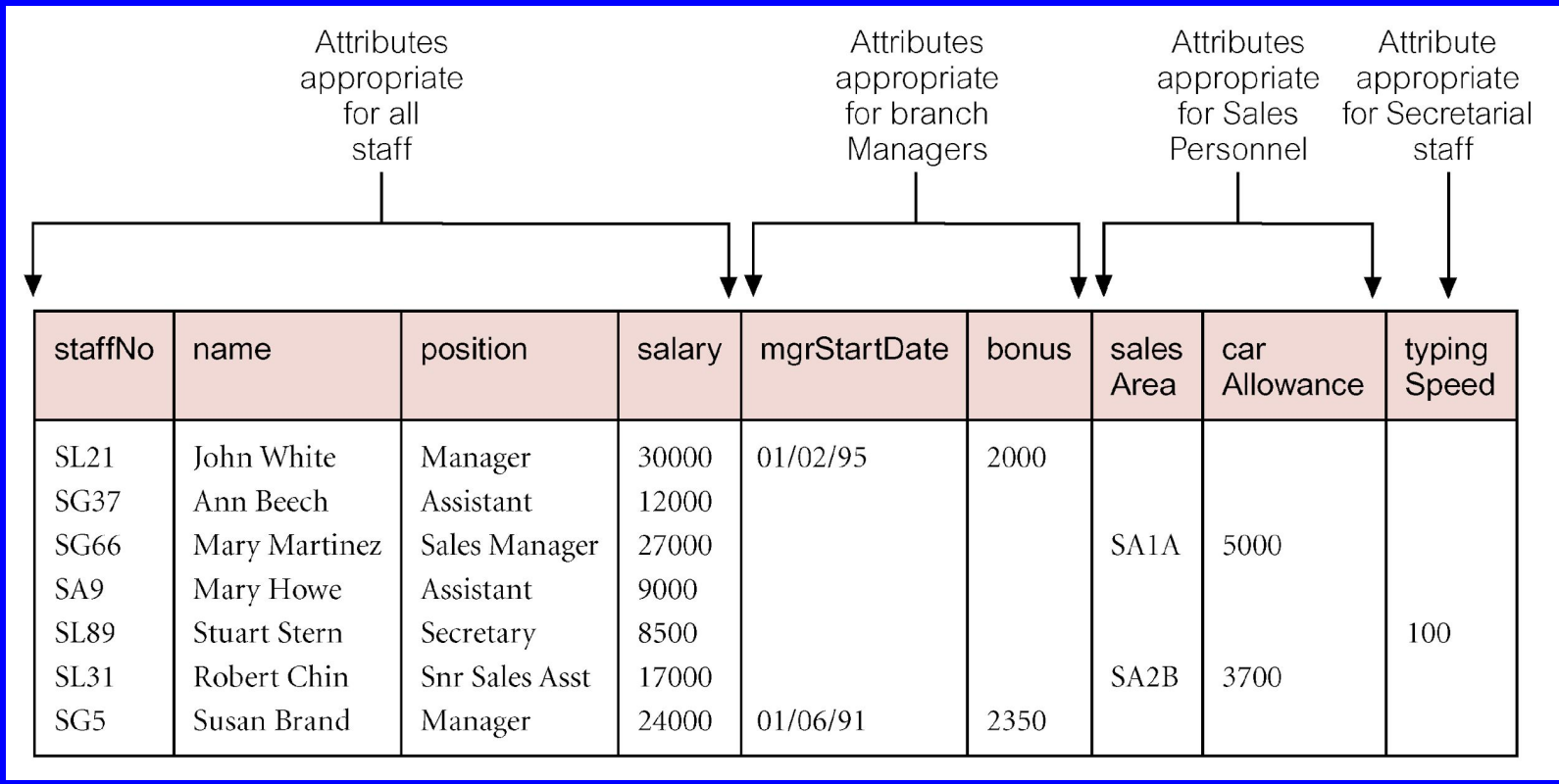
- **Attribute Inheritance**
  - **An entity in a subclass represents same 'real world' object as in superclass, and may possess subclass-specific attributes, as well as those associated with the superclass.**

Specialization / Generalization

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

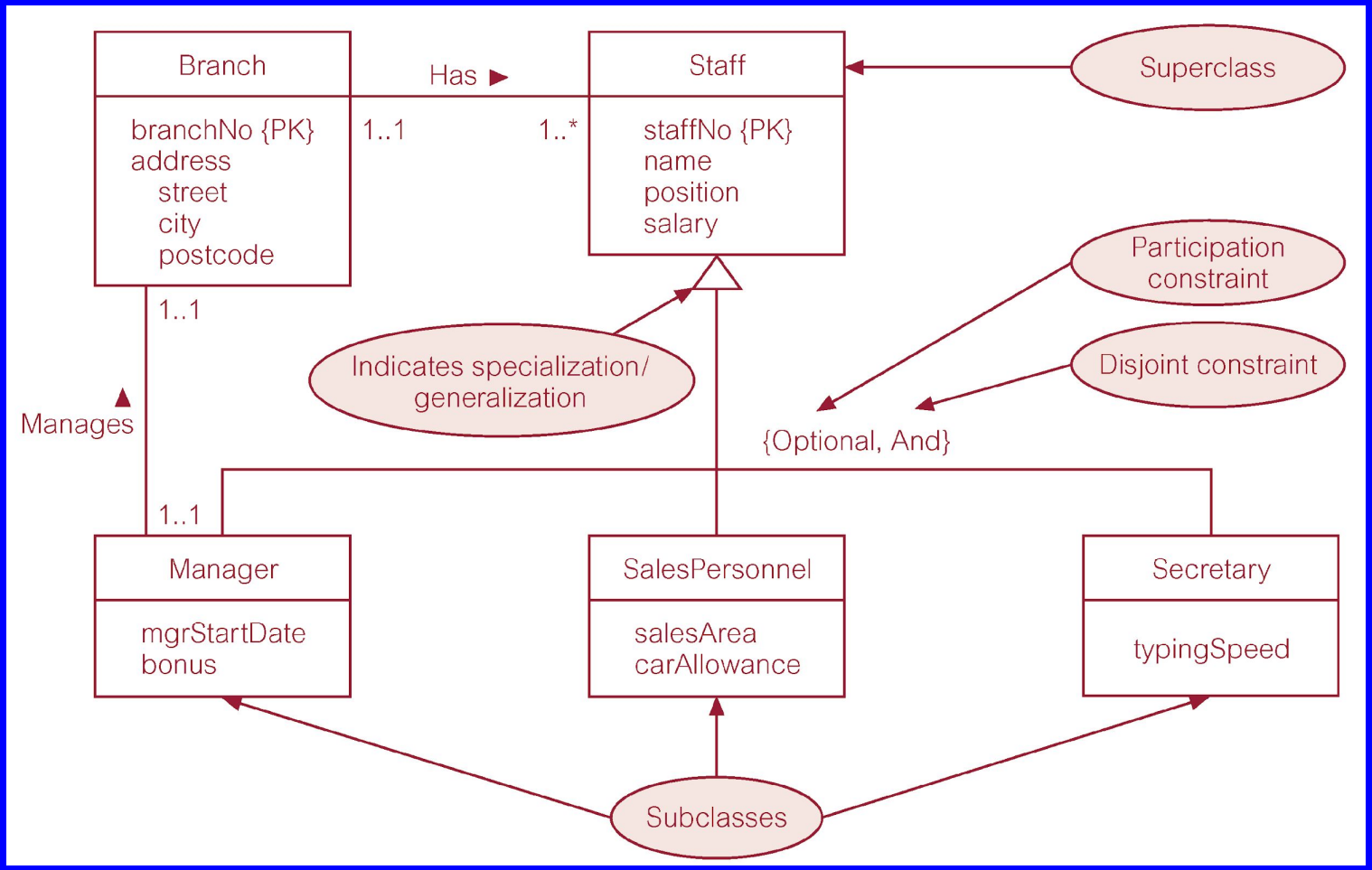
- **Generalization**
  - **Process of minimizing differences between entities by identifying their common characteristics.**

AllStaff relation holding details of all staff

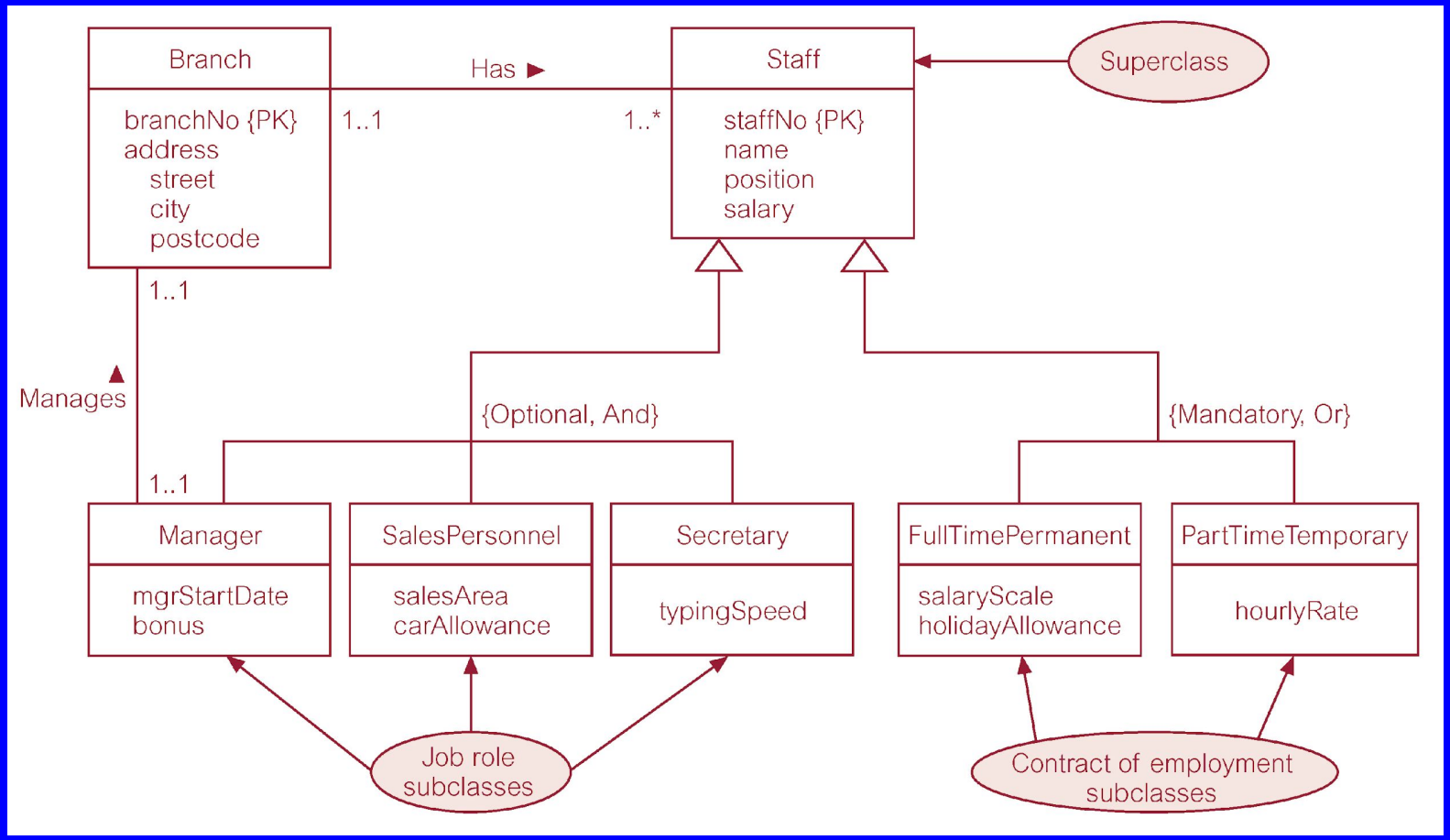


staffNo	name	position	salary	mgrStartDate	bonus	sales Area	car Allowance	typing Speed
SL21	John White	Manager	30000	01/02/95	2000			
SG37	Ann Beech	Assistant	12000					
SG66	Mary Martinez	Sales Manager	27000			SA1A	5000	
SA9	Mary Howe	Assistant	9000					
SL89	Stuart Stern	Secretary	8500					100
SL31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

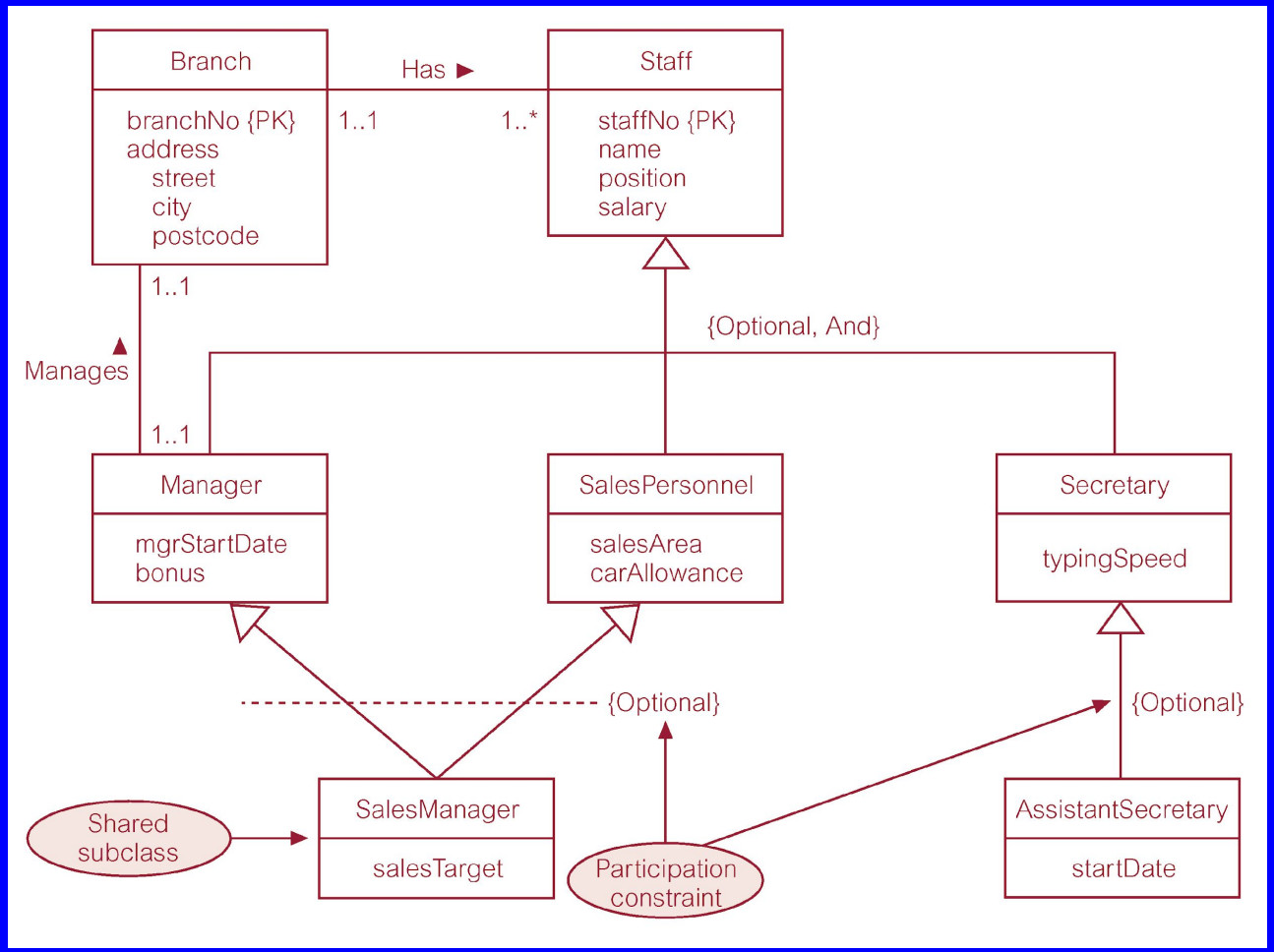
Specialization/generalization of Staff entity into subclasses representing job roles



Specialization/generalization of Staff entity 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 mandatory or optional.

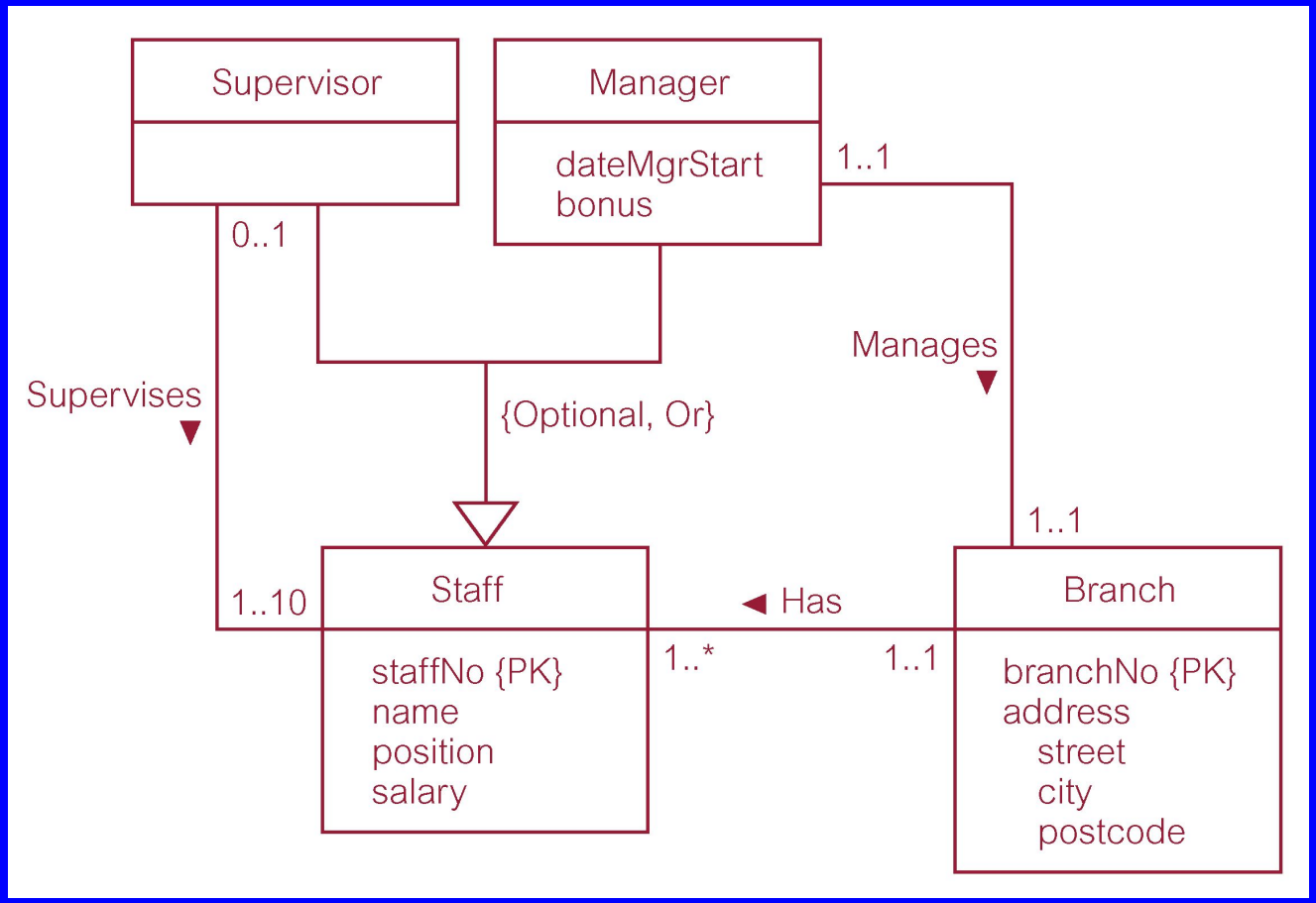
Constraints on Specialization / Generalization

- **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 disjoint or nondisjoint.**

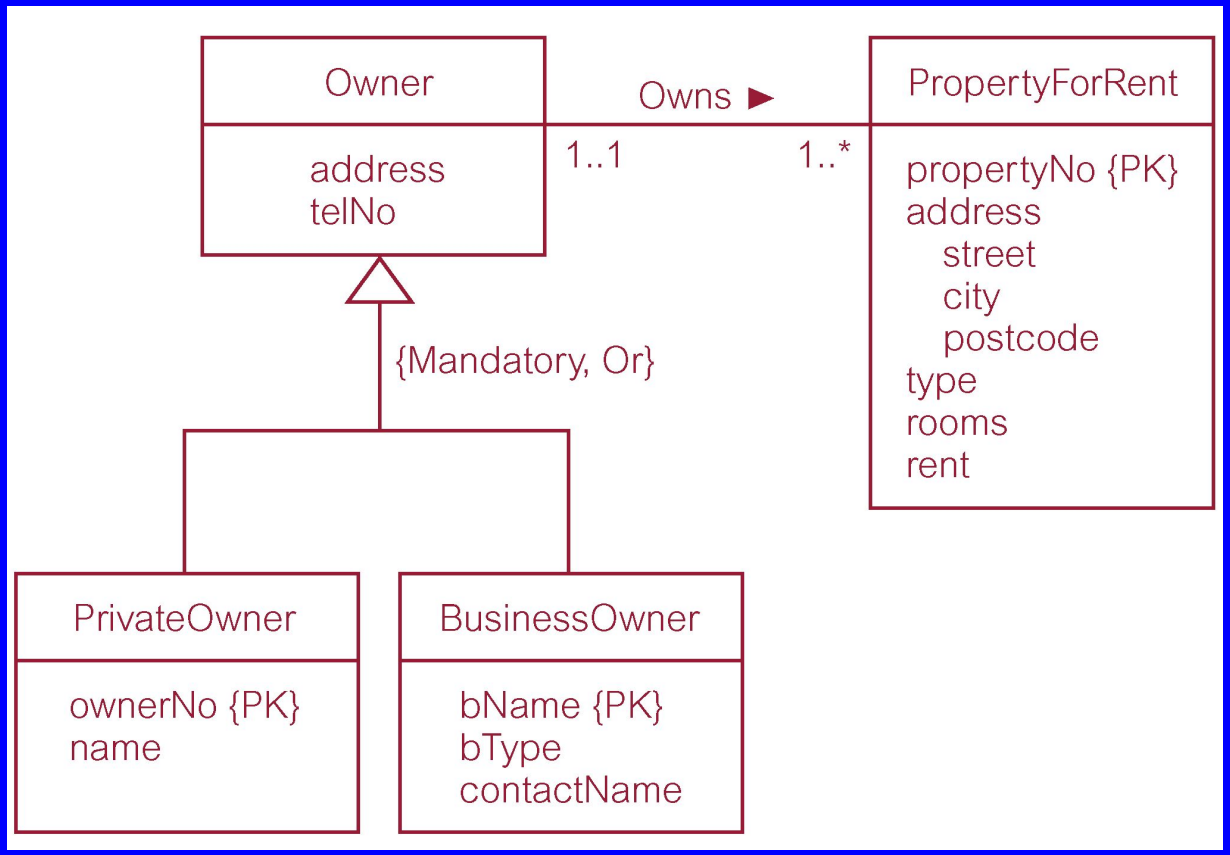
Constraints on Specialization / Generalization

- There are four categories of constraints of specialization and generalization:
  - mandatory and disjoint
  - optional and disjoint
  - mandatory and nondisjoint
  - optional and nondisjoint.

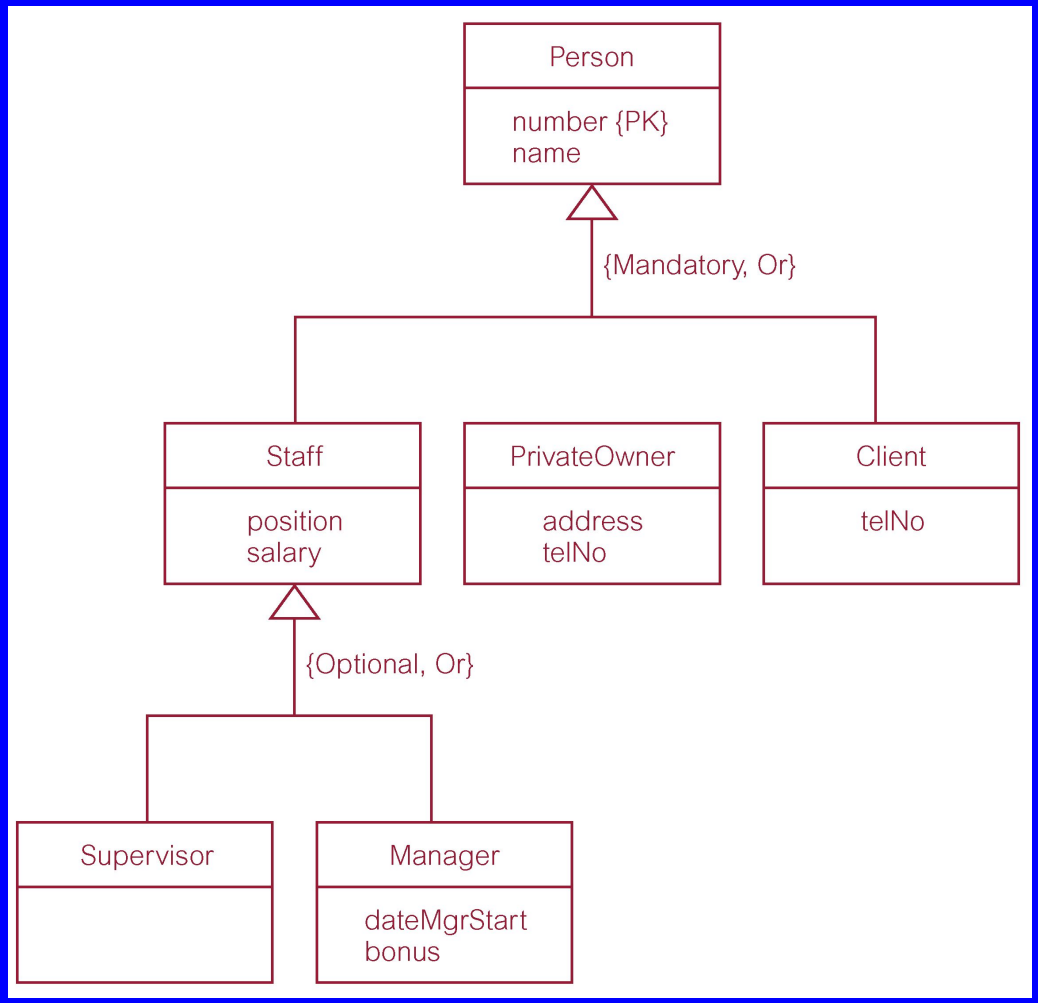
DreamHome worked example - Staff Superclass with Supervisor and Manager subclasses



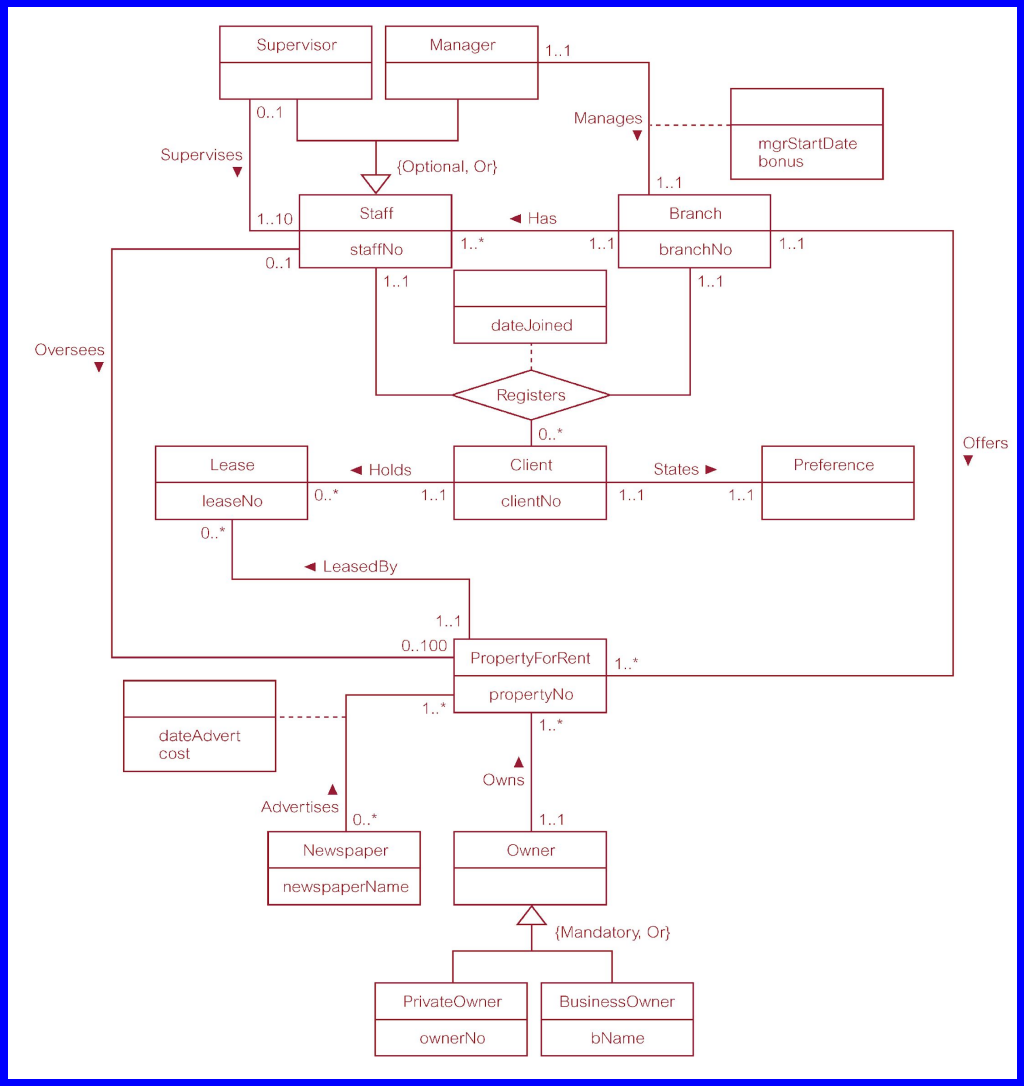
DreamHome worked example - Owner Superclass with PrivateOwner and BusinessOwner subclasses



DreamHome worked example - Person superclass with Staff, PrivateOwner, and Client subclasses



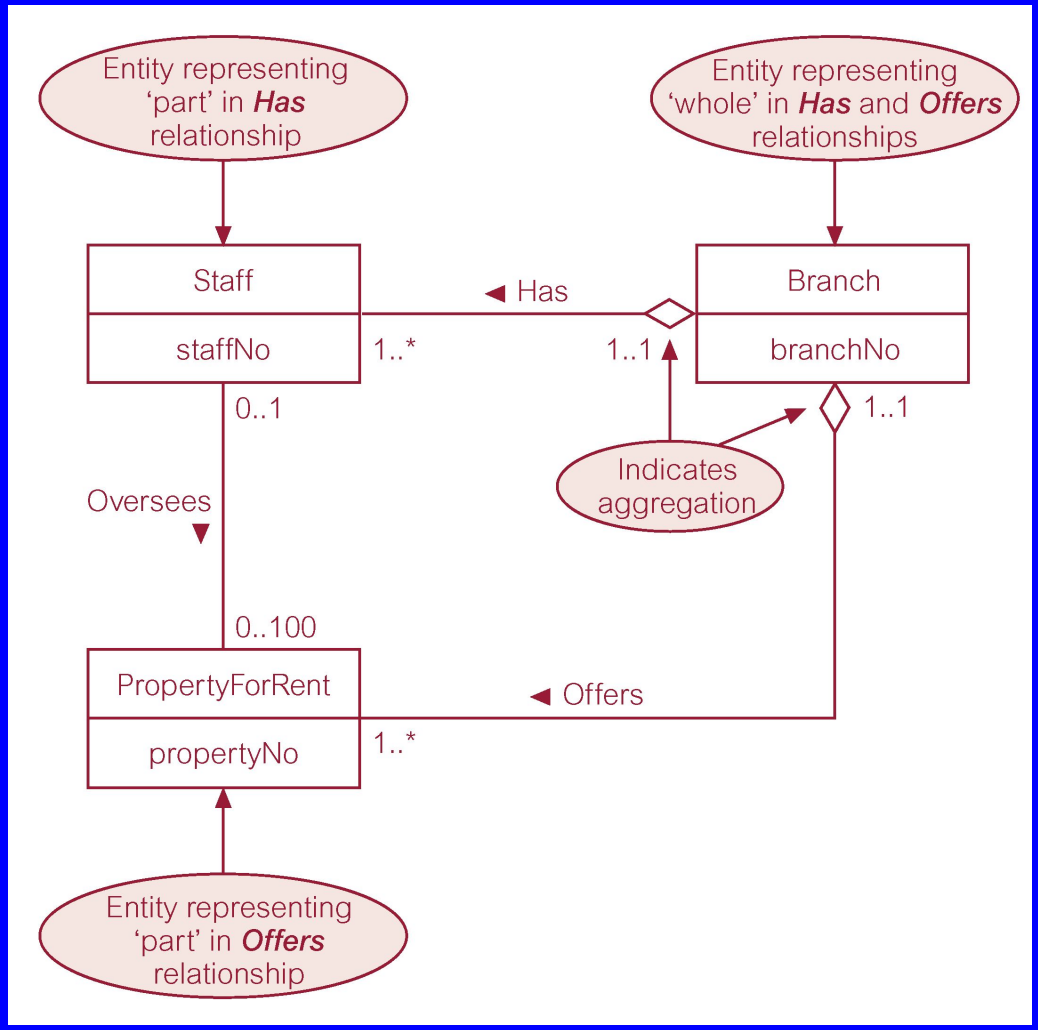
EER diagram of Branch view of *DreamHome* with specialization/generalization



Aggregation

- **Represents a ‘has-a’ or ‘is-part-of’ relationship between entity types, where one represents the ‘whole’ and the other ‘the part’.**

Examples of Aggregation



Composition

- **Specific form of aggregation that represents an association between entities, where there is a strong ownership and coincidental lifetime between the ‘whole’ and the ‘part’.**

Example of Composition