

Enhanced Entity-Relationship Modelling

Dr Na Yao

Learning Outcomes

- Understand the limitations of basic concepts of the ER model.
- Understand the requirements to represent more complex applications using additional data modelling concepts.
- Be able to identify the situations where superclass/subclass relationships are needed in data model.
- Be able to use EER diagram to model superclass/subclass relationships.

Enhanced Entity-Relationship Model

- Since 1980s there has been an increase in new database applications with more demanding requirements.
- Basic ER modelling is not sufficient for requirements of newer, more complex applications.
- Response is development of additional 'semantic' modelling concepts.

The Enhanced Entity-Relationship Model

- Semantic concepts are incorporated into the original ER model and called the Enhanced Entity-Relationship (EER) model.
- Most useful additional concept of EER model: specialization/generalization.

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.

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	SA1A	5000	100
SG37	Ann Beech	Assistant	12000					
SG66	Mary Martinez	Sales Manager	27000					
SA9	Mary Howe	Assistant	9000					
SL89	Stuart Stern	Secretary	8500	01/06/91	2350	SA2B	3700	
SL31	Robert Chin	Snr Sales Asst	17000					
SG5	Susan Brand	Manager	24000					

Specialization / Generalization

- Attribute Inheritance
 - An entity in a subclass represents same 'real world' object as in superclass
 - 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.

One entity has several different types? Potential subclasses?

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

Several entities similar? Potential superclass?

Constraints on Specialization / Generalization

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

Constraints on Specialization / Generalization

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

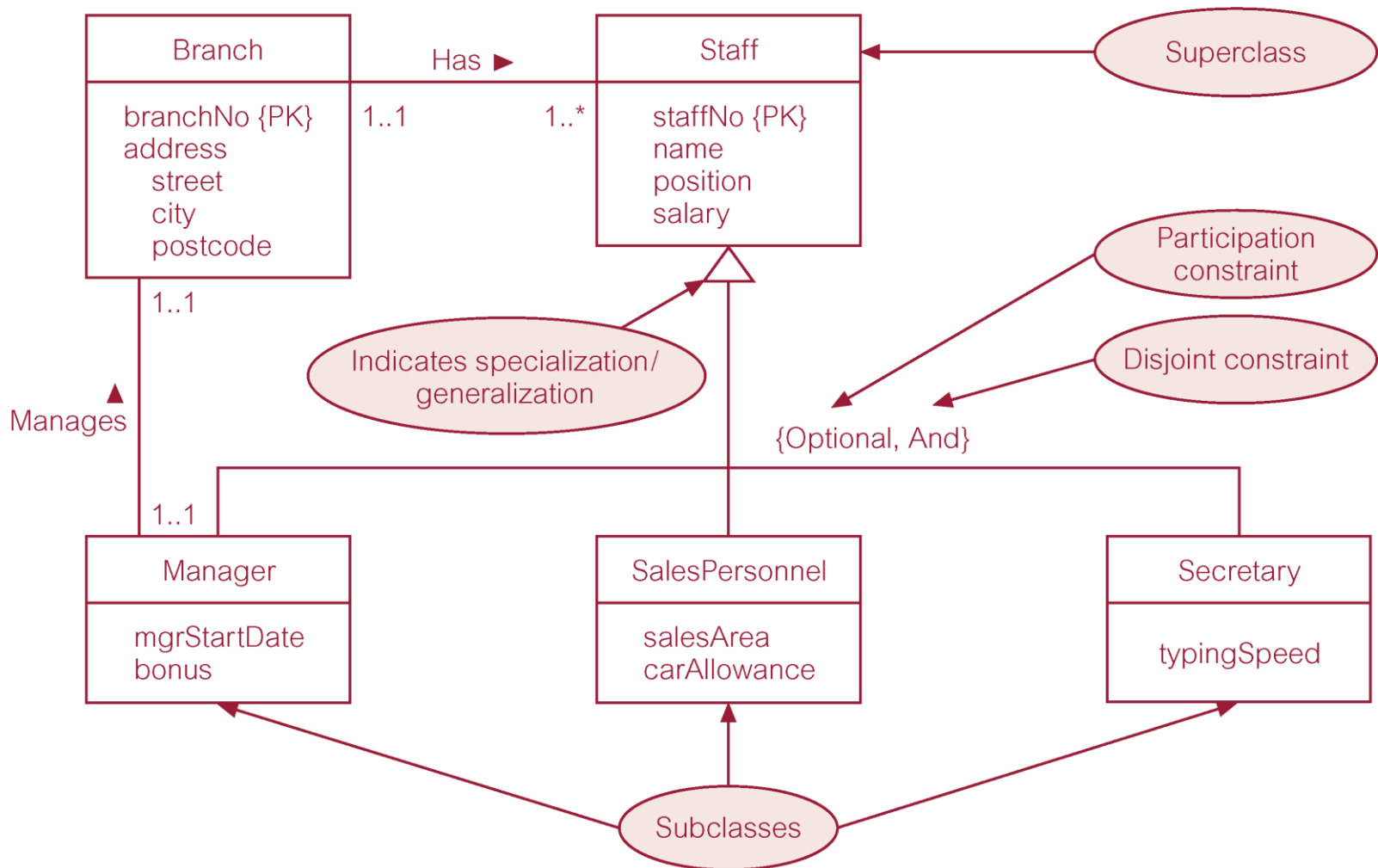
Constraints on Specialization / Generalization

- 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*.
 - Disjoint: member of superclass is member of at most one subclass (**or**).
 - Nondisjoint: member of superclass can be member of more than one subclass (**and**)

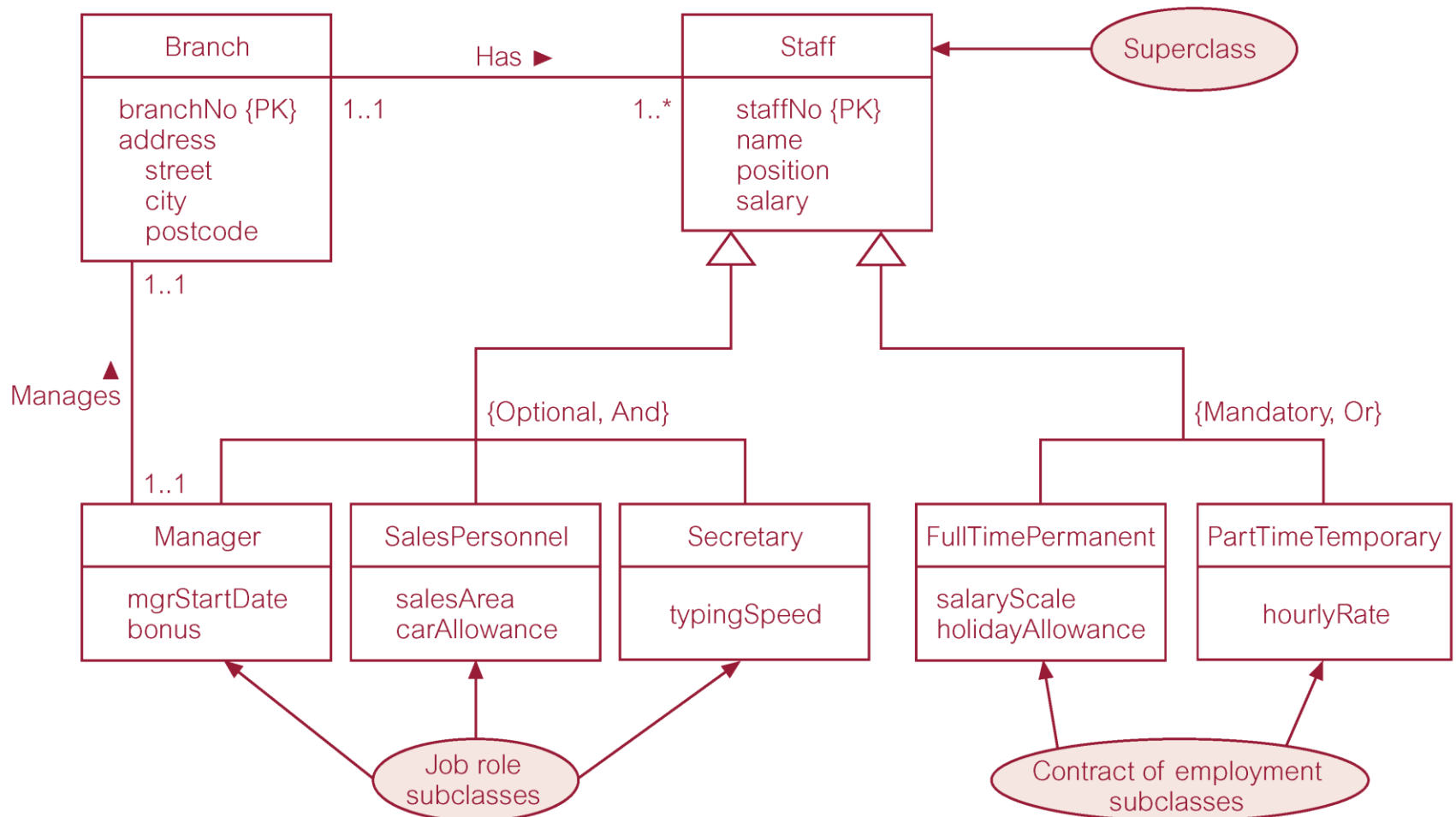
Constraints on Specialization / Generalization

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

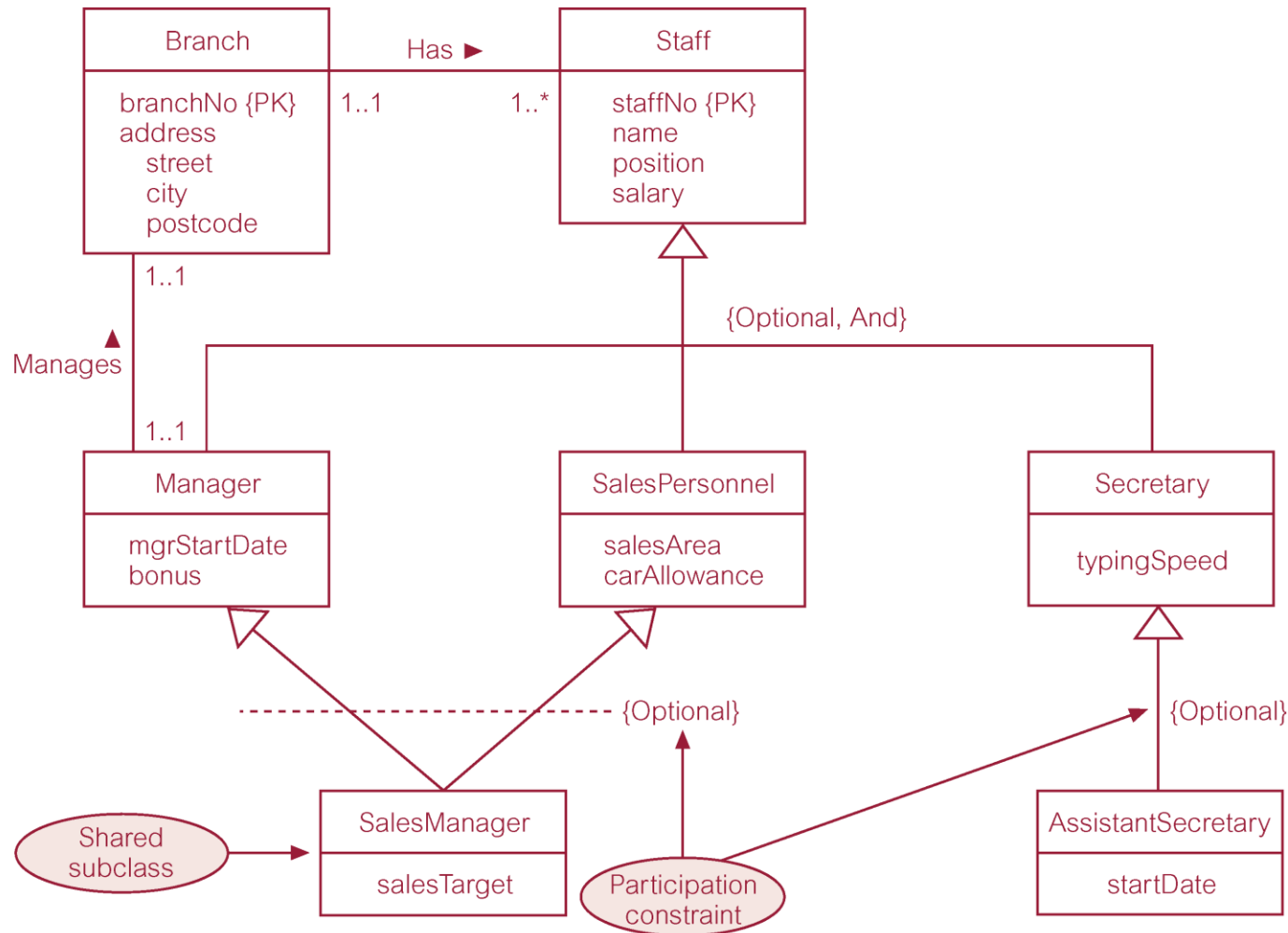
Specialization/generalization of Staff entity into subclasses representing job roles



Specialization/generalization of Staff entity into job roles and contracts of employment



EER diagram with shared subclass and subclass with its own subclass

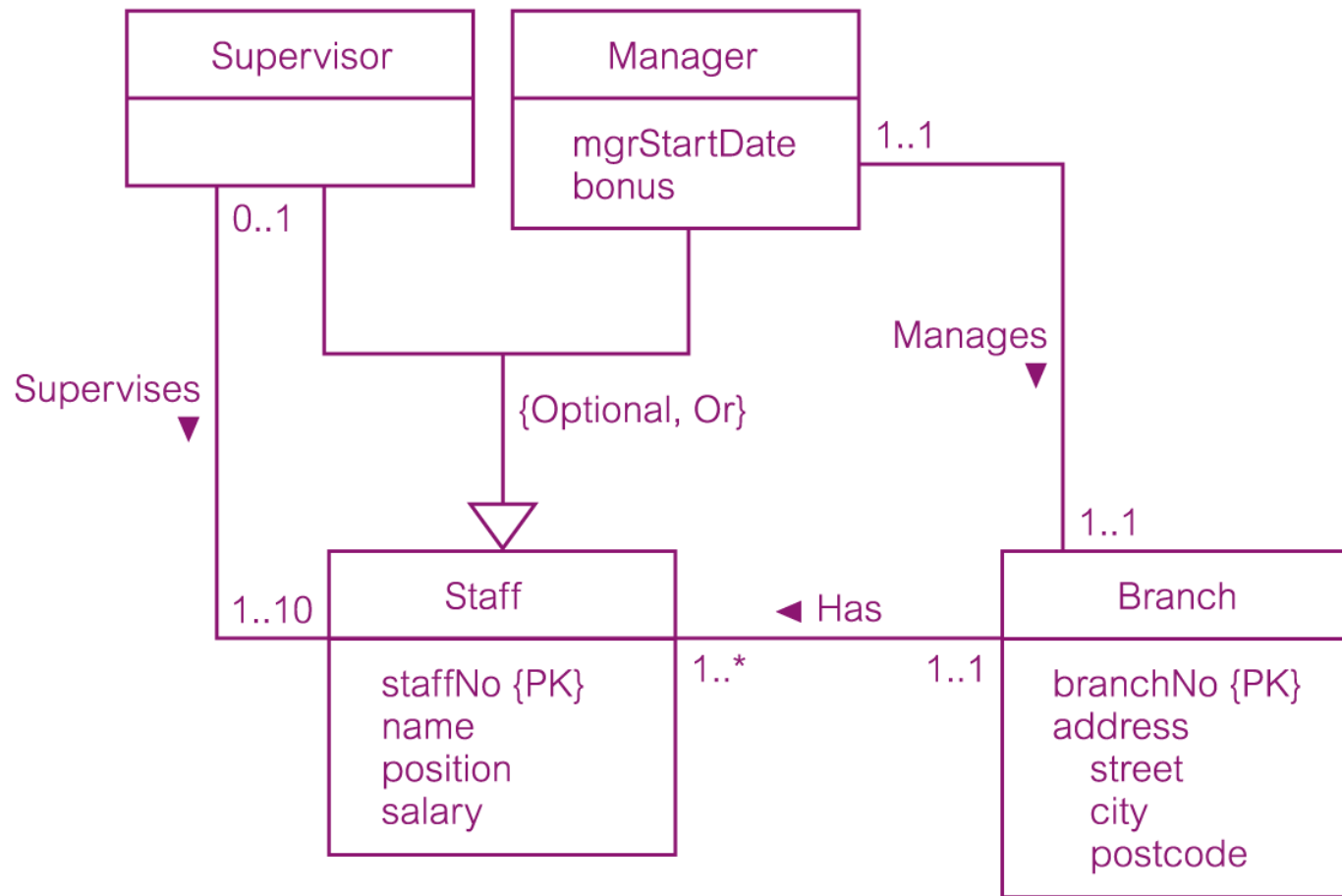


Superclass/subclass – when to use them?

Generally speaking, you should consider using superclass and subclass relationships when either (or both) of the following conditions are present:

1. There are attributes that apply to some (but not all) instances of an entity.
2. The instances of a potential subclass participate in a relationship unique to that subclass.

DreamHome worked example - Staff Superclass with Supervisor and Manager subclasses



Discussion

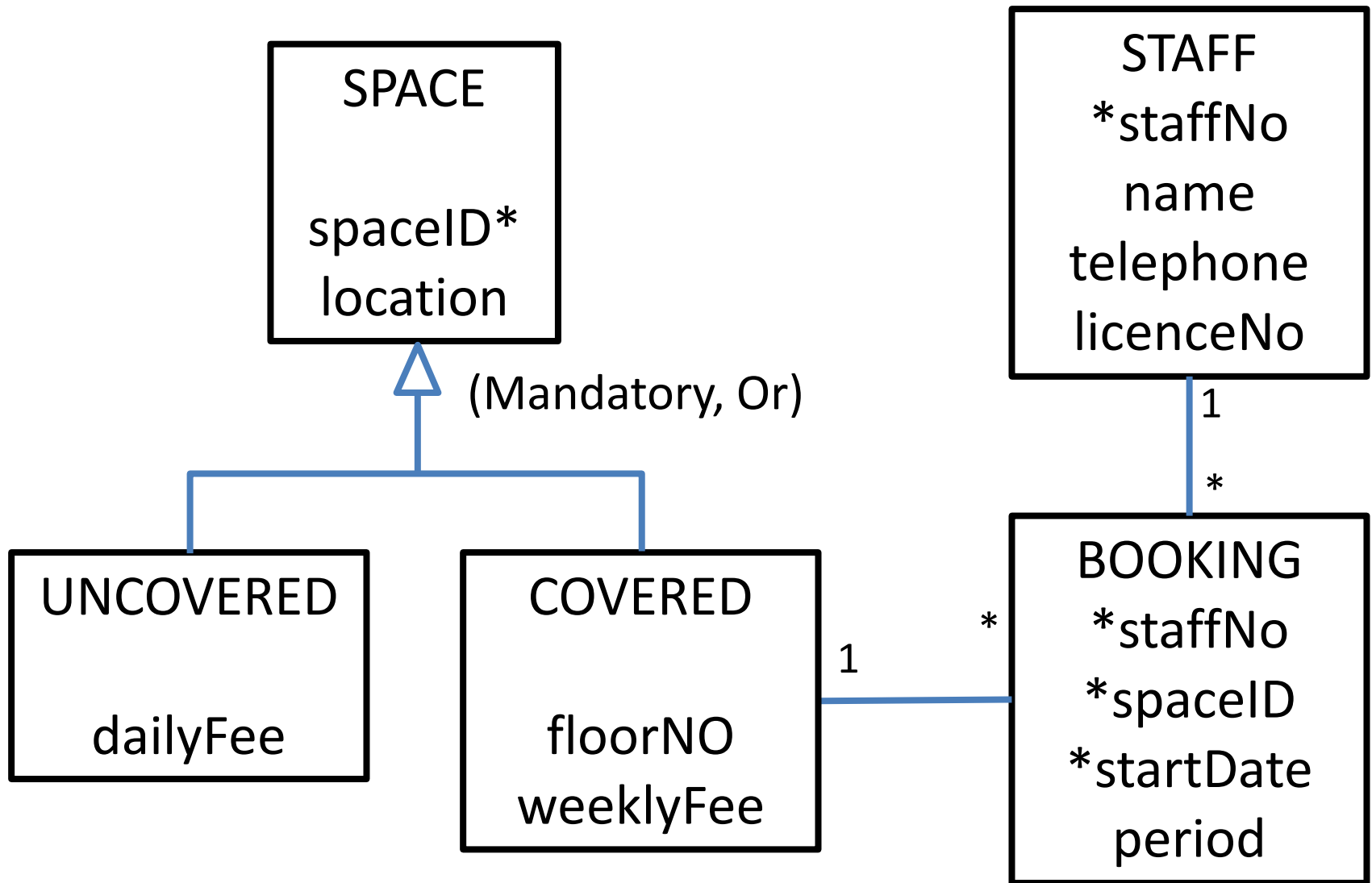
- A rental car agency classifies the vehicles it rents into ***four categories: compact, midsize, full size, and sport utility.*** The agency wants to record the following data for all vehicles: Vehicle ID, Make, Model, Year and Colour.
- There are **no** unique attributes for any of the four classes of vehicle. The entity type vehicle has a relationship (named Rents) with a customer entity type. **None** of the four vehicle classes has a unique relationship with an entity type.
- Would you consider creating a superclass/subclass relationship for this problem? Why?

Exercise

Create an EER model for the following descriptions:

- A large organization has many parking spaces, which can be used by staff. Each parking space are uniquely identified using a space number. Other information of parking space includes location of the space.
- Each member of staff has a unique number, name, telephone extension number, and vehicle license number.
- There are two types of parking spaces: covered spaces (in a car park building) and uncovered spaces (in an outdoor car park). Attribute of covered spaces is floor number. Covered spaces charge a weekly fee and staff can book a covered space in advance. Staff need to specify start date of a booking and how long a covered space is required in the booking.
- Uncovered parking spaces charges a daily fee, but no booking is required.

One possible solution



What have we learned?

- Enhanced Entity-Relationship adds new features to basic ER
- Specialisation/Generalisation
 - Specialisation – single entity with several subtypes which become subclasses.
 - Generalisation – many entities with attributes in common becomes superclass.
- Constraints on subclasses:
 - Optional/Mandatory
 - Disjoint/Non-disjoint