
Database Design and Practice 1

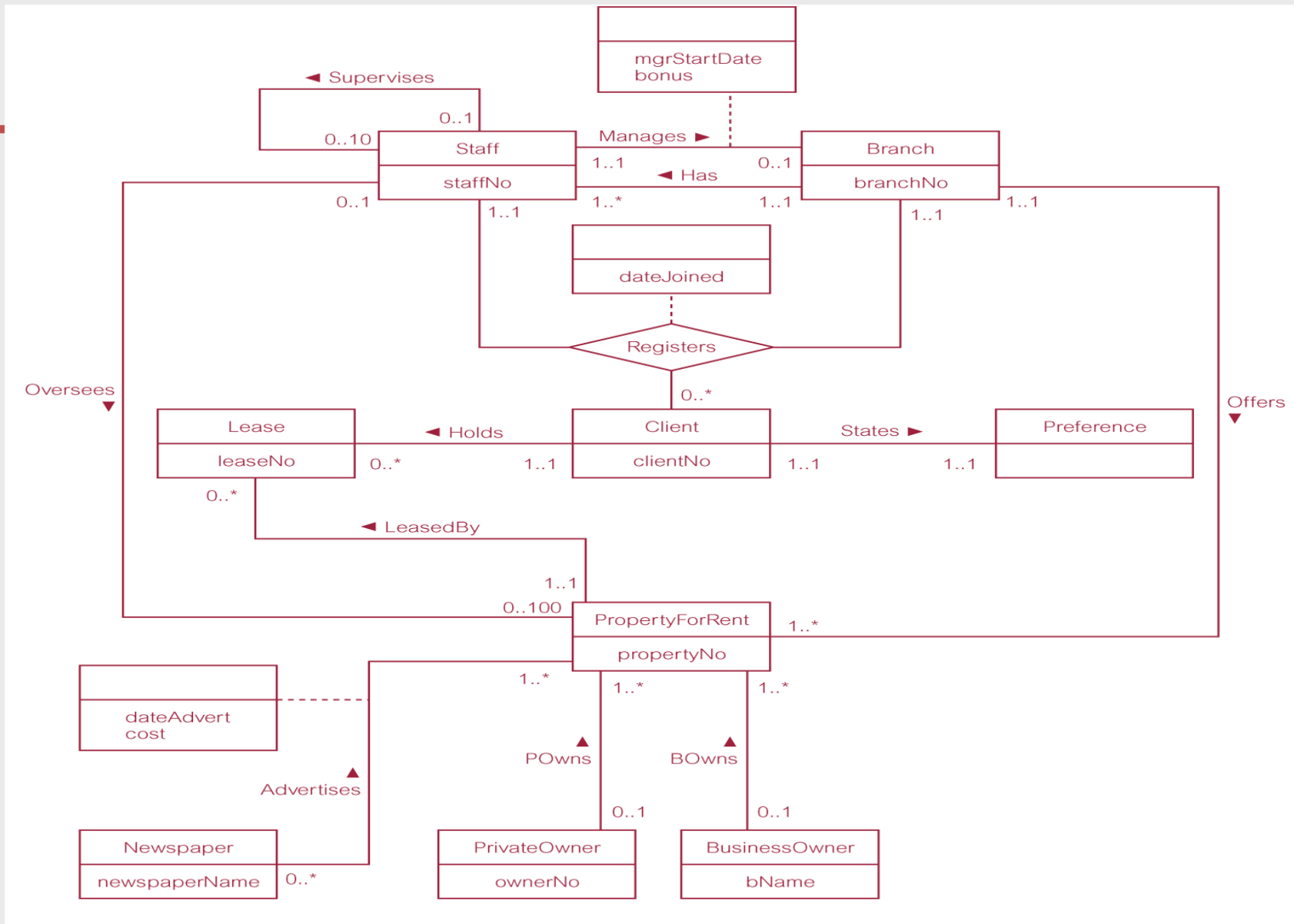
Lecture 01

**Entity-Relationship Modelling: entities,
attributes, relationships, multiplicity**

Lecture 01 - Objectives

- ◆ **How to use Entity–Relationship (ER) modeling in database design.**
- ◆ **Basic concepts associated with ER model: entities, attributes, relationships, multiplicity**
- ◆ **Diagrammatic technique for displaying ER model using Unified Modeling Language (UML).**

ER diagram of Branch user views of *DreamHome*



Concepts of the ER Model

- ◆ **Entity types**
- ◆ **Attributes**
- ◆ **Relationship types**

Entity Type

- ◆ **Entity type**
 - **Group of objects with same properties, identified by enterprise as having an independent existence.**
- ◆ **Entity occurrence**
 - **Uniquely identifiable object of an entity type.**

Examples of Entity Types

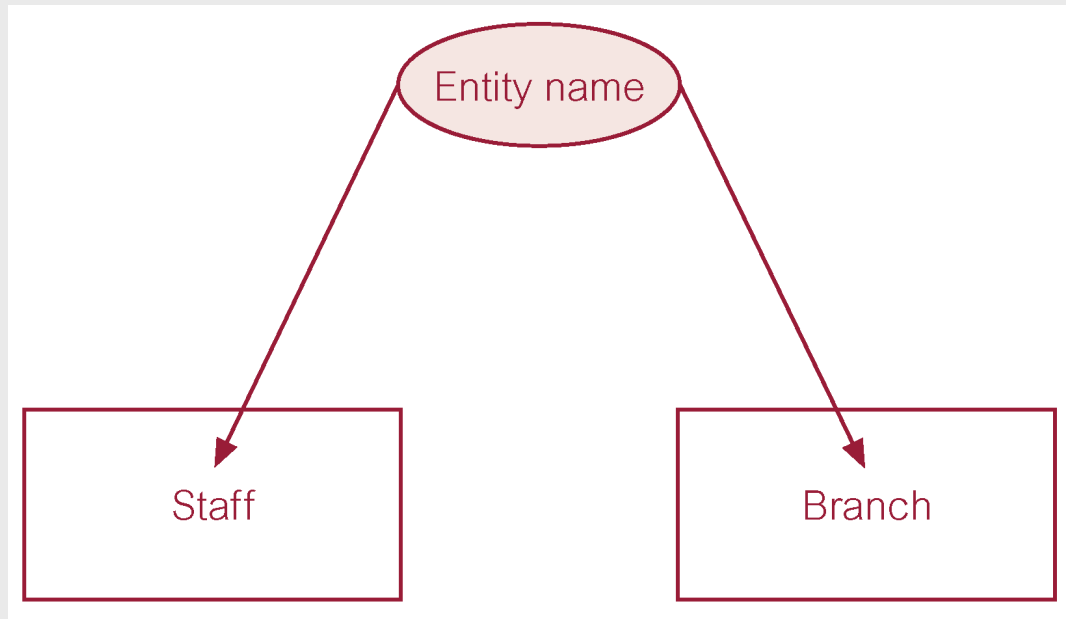
Physical existence

Staff	Part
Property	Supplier
Customer	Product

Conceptual existence

Viewing	Sale
Inspection	Work experience

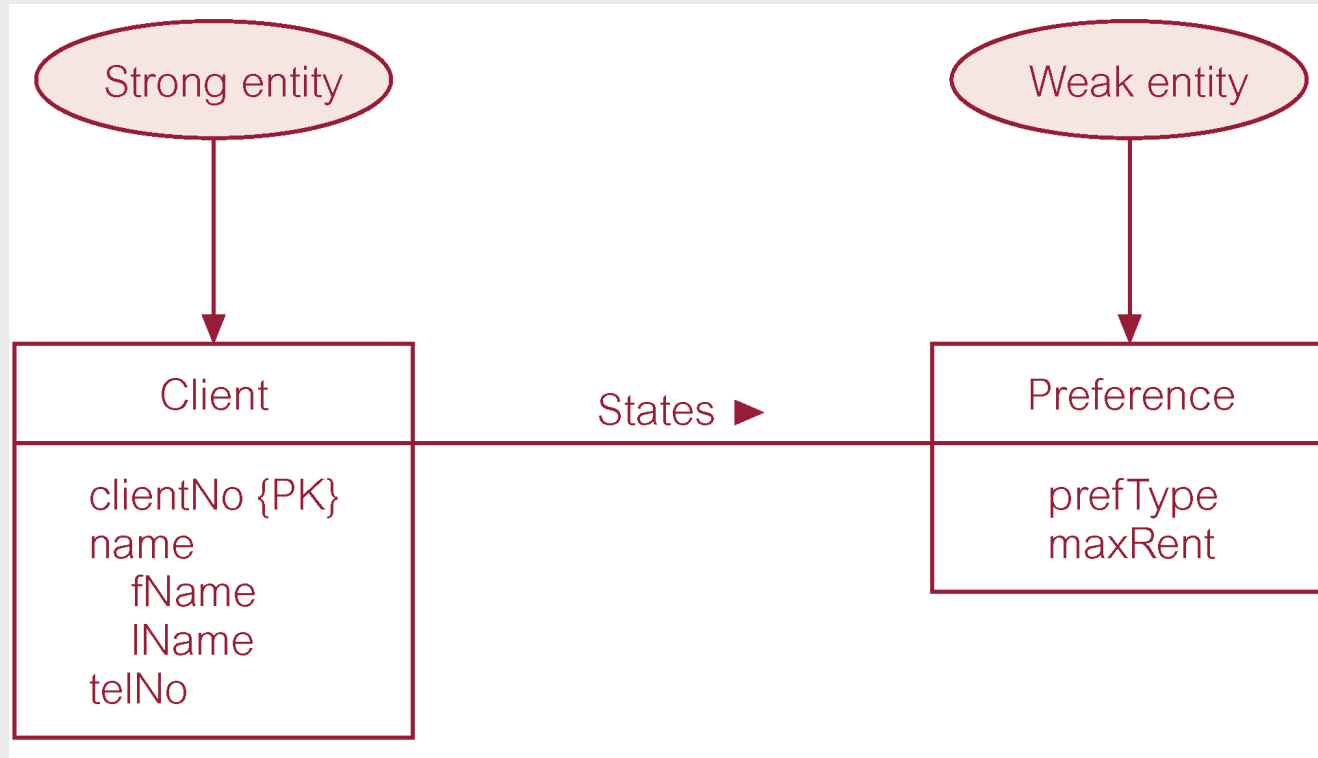
ER diagram of Staff and Branch entity types



Entity Type

- ◆ **Strong Entity Type**
 - Entity type that is *not* existence-dependent on some other entity type.
- ◆ **Weak Entity Type**
 - Entity type that is existence-dependent on some other entity type.

Strong entity type called Client and weak entity type called Preference



Attributes

- ◆ **Attribute**
 - **Property of an entity or a relationship type.**
- ◆ **Attribute Domain**
 - **Set of allowable values for one or more attributes.**

Attributes

- ◆ **Simple Attribute**
 - **Attribute composed of a single component with an independent existence.**

- ◆ **Composite Attribute**
 - **Attribute composed of multiple components, each with an independent existence.**

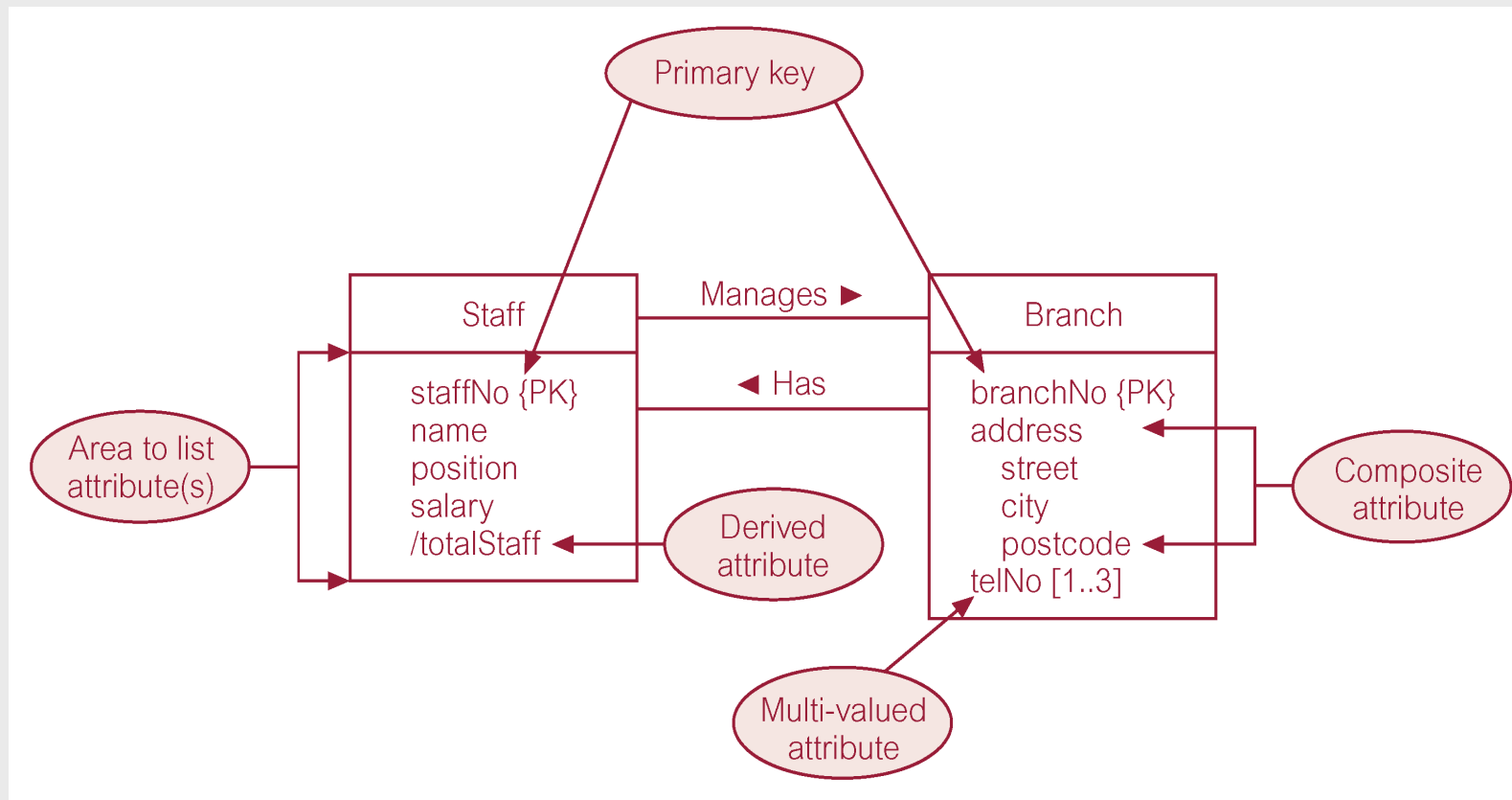
Attributes

- ◆ **Single-valued Attribute**
 - Attribute that holds a single value for each occurrence of an entity type.
- ◆ **Multi-valued Attribute**
 - Attribute that holds multiple values for each occurrence of an entity type.

Attributes

- ◆ **Derived Attribute**
 - **Attribute that represents a value that is derivable from value of a related attribute, or set of attributes, not necessarily in the same entity type.**

ER diagram of Staff and Branch entities and their attributes

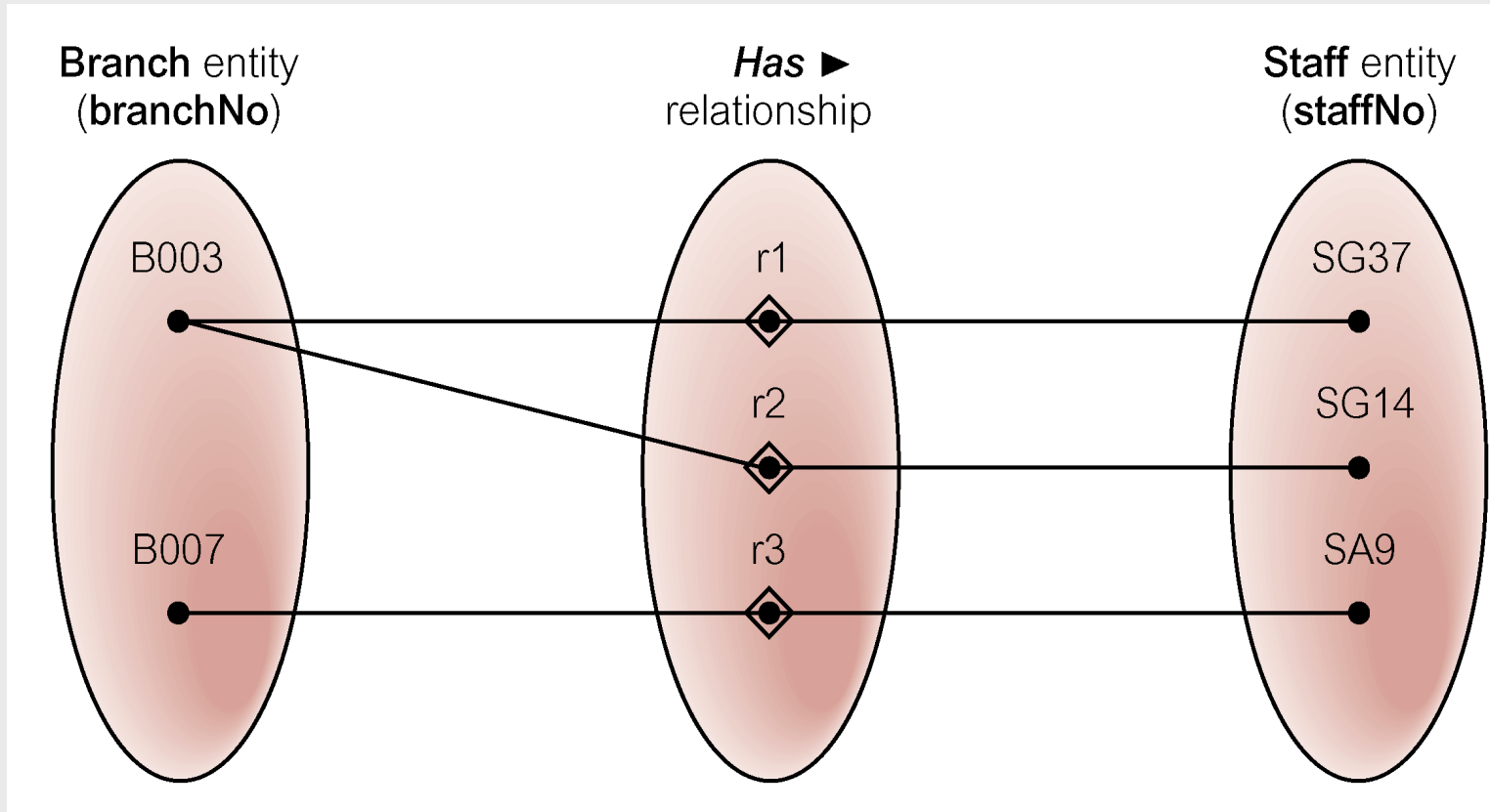


Relationship Types

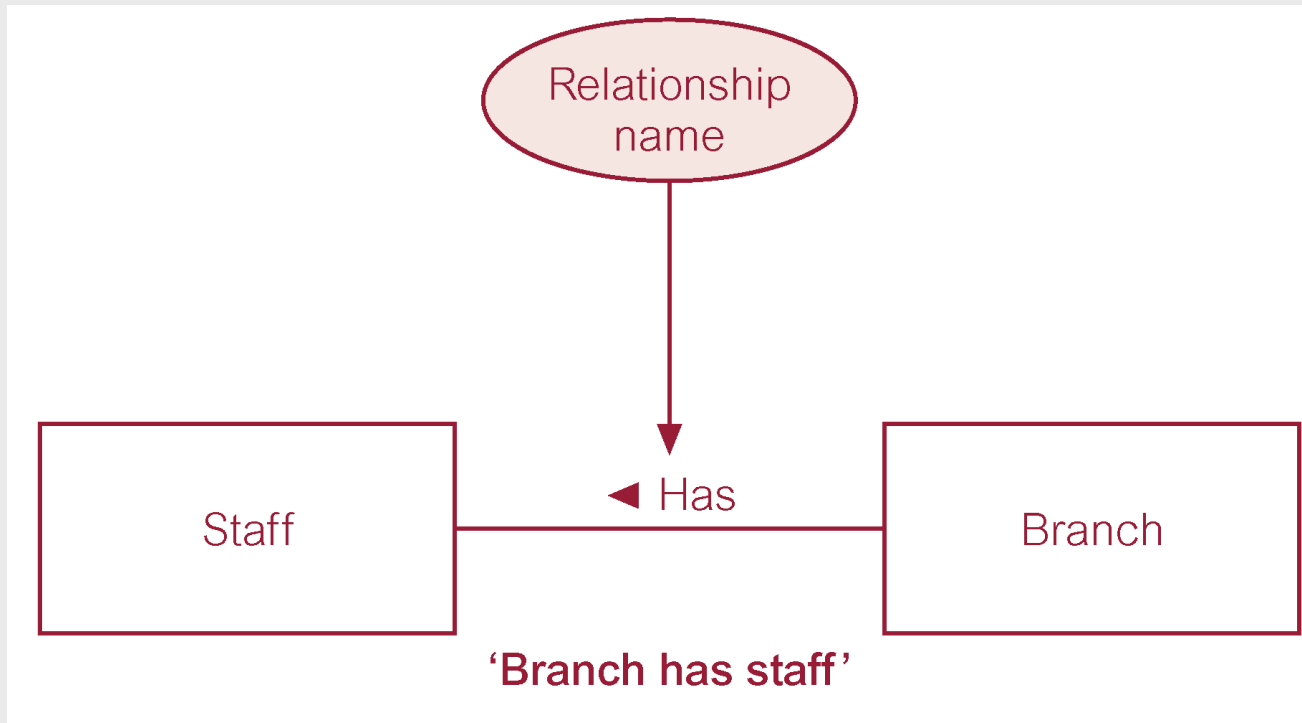
- ◆ **Relationship type**
 - **Set of meaningful associations among entity types.**

- ◆ **Relationship occurrence**
 - **Uniquely identifiable association, which includes one occurrence from each participating entity type.**

Semantic net of *Has* relationship type



ER diagram of Branch *Has* Staff relationship



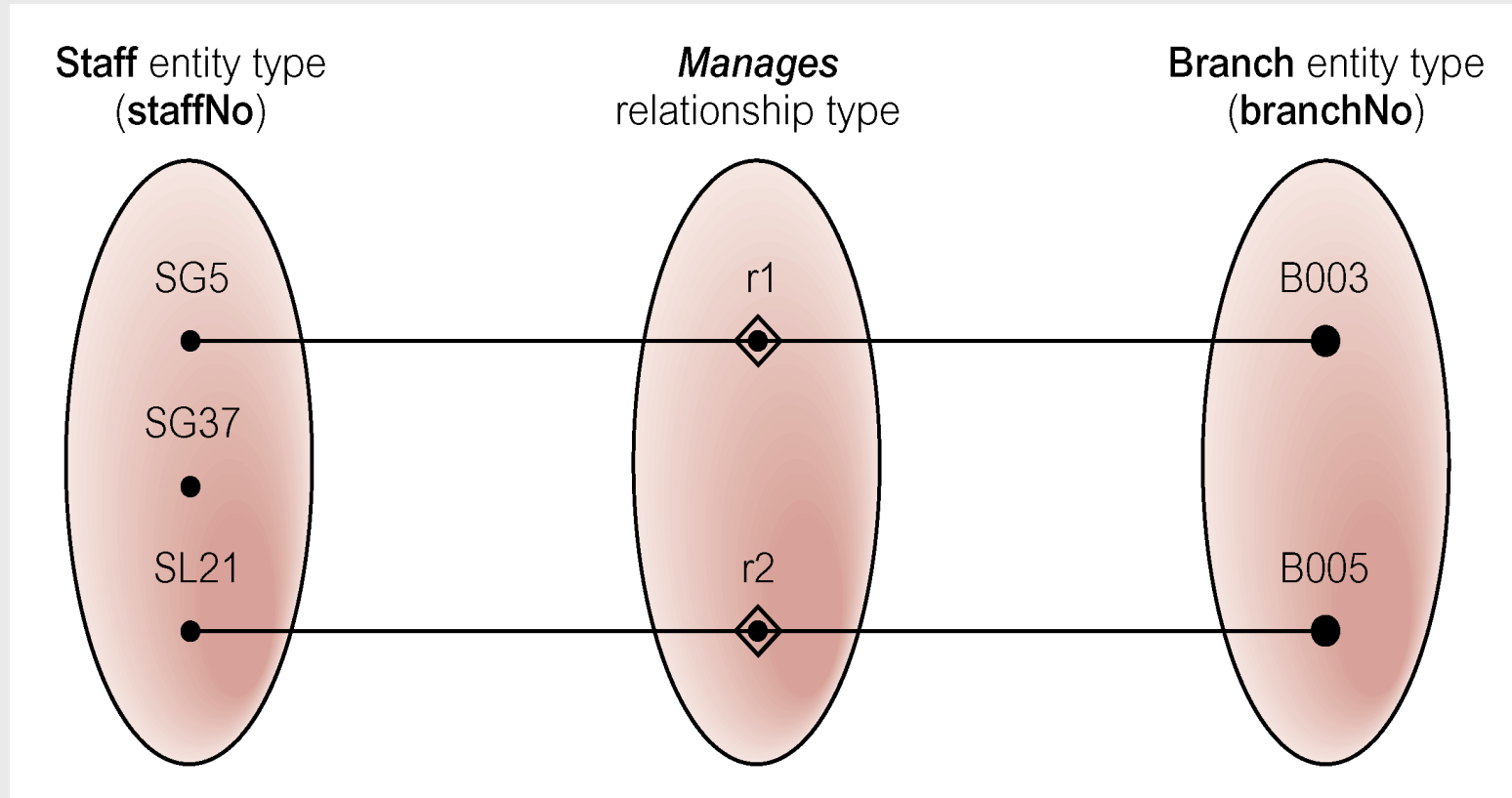
Structural Constraints

- ◆ **Main type of constraint on relationships is called *multiplicity*.**
- ◆ **Multiplicity - number (or range) of possible occurrences of an entity type that may relate to a single occurrence of an associated entity type through a particular relationship.**
- ◆ **Represents policies (called *business rules*) established by user or company.**

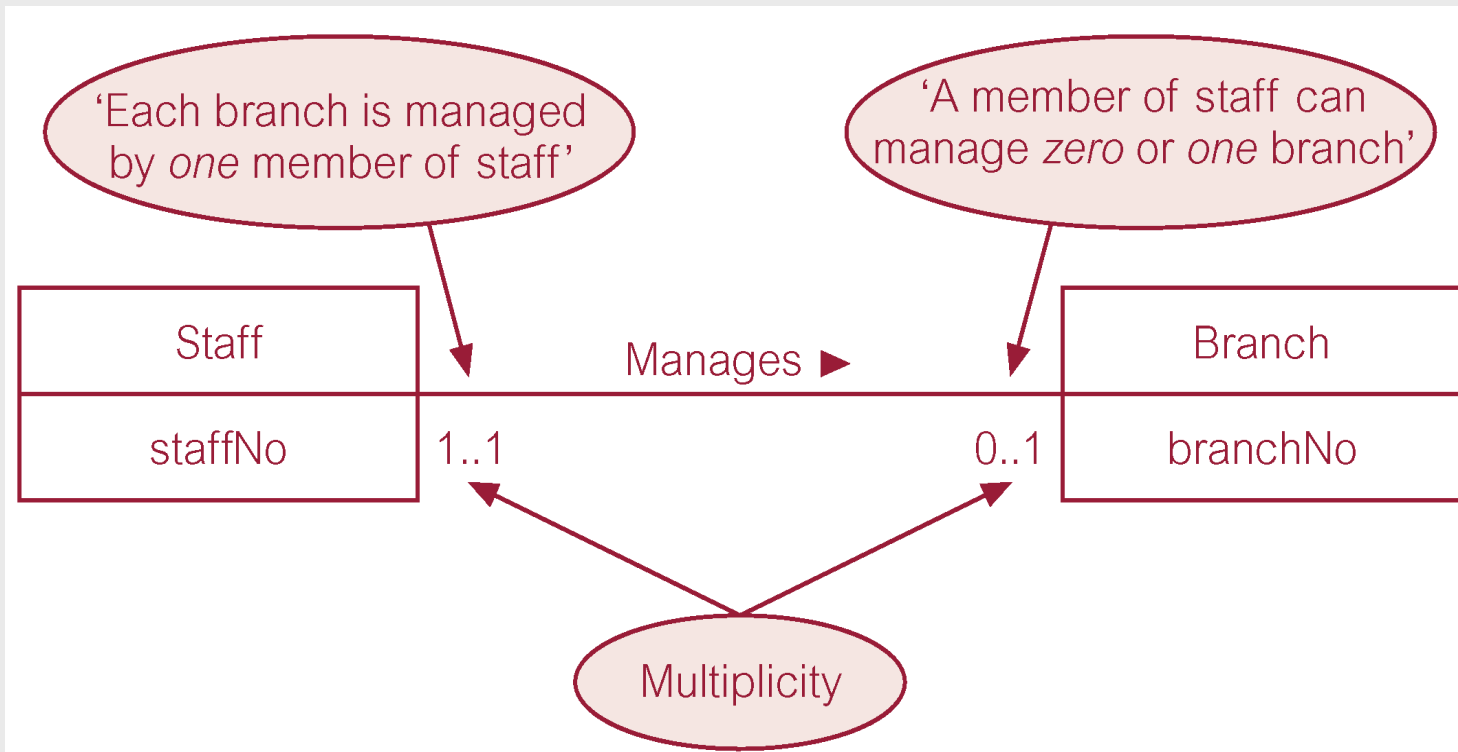
Structural Constraints

- ◆ **The most common degree for relationships is binary.**
- ◆ **Binary relationships are generally referred to as being:**
 - **one-to-one (1:1)**
 - **one-to-many (1:*)**
 - **many-to-many (*:*)**

Semantic net of Staff *Manages* Branch relationship type

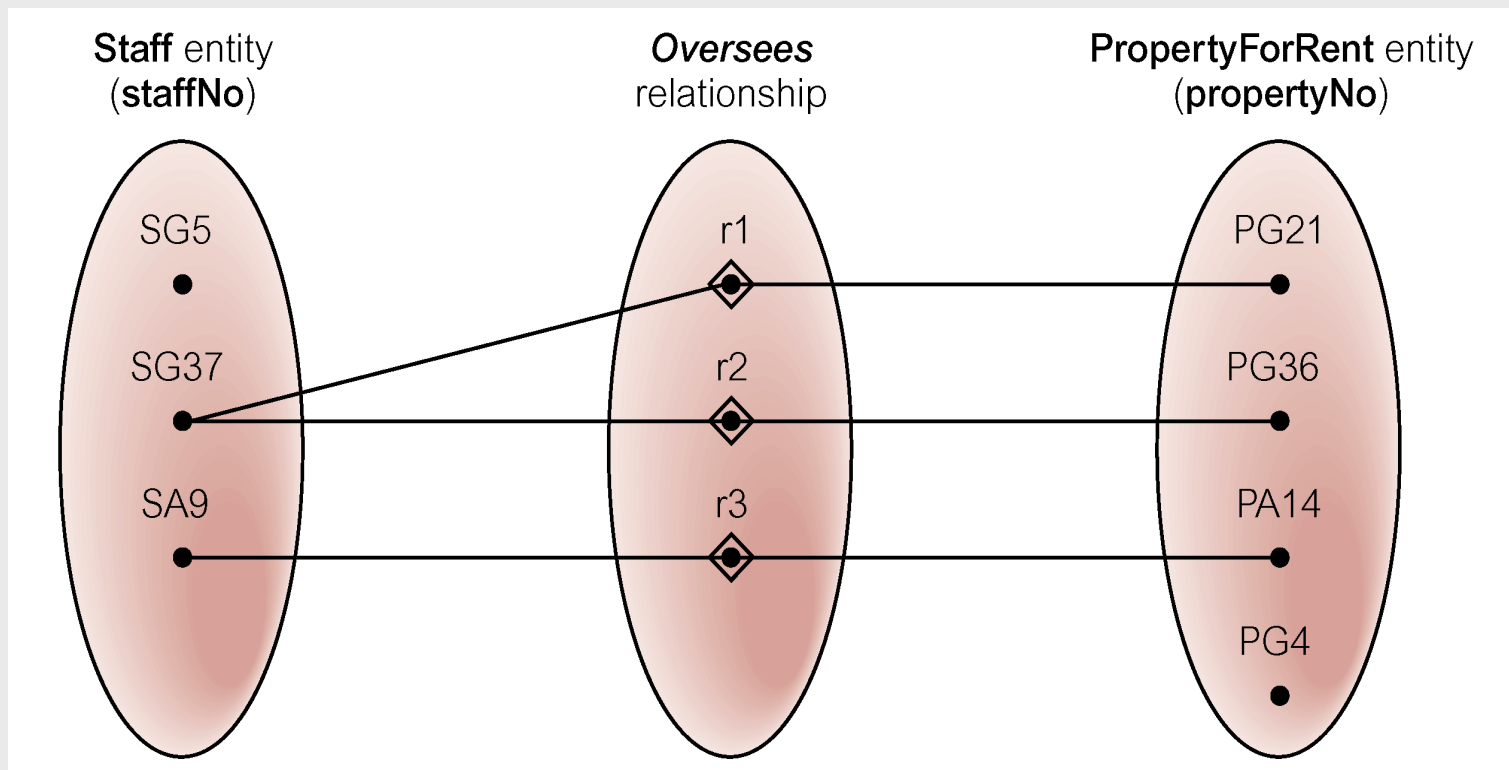


Multiplicity of Staff *Manages* Branch (1:1) relationship

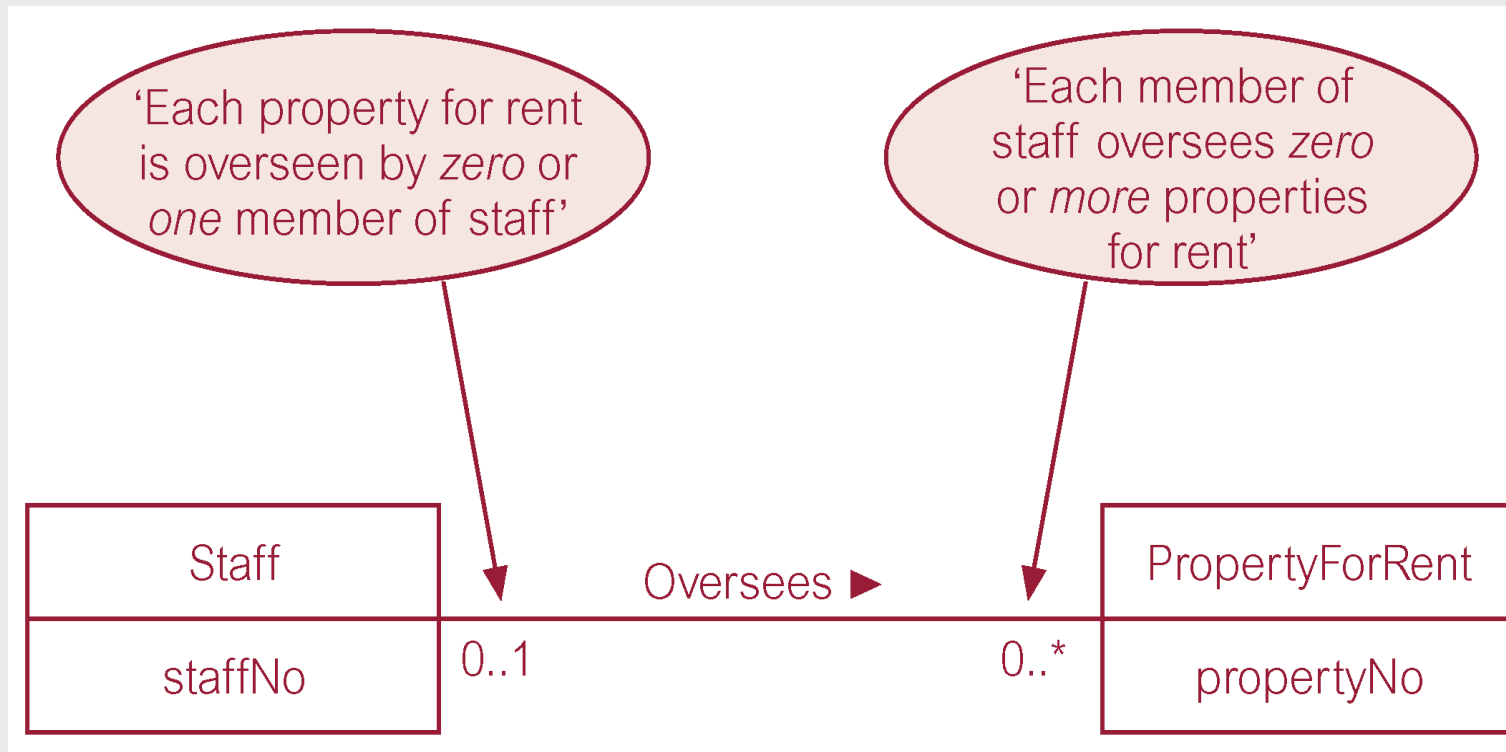


Semantic net of Staff Oversees

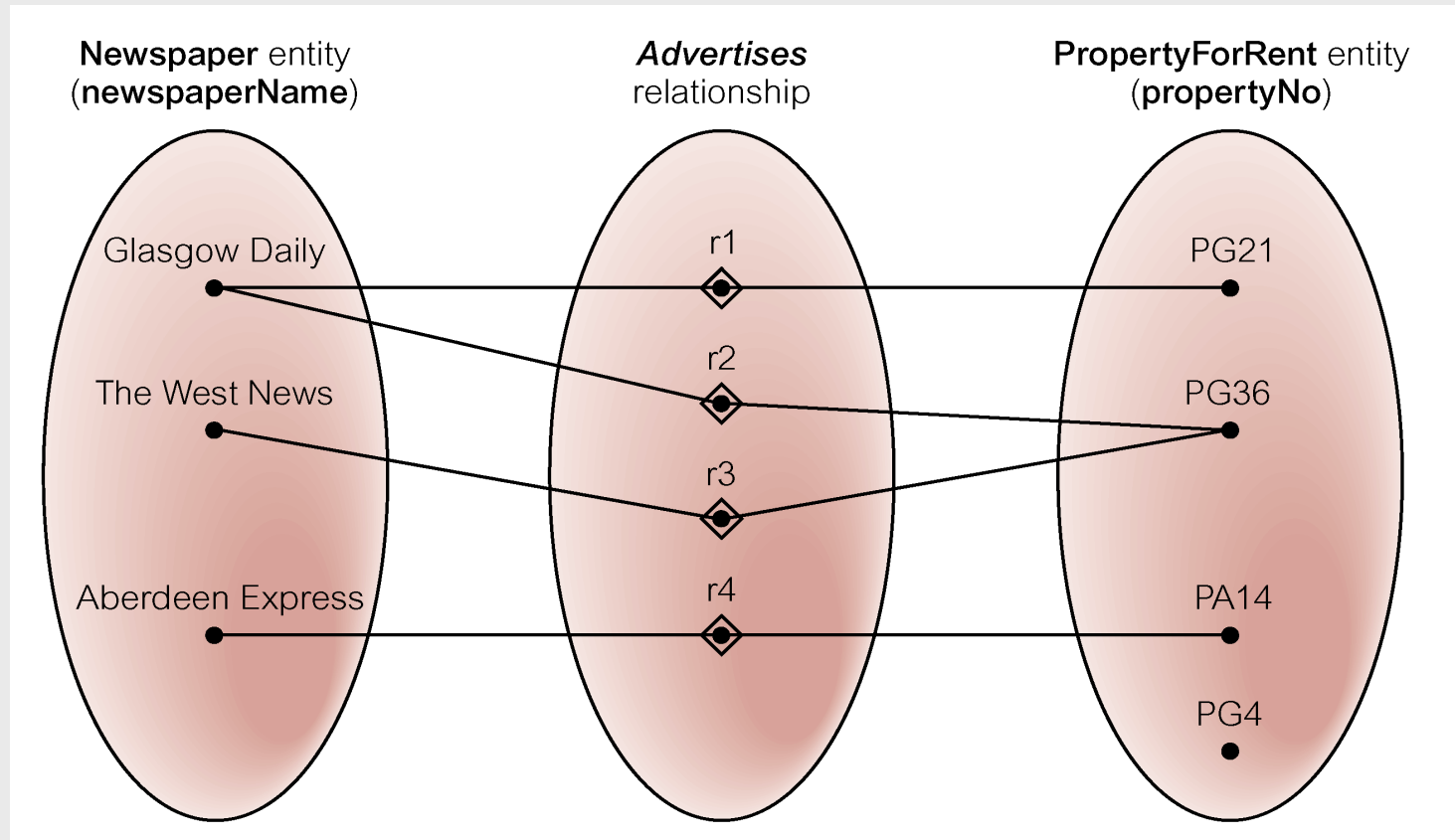
PropertyForRent relationship type



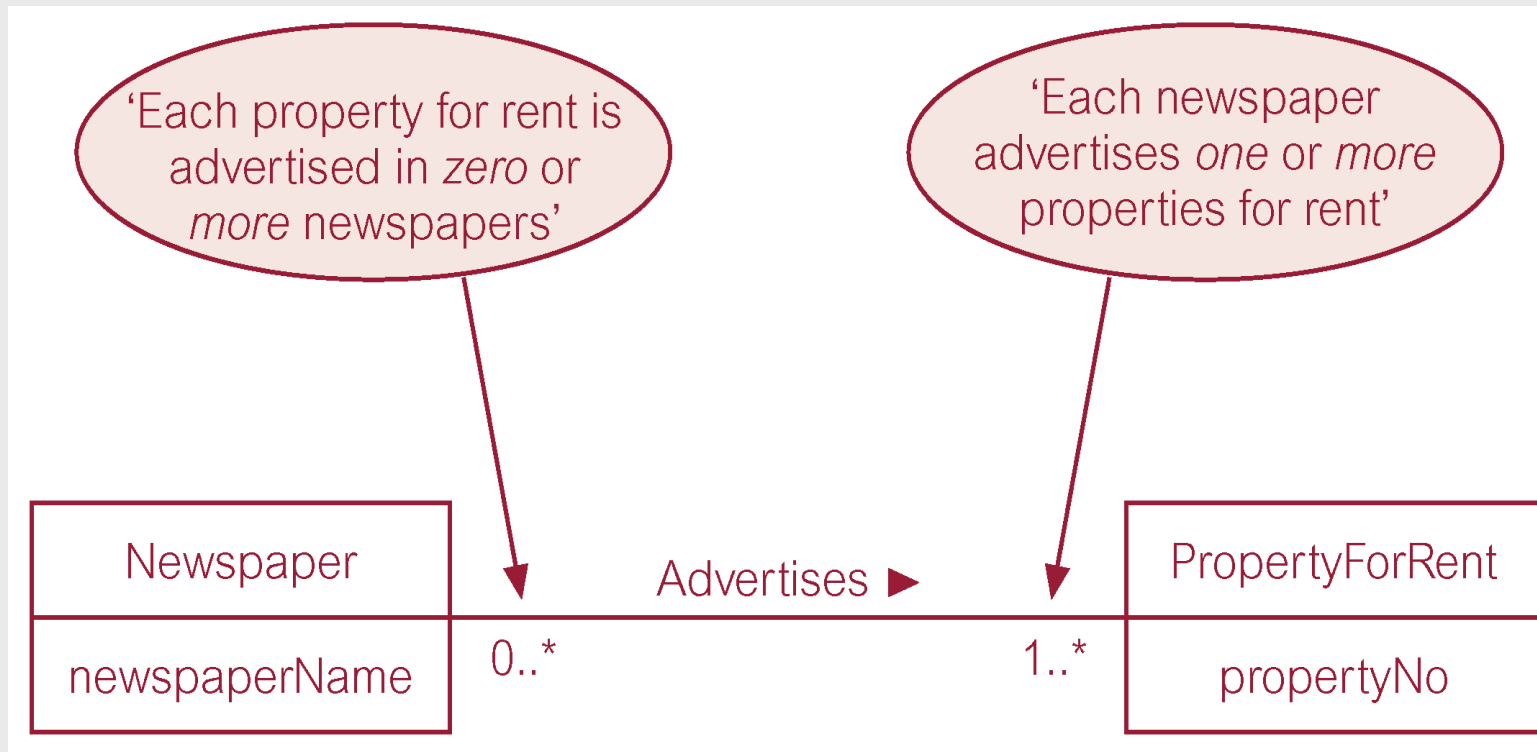
Multiplicity of Staff Oversees PropertyForRent (1:*) relationship type



Semantic net of Newspaper *Advertises* PropertyForRent relationship type



Multiplicity of Newspaper *Advertises* PropertyForRent (*:*) relationship



Summary of multiplicity constraints

Alternative ways to represent multiplicity constraints

Meaning

0..1	Zero or one entity occurrence
1..1 (or just 1)	Exactly one entity occurrence
0..* (or just *)	Zero or many entity occurrences
1..*	One or many entity occurrences
5..10	Minimum of 5 up to a maximum of 10 entity occurrences
0, 3, 6–8	Zero or three or six, seven, or eight entity occurrences

Structural Constraints

- ◆ **Multiplicity is made up of two types of restrictions on relationships: *cardinality* and *participation*.**

Structural Constraints

- ◆ **Cardinality**
 - **Describes maximum number of possible relationship occurrences for an entity participating in a given relationship type.**
- ◆ **Participation**
 - **Determines whether all or only some entity occurrences participate in a relationship.**

Multiplicity as cardinality and participation constraints

