

Lecture 8

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*Chapter 5*

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**Entity-Relationship  
Modeling (Continued)**

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*Structural Constraints*

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- Two main types of restrictions on relationships are:
  - Cardinality Constraints
  - Participation Constraints

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### *Cardinality Constraints*

- Determines the number of possible relationships for each participating entity.
- Most common degree for relationships is binary with cardinality ratios of:
  - one-to-one (1:1),
  - one-to-many (1:M) or
  - many-to-many (M:N)

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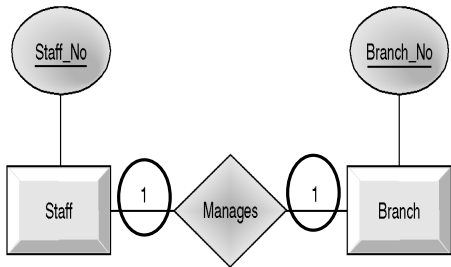
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### *Staff Manages Branch (1:1) Relationship*




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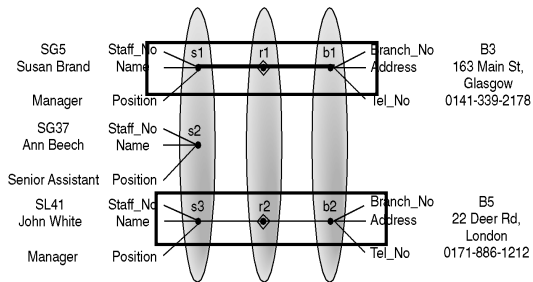
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### *A Semantic Net Model of Staff Manages Branch Relationship*




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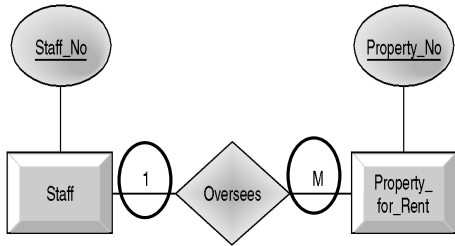
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**Staff Oversees Property\_for\_Rent  
(1:M) Relationship**




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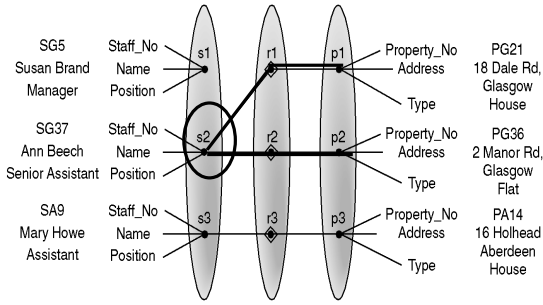
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**Semantic Net Diagram of Staff Oversees  
Property\_for\_Rent Relationship**




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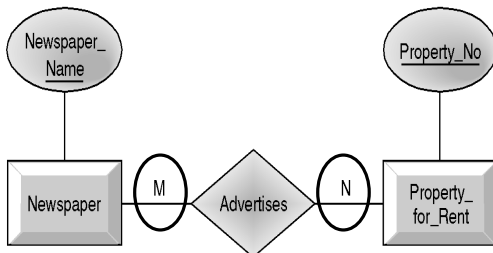
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**Newspaper Advertises Property\_for\_Rent  
(M:N) Relationship**




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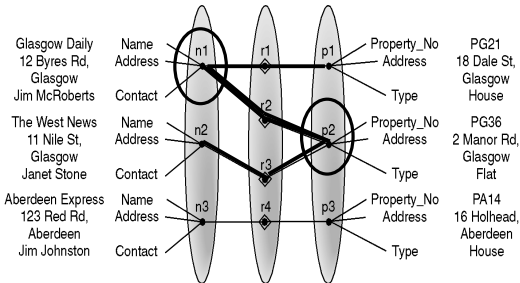
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***Semantic Net Diagram of Newspaper  
Advertises Property\_for\_Rent Relationship***




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***Participation Constraints***

- Determines whether the existence of an entity depends on its being related to another entity through the relationship.
- Total Participation
- Partial Participation

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***Participation Constraints***

- Total Participation
  - The participation is total if an entity's existence requires the existence of an associated entity in a particular relationship.
- Partial Participation
  - The participation is partial for the vice versa.

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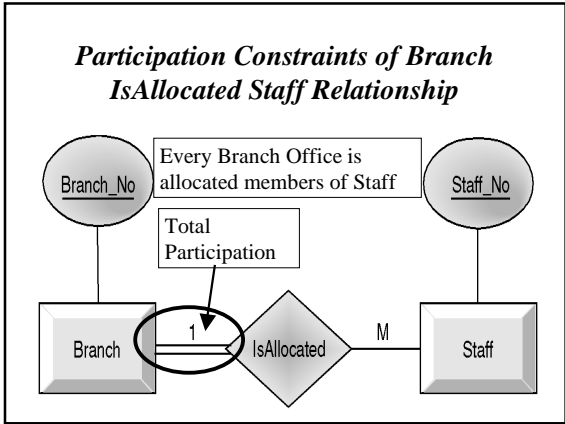
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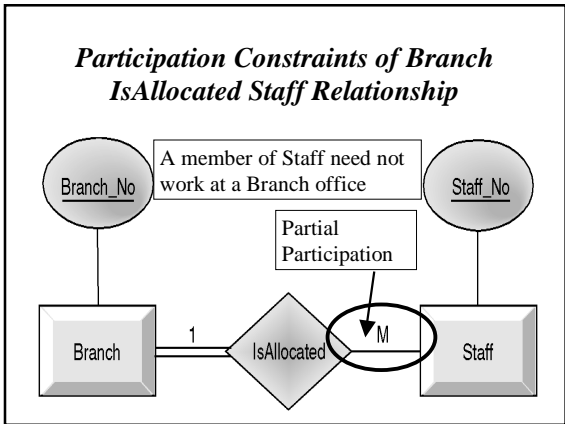
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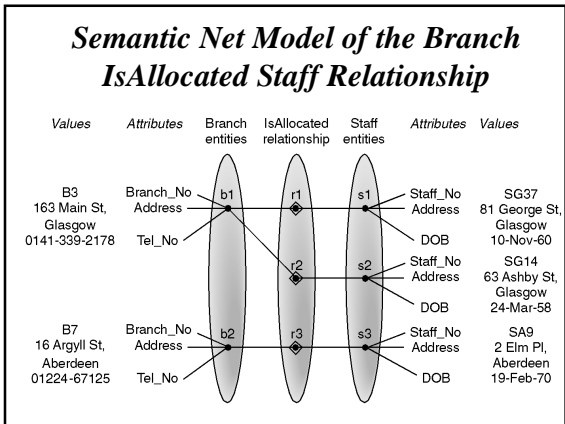
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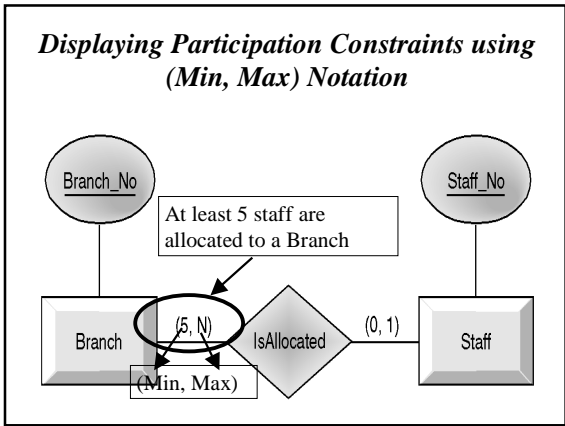
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**Displaying Participation Constraints using (Min, Max) Notation**




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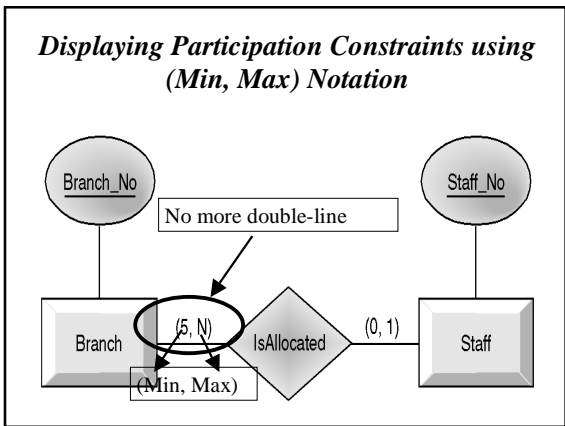
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**Displaying Participation Constraints using (Min, Max) Notation**




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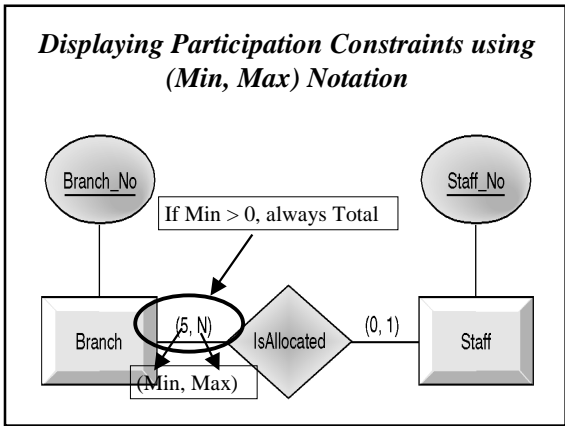
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**Displaying Participation Constraints using (Min, Max) Notation**




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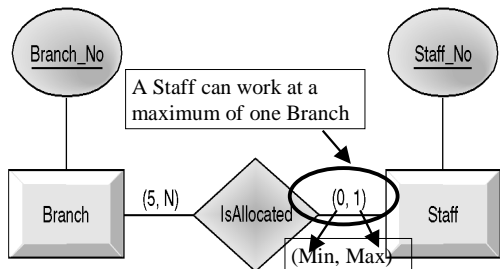
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**Displaying Participation Constraints using (Min, Max) Notation**



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**Problems with ER Models**

- Problems may arise when designing a conceptual data model called connection traps.
- Often due to a misinterpretation of the meaning of certain relationships.

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**The Enhanced ER Models**

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***The Enhanced ER Model***

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

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***The Enhanced ER Model***

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- Semantic concepts are incorporated into the original ER model and is called the Enhanced Entity-Relationship (EER) model.
- Additional concepts of EER model includes specialization / generalization, and categorization.

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***Superclass***

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- An entity type that includes distinct Subclasses that require to be represented In a data model.

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### *Subclass*

- A Subclass is an entity type that has a distinct role and is also a member of the Superclass.

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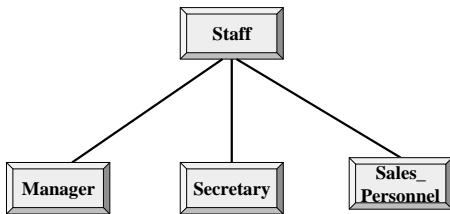
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### *Superclass/Subclass*



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### *Inheritance*

- **Attribute Inheritance**
- An entity in a Subclass may possess subclass specific attributes, as well as those associated with the Superclass.

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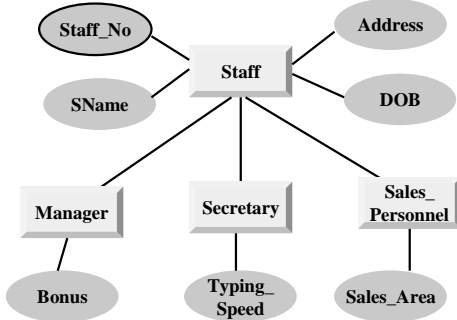
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### *Superclass/Subclass*



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### *Concept of Specialization / Generalization*

- **Specialization**
  - The process of maximizing the differences between members of an entity by identifying their distinguishing characteristics.
- **Generalization**
  - The process of minimizing the differences between entities by identifying their common features.

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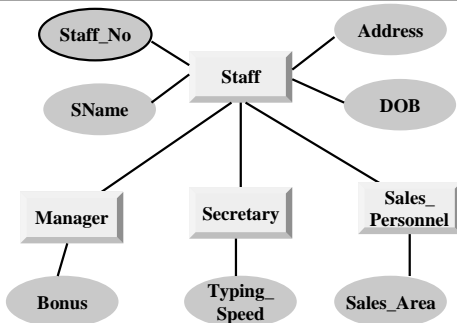
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### *Concept of Specialization / Generalization*



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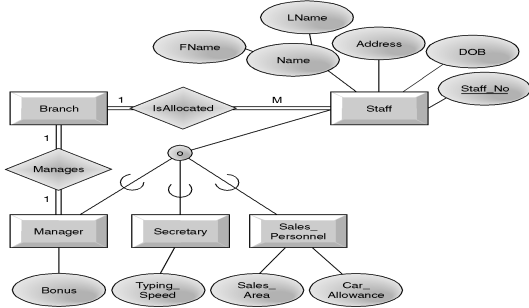
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**Specialization of Staff Entity into Job Roles Subclasses**




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**Concept of Specialization / Generalization**

- Specialization and generalization has:
- Disjoint Constraints
- Participation Constraints

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**Disjoint Constraints**

- Disjoint
  - Members in different Subclasses from the same Superclass are completely different.
- Non-Disjoint
  - Members in a Superclass can be enrolled in more than one Subclass.

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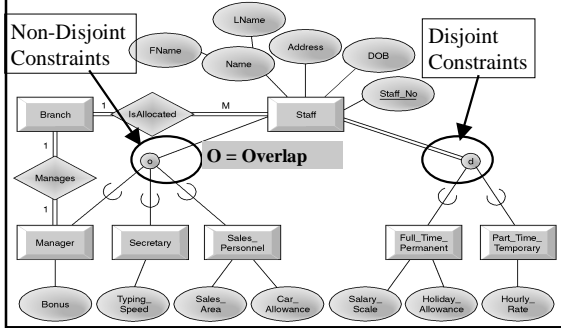
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**Specialization of Staff Entity into Job Roles and Contract of Employment Subclasses**




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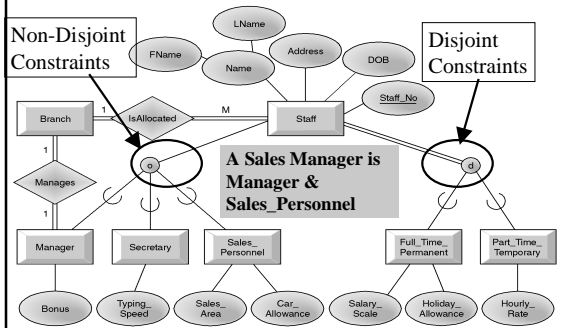
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**Specialization of Staff Entity into Job Roles and Contract of Employment Subclasses**




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**Participation Constraints**

- **Total**
  - All member in the Superclass must participate in either one Subclass.
  
- **Partial**
  - At least one member in the Superclass does not participate in the Subclass.

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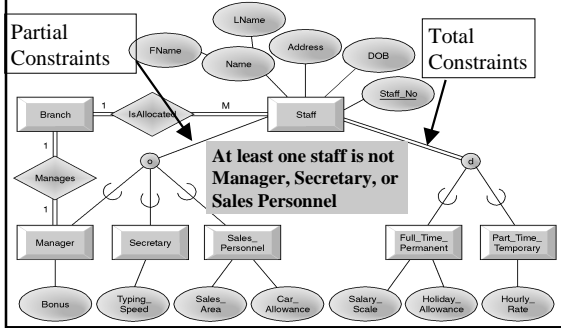
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**Specialization of Staff Entity into Job Roles and Contract of Employment Subclasses**




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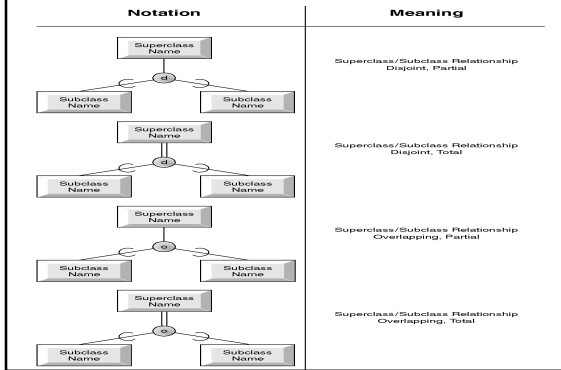
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**Summary of Specialization/Generalization Notation**




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**Categorization**

- The modeling of a single subclass (called a category) with a relationship that involves more than one distinct superclass.
- A category subclass has selective inheritance.
- Divided based on total or partial participation.
  - Total - every occurrence of all superclasses must appear in the category.
  - Partial - constraint is removed.

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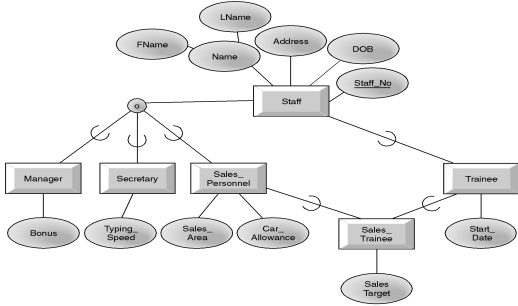
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***A Shared Subclass called Sales\_Trainee***




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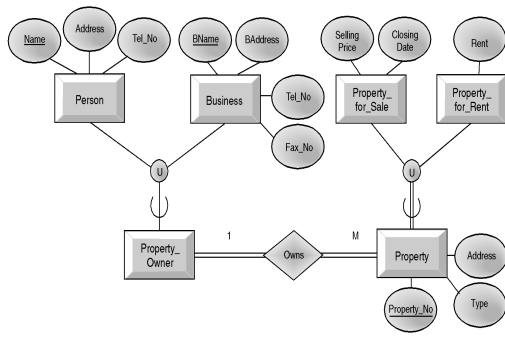
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***Property\_Owner and Property Categories***




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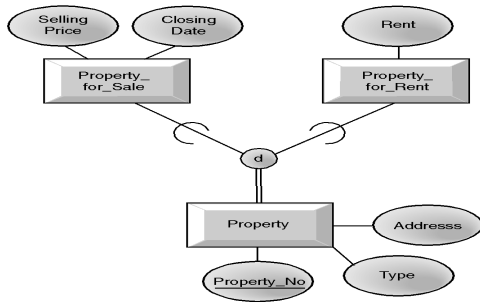
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***Property represented as a Specialization / Generalization.***




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### *Building an EER Model*

- Identify entity types.
- Identify relationship types.
  - Determine cardinality and participation constraints of relationship types.
- Identify and associate attributes with entity or relationship types.

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### *Building an EER Model*

- Determine candidate and primary key attributes.
- Specialize / generalize entity types.
  - Categorize entity types.
  - Draw the EER Diagram.

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### *Summary of Entity-Relationship Notation*

Notation	Meaning
	The Strong Entity Type
	The Weak Entity Type
	The Relationship Type
	The Weak Relationship Type
	The Attribute
	The Primary Key Attribute
	The Multi-valued Attribute
	The Derived Attribute
	The Composite Attribute

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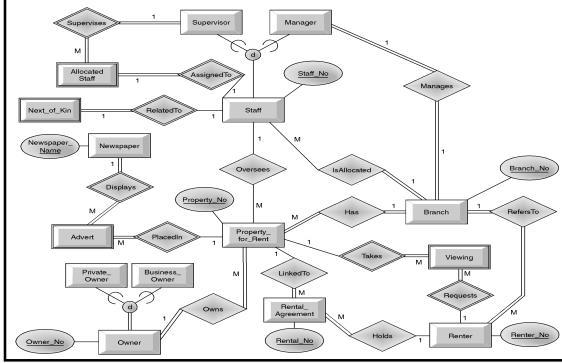
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## An Example ER Model




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