

Entity Relationship Diagram

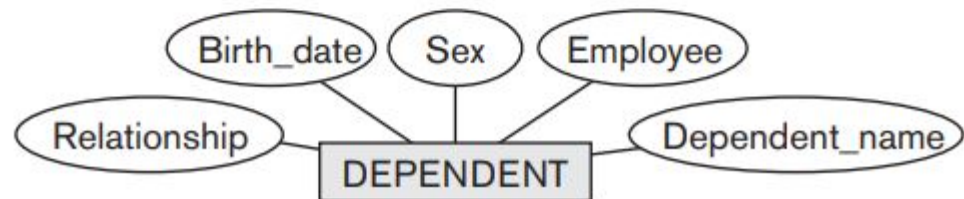
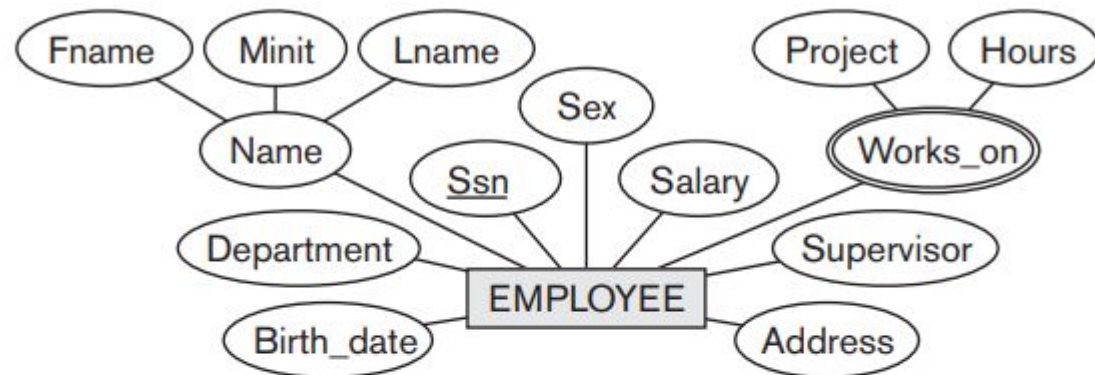
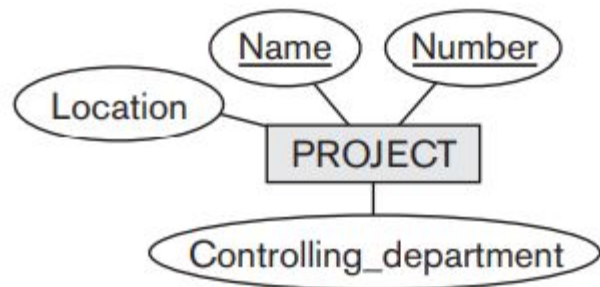
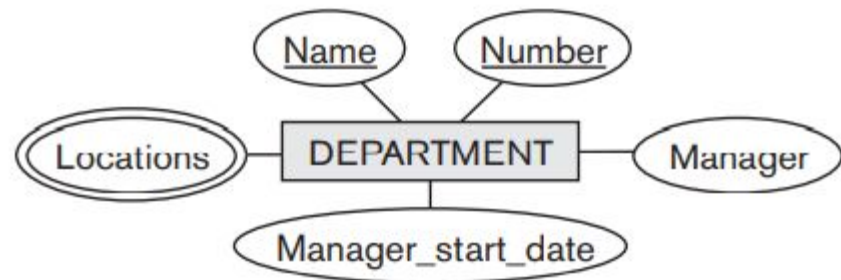
Relationships

Reading

- Chapter 7: “Data Modelling Using the Entity Relationship Model”
- Book: Fundamentals of Database System – 6th Edition by Elmasri

Example: COMPANY Database

- DEPARTMENT (Name, Number, Locations, Manager and Manager_start_date)
 - Location – Multivalued Attribute, Name and Number - Unique
- PROJECT (Name, Number, Location and Controlling Department)
- EMPLOYEE (Name, SSN, Gender, Address, Salary, Birth_date, Department and Supervisor)
 - Name and Address – Composite Attributes
- DEPENDENT (Employee, Dependent_name, Gender, Birth_date and Relationship)



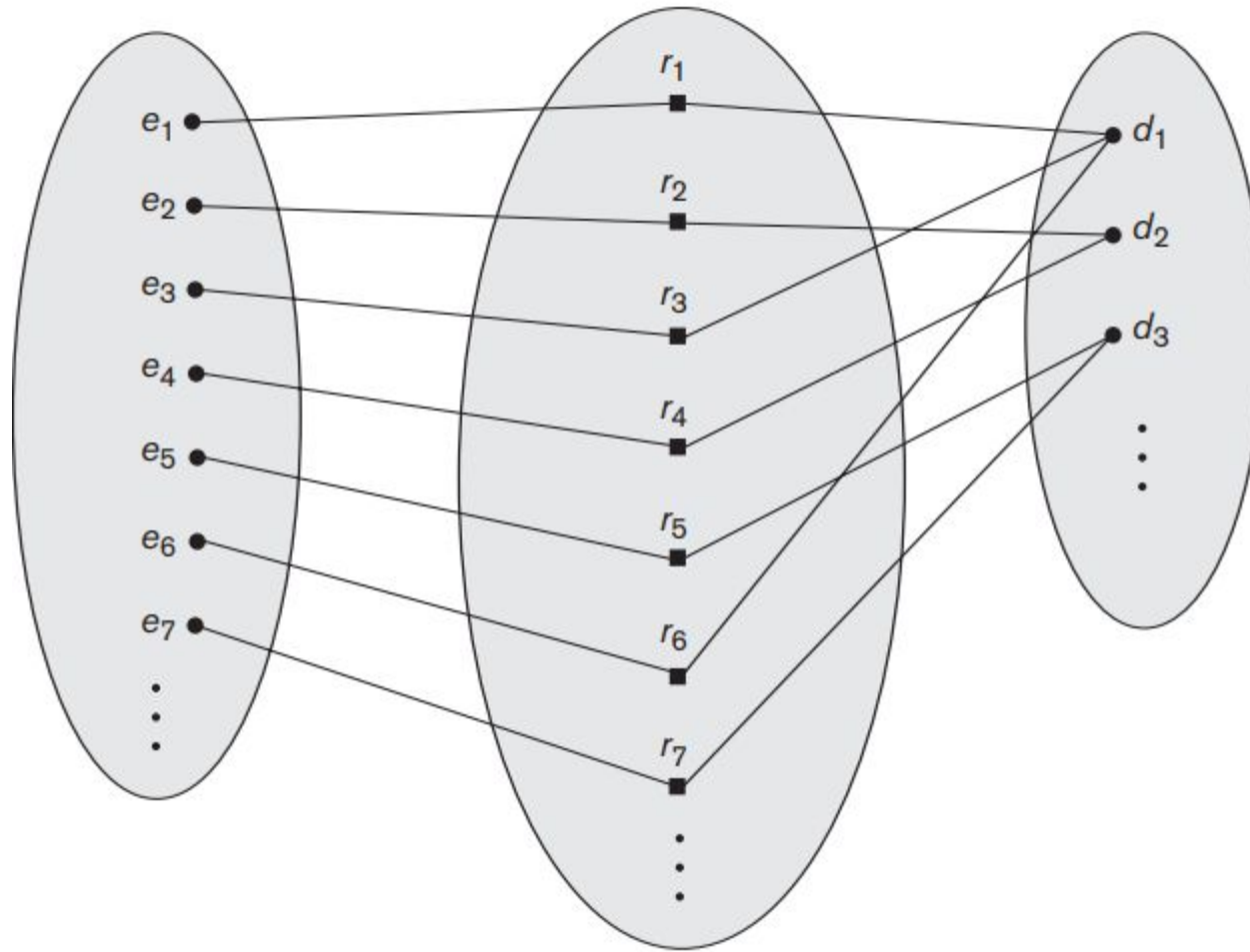
Relationship

- When attribute of one entity type refers to another entity type, some relationship exists.
 - Manager is an employee
 - Employee has a dependent etc.
- An **entity type** defines a collection (or set) of entities that have the same attributes (same as entity set)
- Each of the entity set **participates** in a relationship
- Each relationship instance r_i in R is an association of entities, where the association includes exactly one entity from each participating entity type.
- Example: WORKS_FOR between EMPLOYEE and DEPARTMENT

EMPLOYEE

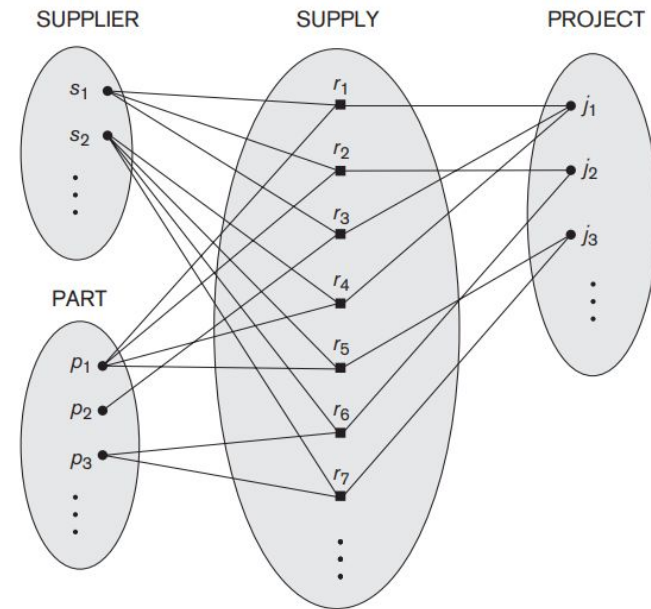
WORKS_FOR

DEPARTMENT



Degree of Relationship

- The **degree** of a relationship type is the number of participating entity types.
- Degree of WORKS_FOR: 2 (**Binary**)
- Degree of SUPPLY: 3 (**Ternary**)
- Can you give example of **Unary**?

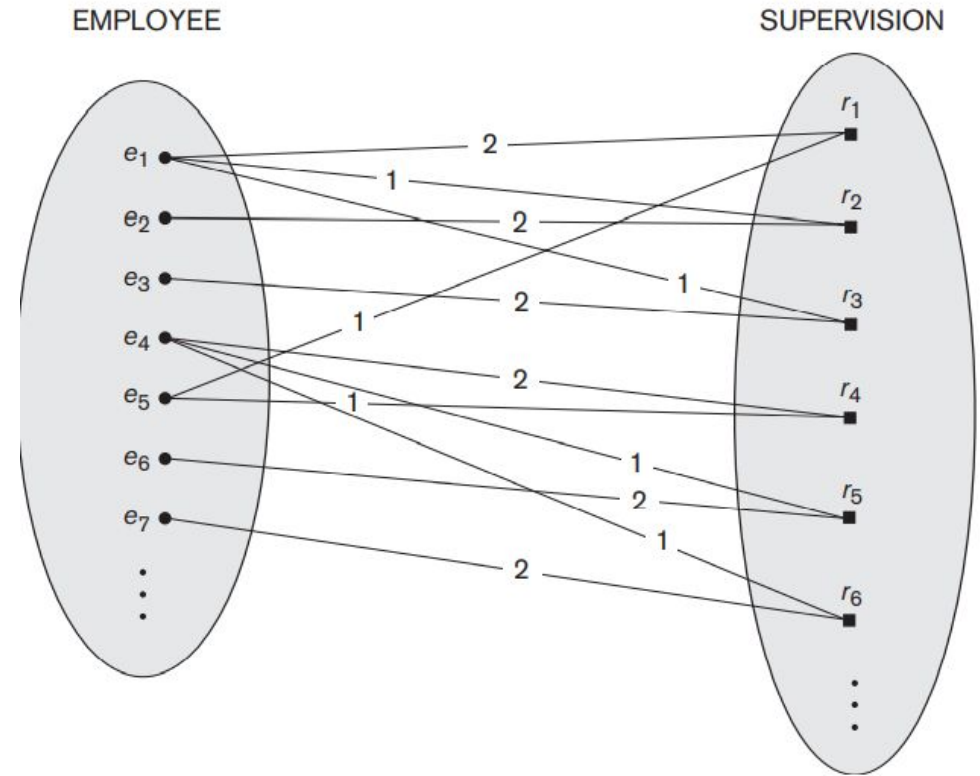


Relationship as Attributes

- Example: WORKS_FOR relationship type

Role and Recursive Relationships

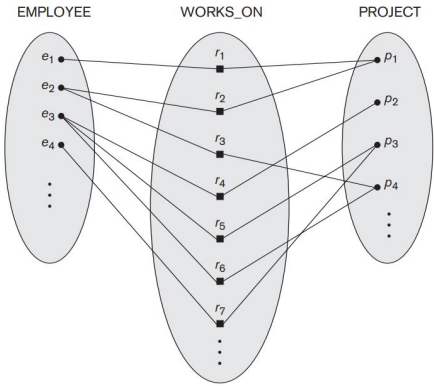
- Role: The role of a participating entity in each relationship instance – explains what relation means
- Recursive:
 - The same entity type participates more than once in a relationship type in different roles
 - SUPERVISION: EMPLOYEE is supervised by SUPERVISOR (Employee)
 - 1 supervisor, 2 supervisee



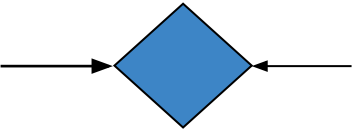
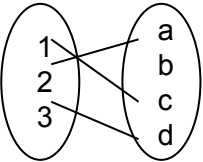
Constraints on Binary Relationship Types

- Limits the possible combinations of entities that may participate in the corresponding relationship
 - Example: An employee can have 1 supervisor only
- Type of Constraints in BR:
 - Cardinality ratio
 - . The cardinality ratio for a binary relationship specifies the maximum number of relationship instances that an entity can participate in. Example: DEPARTMENT and EMPLOYEE has cardinality ratio of 1:N. It can also be values like 4 or 5
 - Participation
 - The participation constraint specifies whether the existence of an entity depends on its being related to another entity via the relationship type
 - This constraint specifies the minimum number of relationship instances that each entity can participate in, and is sometimes called the **minimum cardinality constraint**.

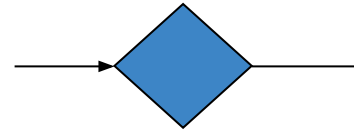
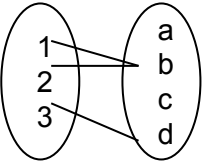
Cardinality/ Multiplicity of Relationships



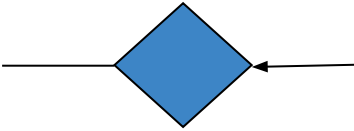
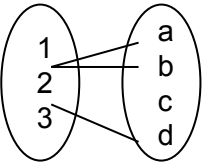
One-to-one:



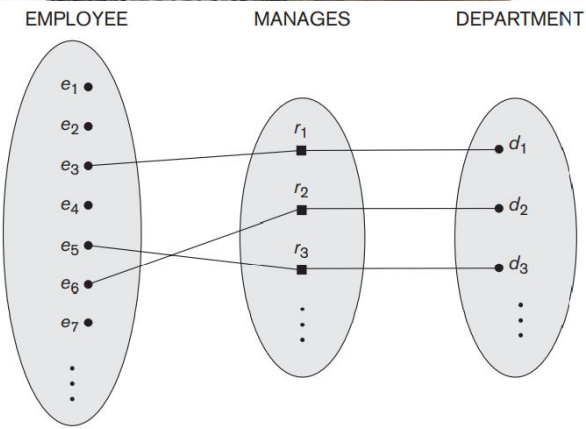
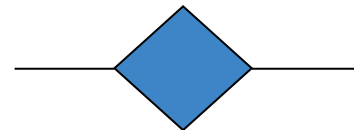
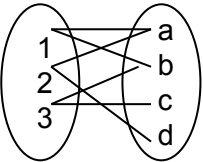
Many-to-one:



One-to-many:



Many-to-many:



Participation Types/Structural Constraints

- **Total/Existence Dependency**

- Every employee must work for a department
- Employer participates in at least one WORKS_FOR relationship
- Every entity must relate to the other entity via a relationship
- Minimum 1: Total participation
- Representation: Double Lines

- **Partial**


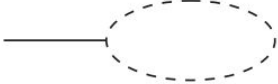
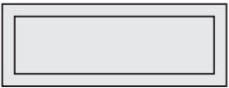
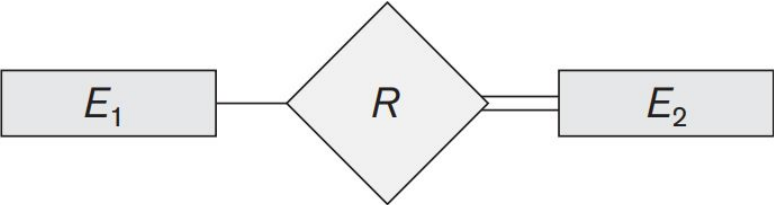
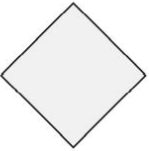
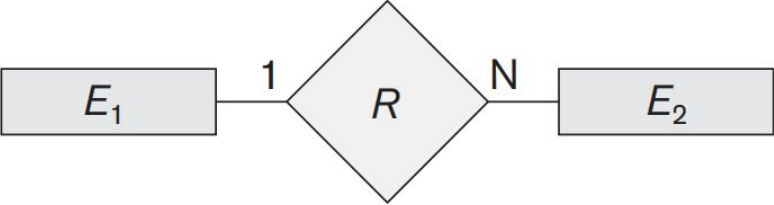
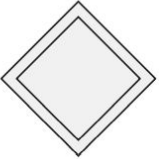
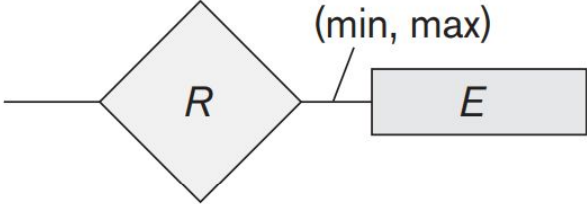


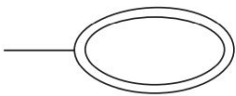
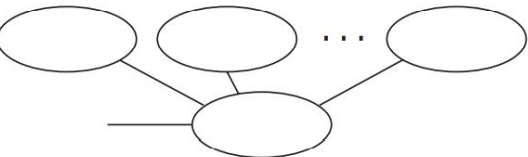
- Some or part of the set of entities are related to the other entity via relationship
- Each employee does not manage a department
- EMPLOYEE in the MANAGES relationship
- Minimum 0: Partial Participation
- Representation: Single Line

Weak and Strong Entity Type

- Weak:
 - No key
 - Entities belonging to a weak entity type are identified by being related to specific entities from another entity type in combination with one of their attribute values. We call this other entity type **the identifying or owner entity type**, 10 and we call the relationship type that relates a weak entity type to its owner the **identifying relationship of the weak entity type**. (**Parent Entity Type or Dominant Entity Type and Child Entity Type or the Subordinate Entity Type**)
 - Always has a total participation constraint (existence dependency) w.r.t to identifying relationship
 - Is every existence dependence results in a weak entity type? No?
 - It sometimes has a **partial key/discriminator** (underlined with a dashed or dotted line)
 - Representation: double line diamonds and boxes
- Strong:
 - Has Key

Naming Conventions

- Entity names: Singular/UPPERCASE and Nouns
- Relationship Type: UPPERCASE and Verbs
- Attribute Names: Initial Letter Capital and Additional Nouns
- Role Names: LOWER
- Readability: Left to Right and Top to Bottom

Symbol	Meaning		
	Entity		Derived Attribute
	Weak Entity		Total Participation of E_2 in R
	Relationship		Cardinality Ratio 1: N for $E_1:E_2$ in R
	Identifying Relationship		Structural Constraint (min, max) on Participation of E in R
	Attribute		
	Key Attribute		
	Multivalued Attribute		
	Composite Attribute		

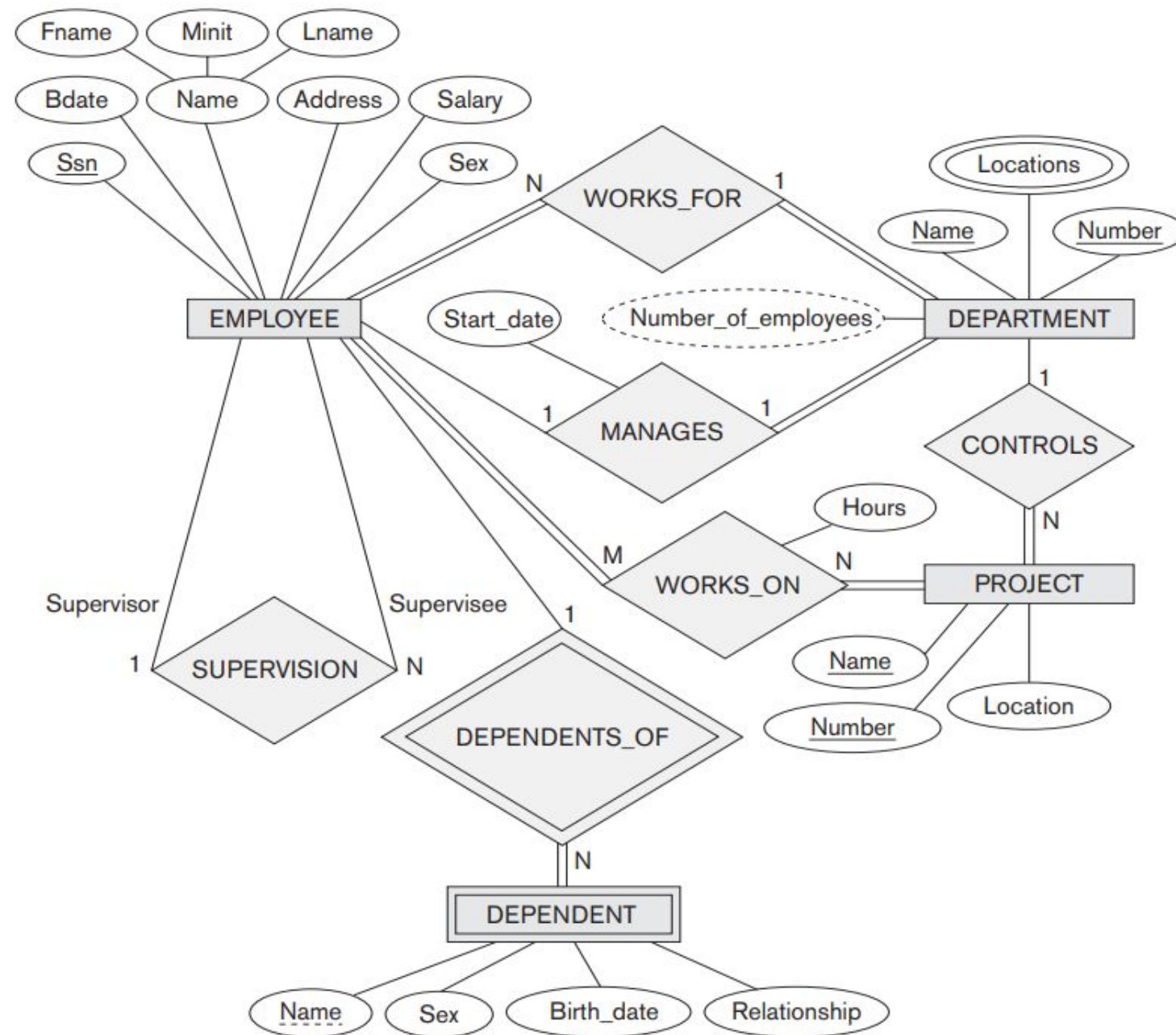


Figure 7.2

An ER schema diagram for the COMPANY database. The diagrammatic notation is introduced gradually throughout this chapter and is summarized in Figure 7.14.

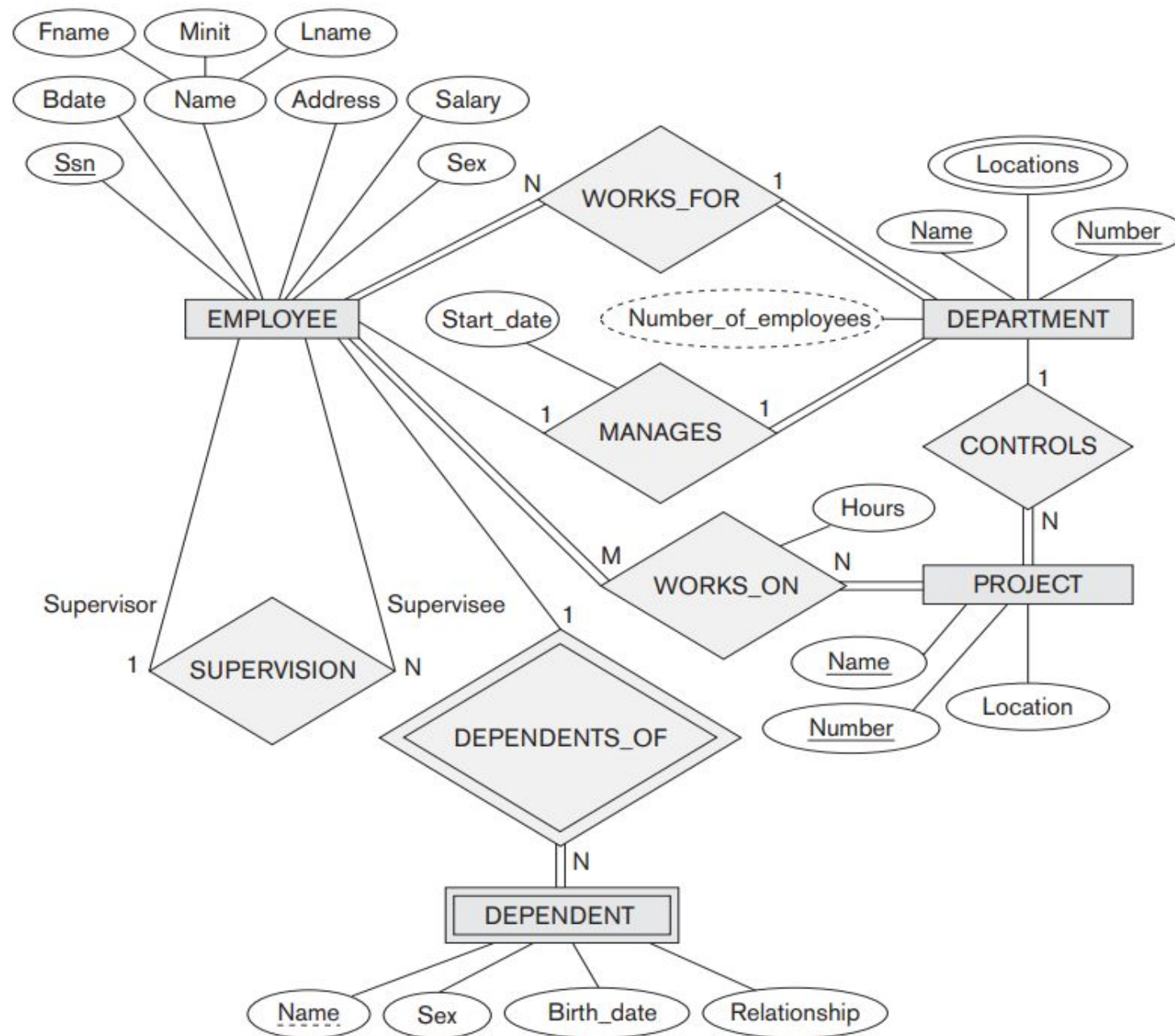
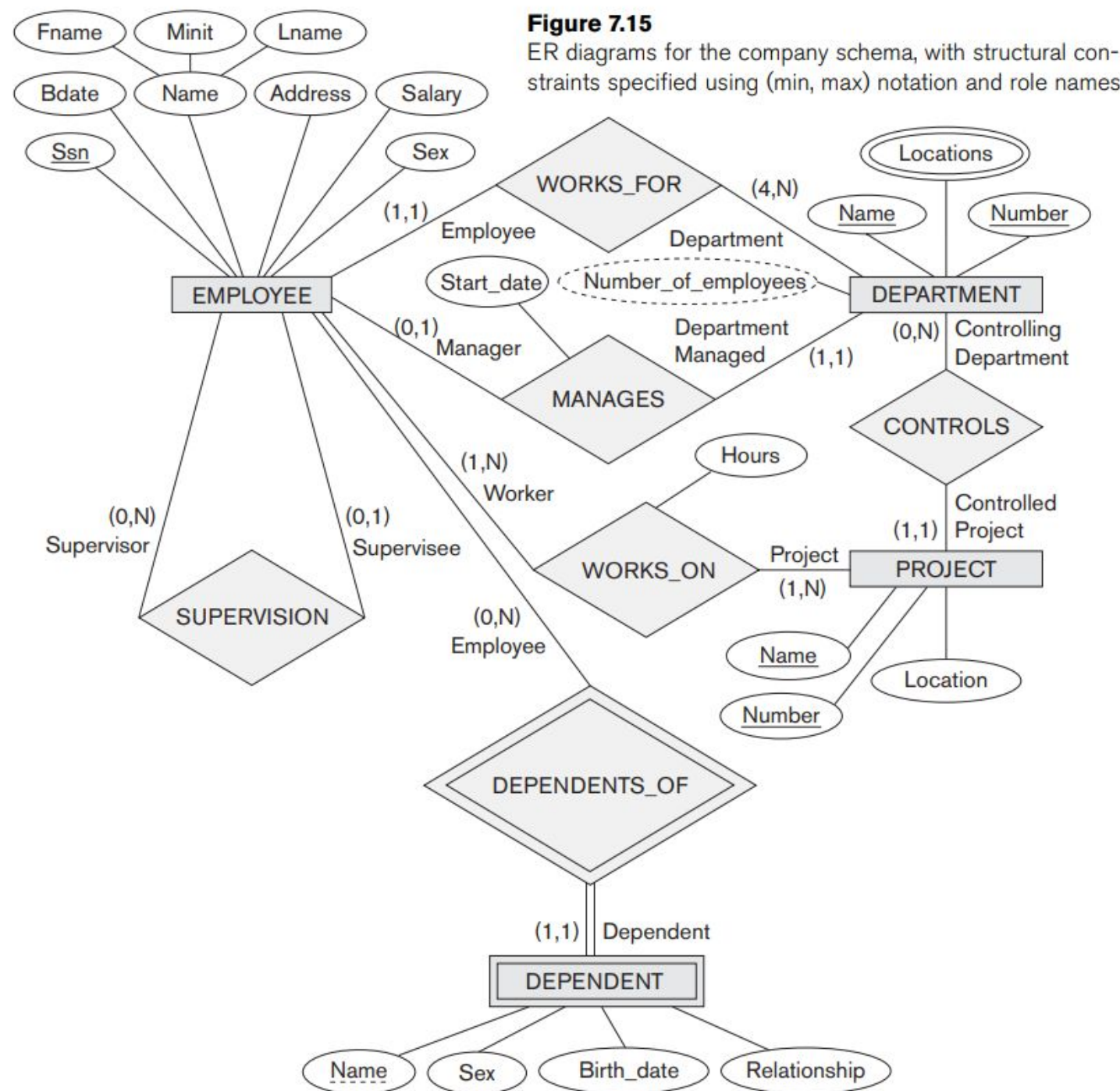


Figure 7.2

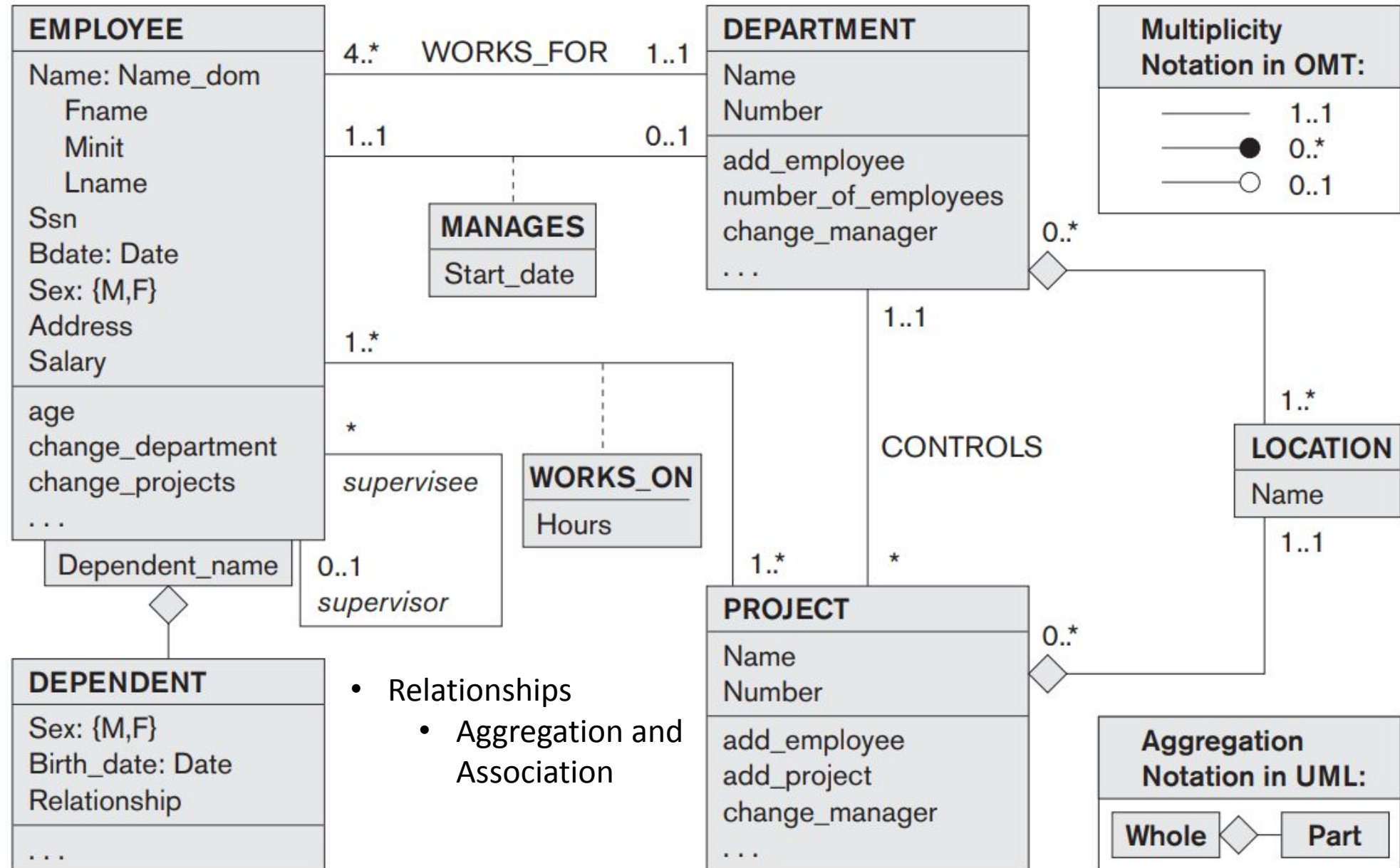
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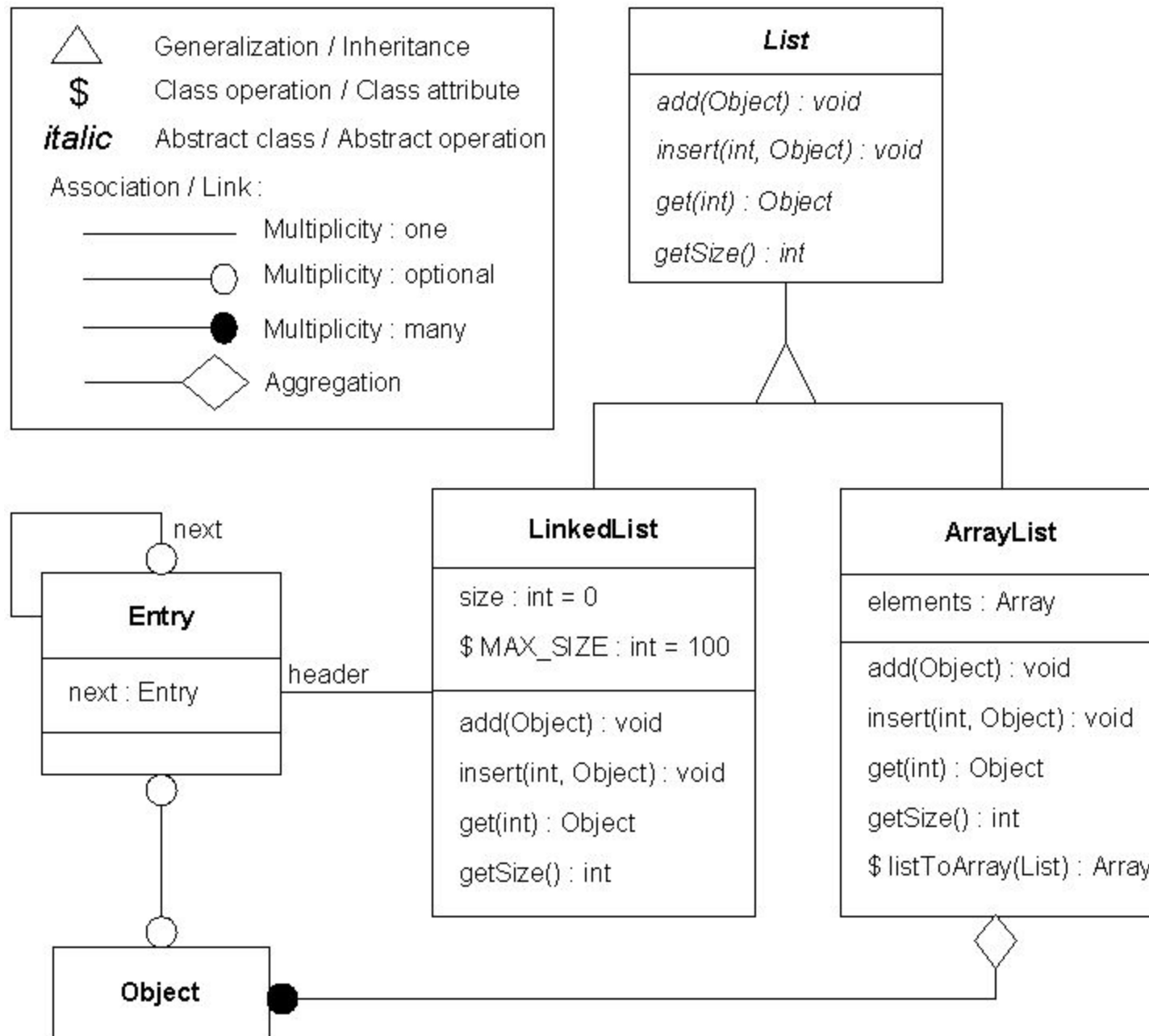
UML Class Diagrams

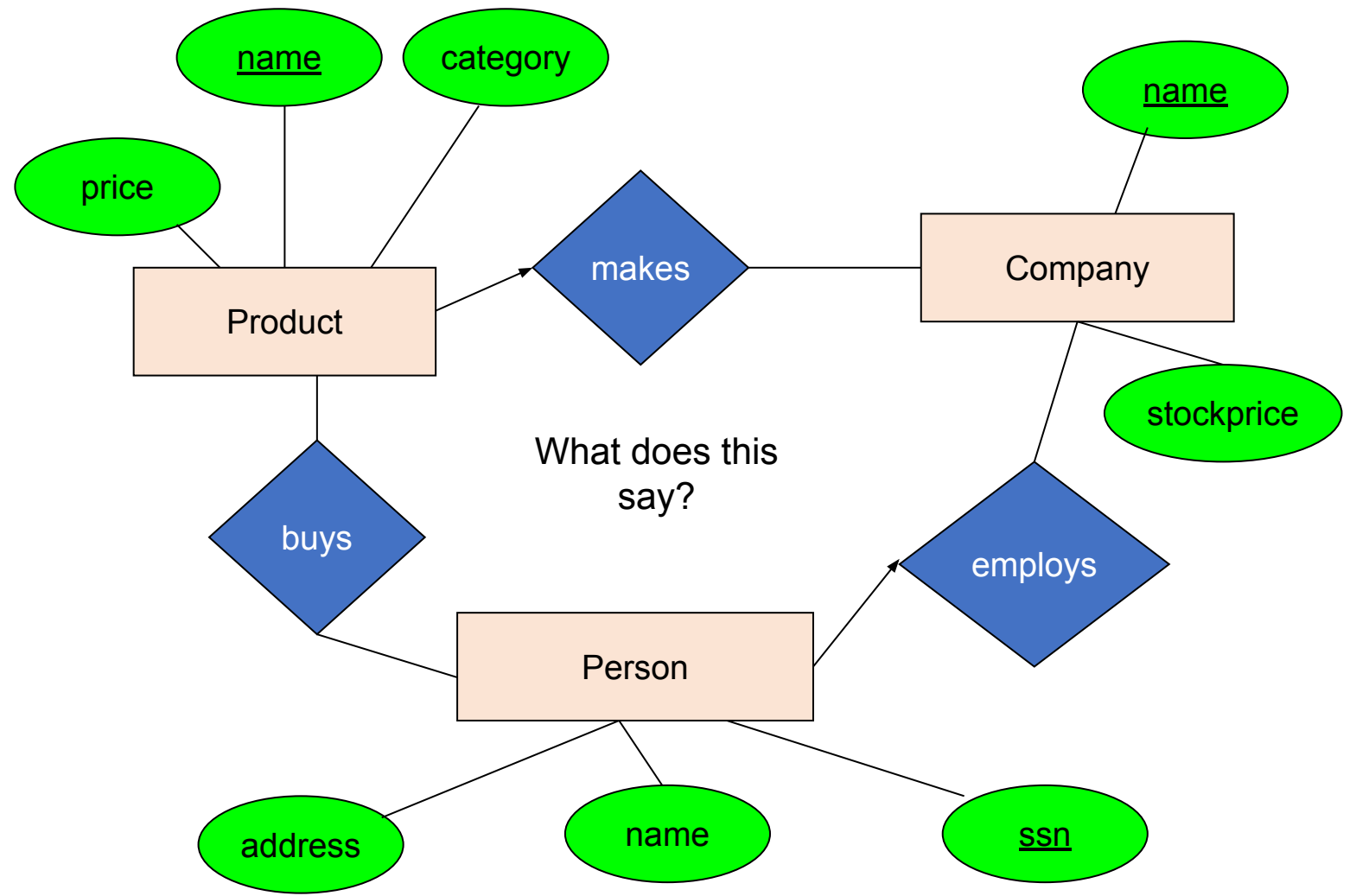
- Big Rectangles:
 - Class Name
 - Attribute
 - Operations
- Composite Attributes
 - Structured Domain
- Multivalued
 - As relation
- Relationship
 - Links
 - Binary links can have names
- Relationship Attribute
 - Link Attribute
 - Dashed Lines
- Constraints
 - Multiplicities
 - Min, max and *
 - Placed on opposite ends
 - Single * = 0..*
 - Single 1 = 1..1
- Recursive Relationship
 - Reflexive Association

Figure 7.16
The COMPANY conceptual schema
in UML class diagram notation.



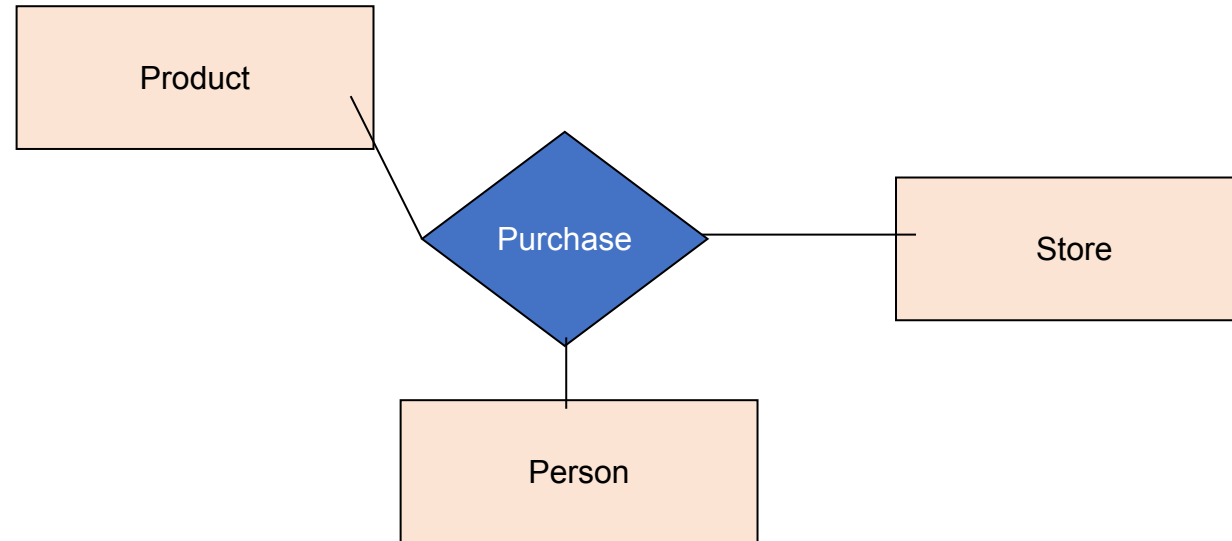
- Relationships
 - Aggregation and Association





Multi-way Relationships

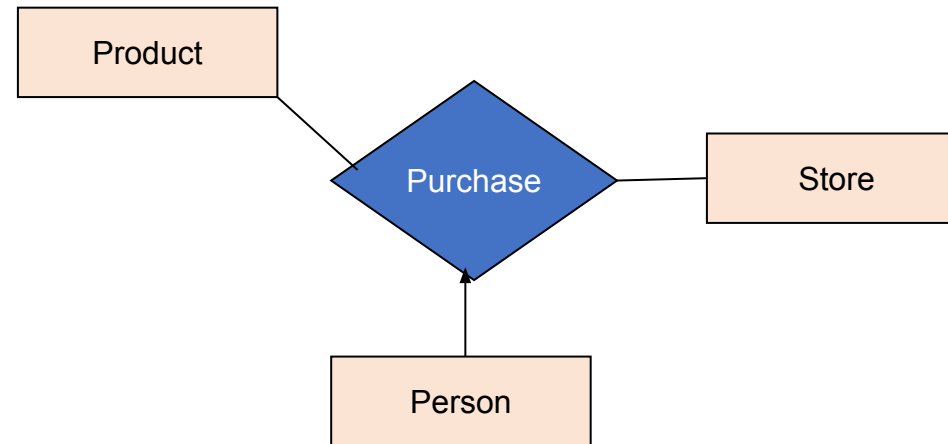
How do we model a purchase relationship between buyers, products and stores?



Need to identify purchases by all three keys

Arrows in Multiway Relationships

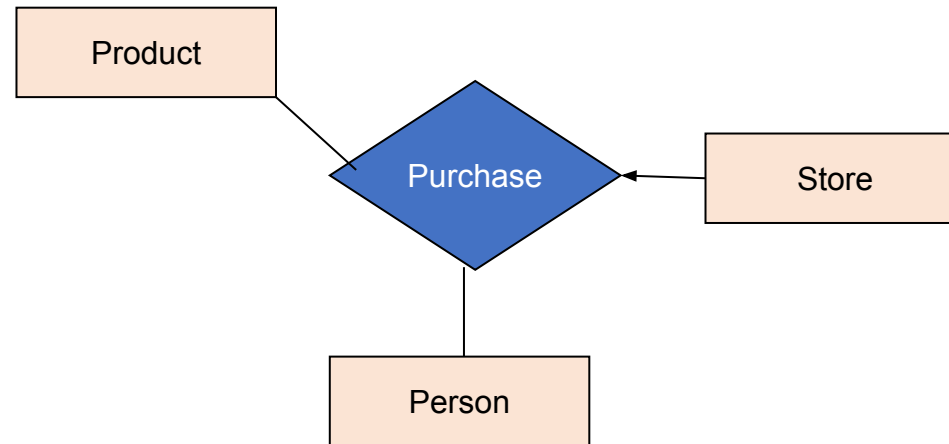
Q: What does the arrow mean ?



Given a person, can determine what they bought and the store where they bought it

Arrows in Multiway Relationships

Q: What does the arrow mean ?

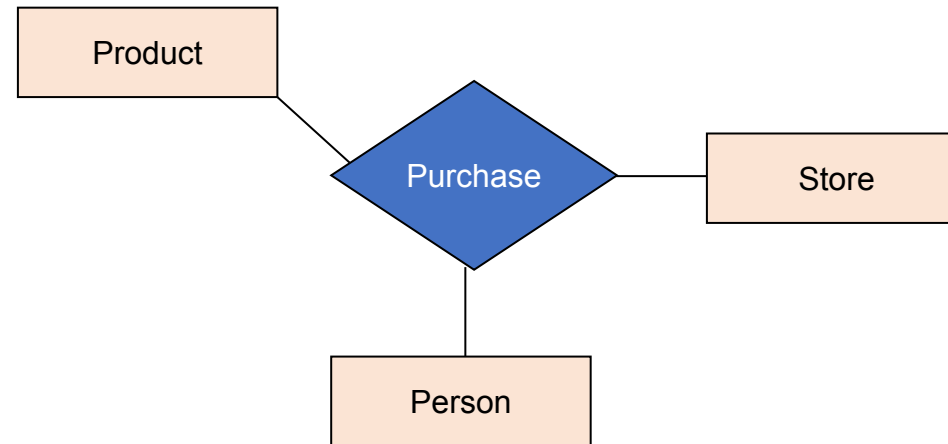


Given a store, can determine who shopped there and the product they bought

- each store sells one product and to one person, ever

Arrows in Multiway Relationships

Q: How do we say that every person shops in at most one store ?



A: Cannot. This is the best approximation.
(Why only approximation ?)