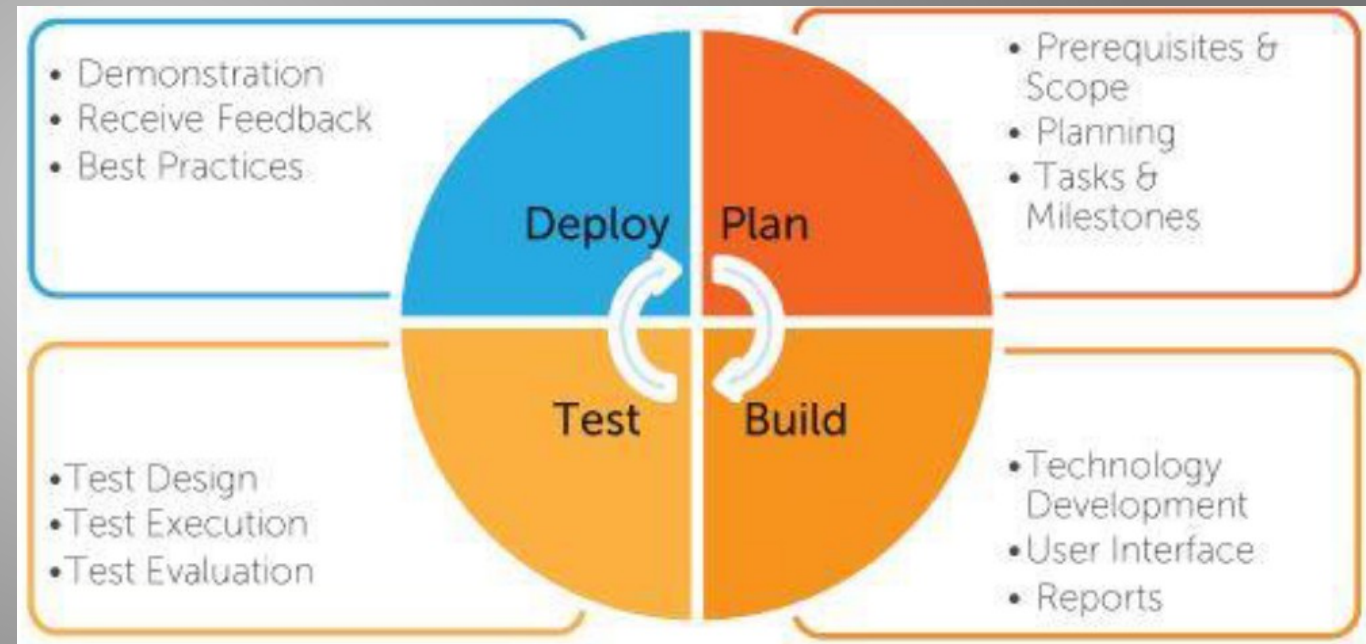
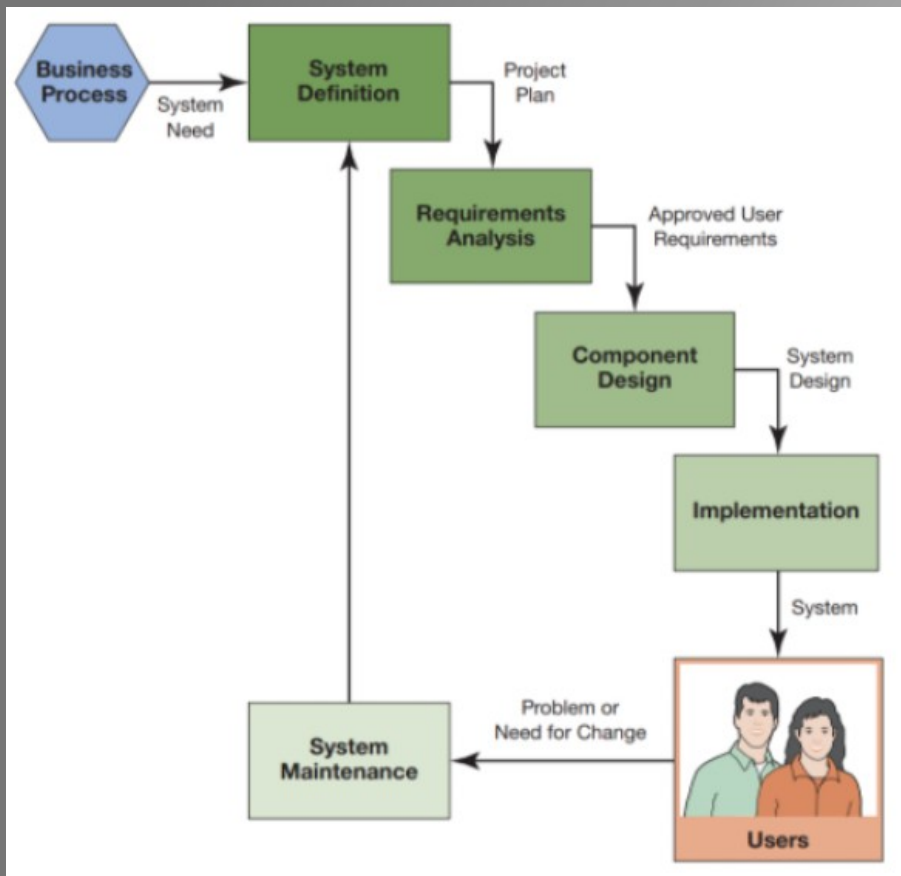


Entity-Relation Diagrams

Database Design

Software Development Life-Cycle

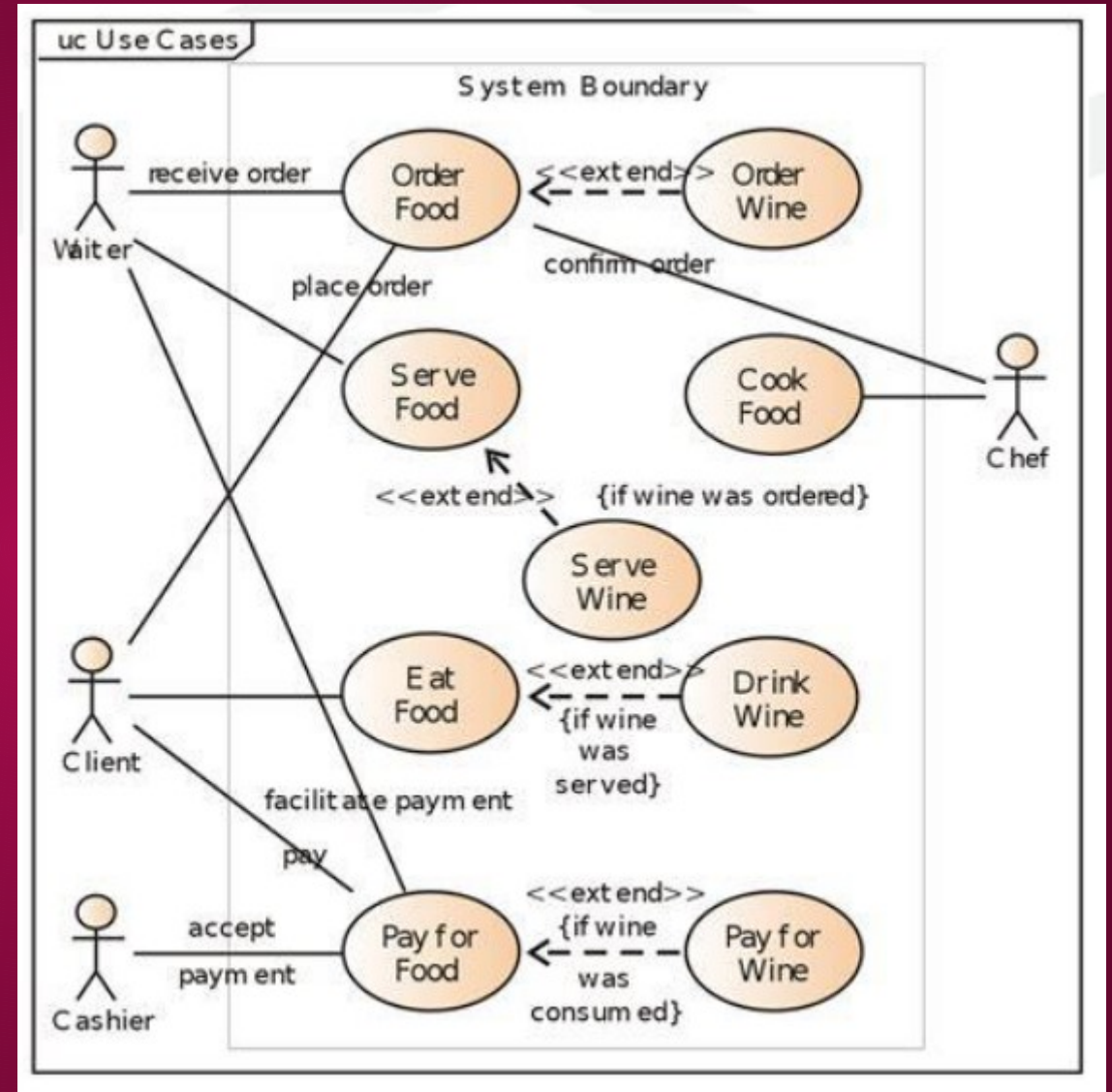
- Commonly either waterfall, or rapid prototyping



Use Case Diagram

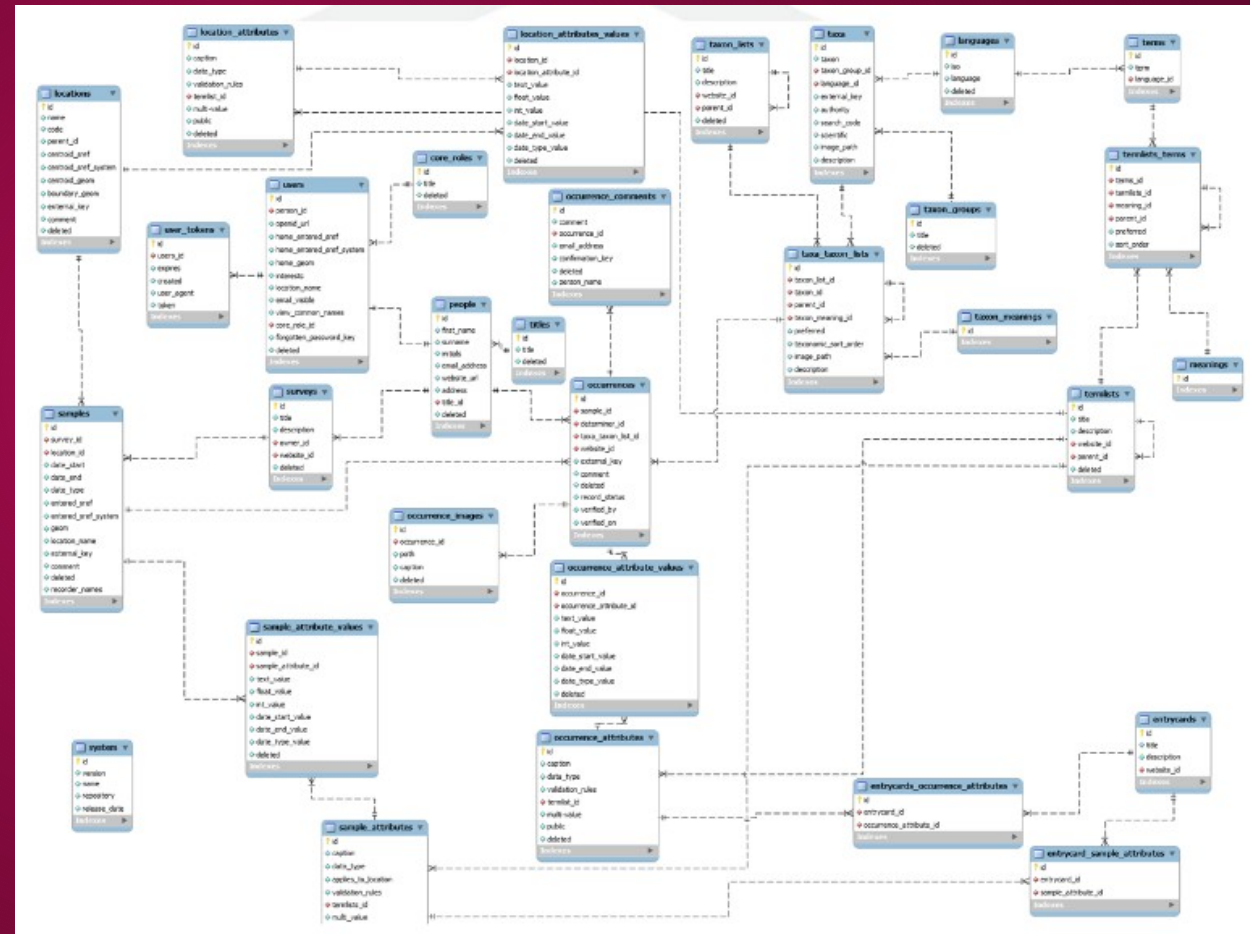
- Actors
 - Active
 - Passive
- Use Case
 - Extend
 - Import
 - Generalization

<https://www.youtube.com/watch?v=zid-MVo7M-E>



ER Diagrams

- Entities
- Relationships
- Attributes



<https://www.youtube.com/watch?v=QpdhBUYk7Kk>

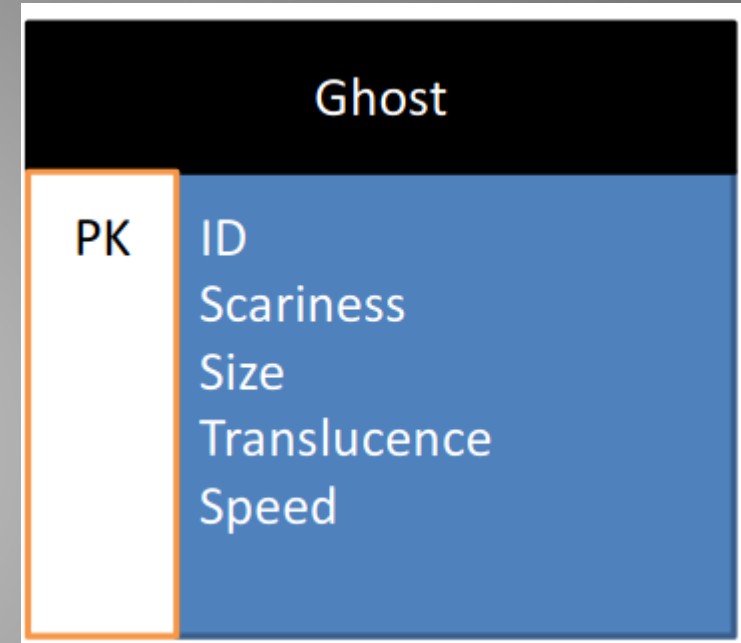
Entity Type

- A set of things
 - Ex: All employees in a company
- Should be singular (Employee, not Employees)
- “Bob Jones, the employee” is an instance of this entity type



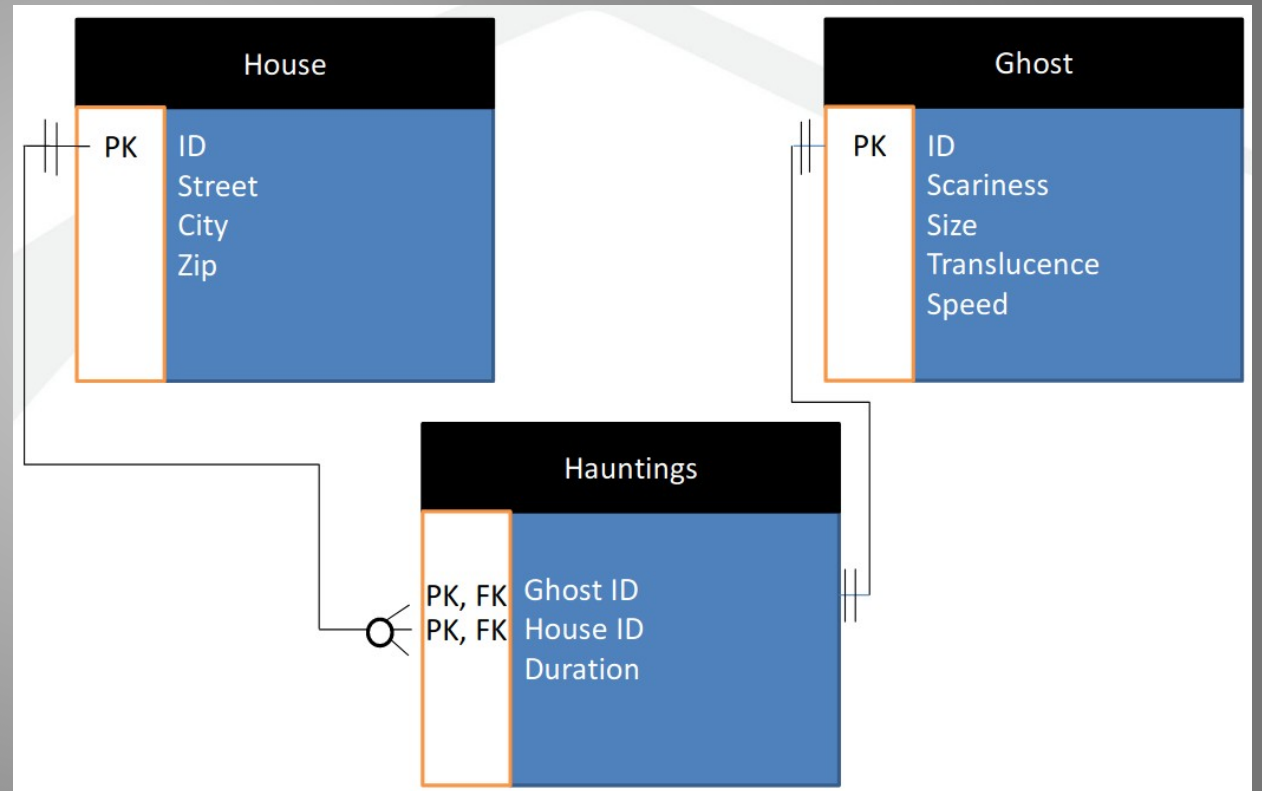
Attribute types

- A set of values
 - Ex: All employee salaries
- Bob has a salary of \$40,000 is an instance of an attribute

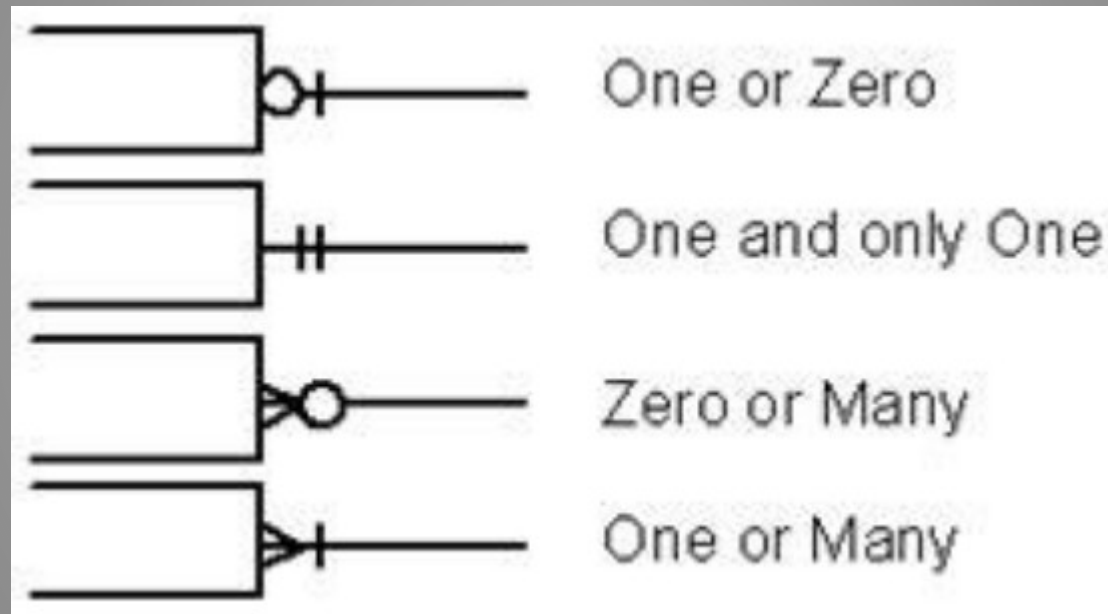


Relationship type

- A statement about entity types
 - Example: Employee-
Manages-Department
- “Bob manages Sales” is an instance of this relationship



Crows foot notation



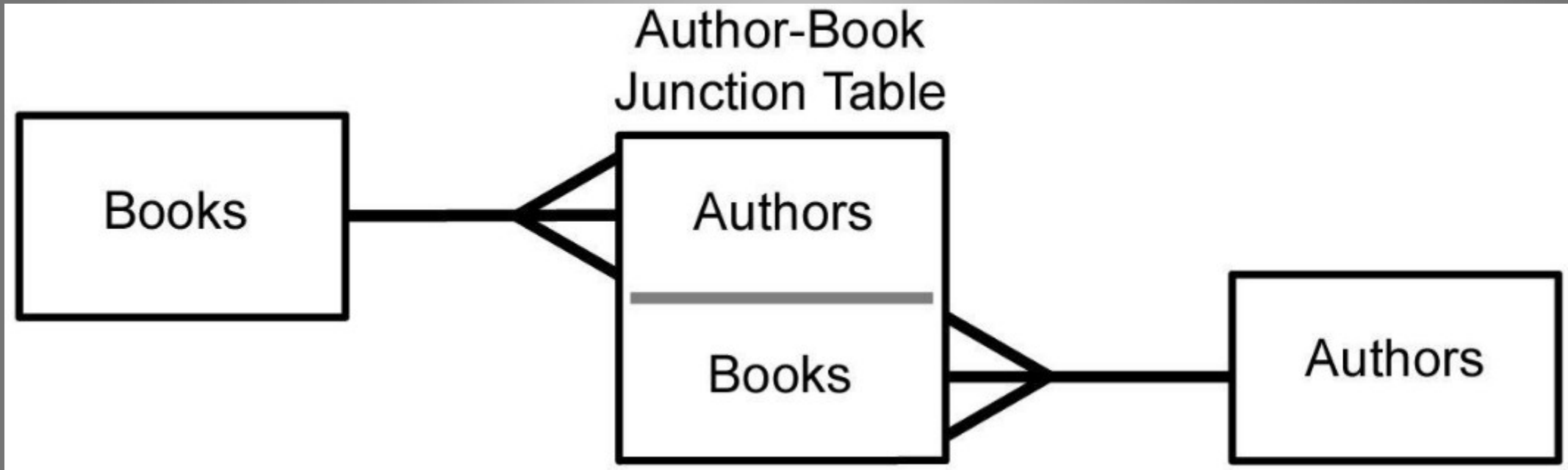
Many-to-many relationship

- How do we represent a many-to-many relationship in a table?



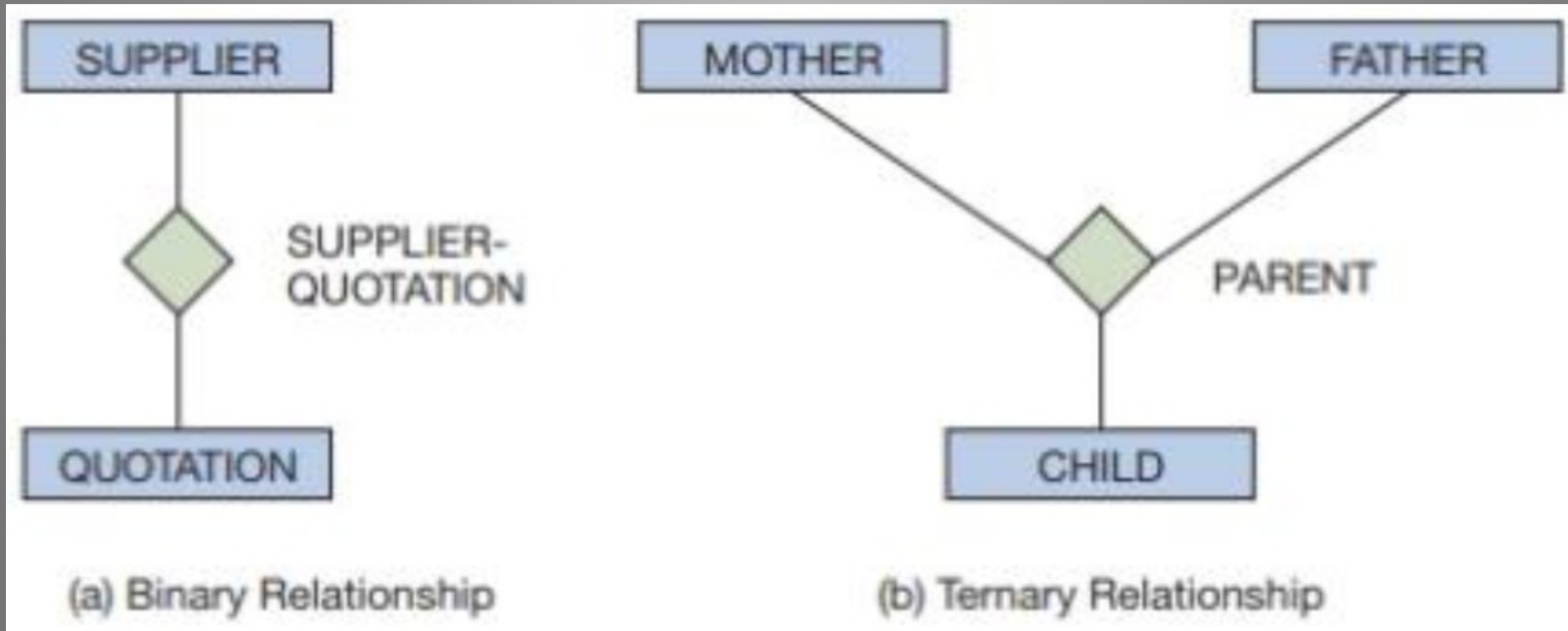
Many-to-many relationship

- How do we represent a many-to-many relationship in a table? Add a bridge (or junction) table



Other ER diagrams

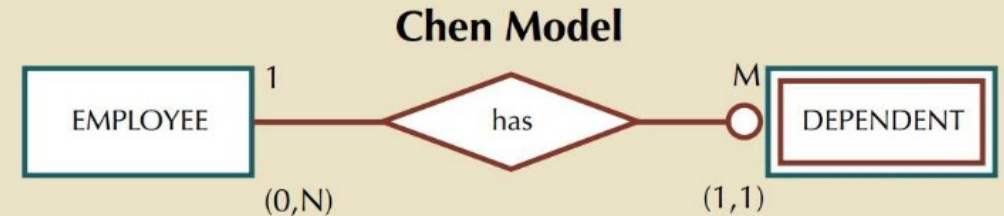
- There are other styles used, but the same ideas are expressed



Other ER diagrams

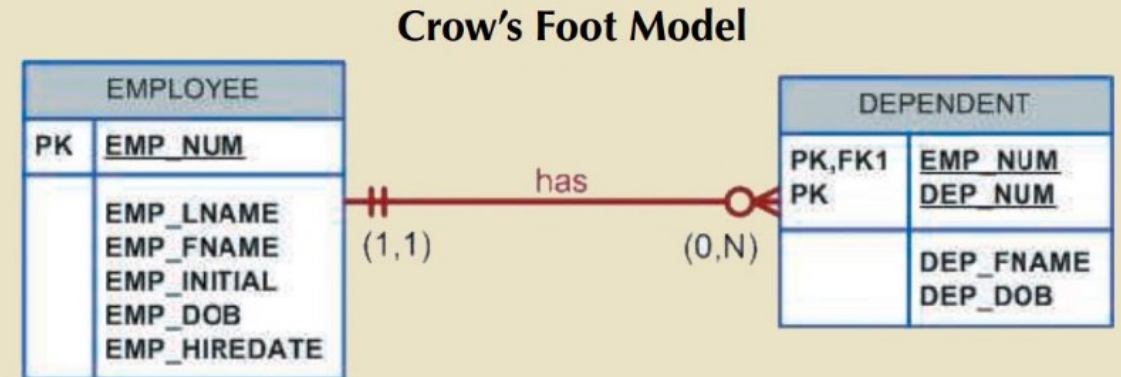
- There are other styles used, but the same ideas are expressed

FIGURE 4.10 A WEAK ENTITY IN AN ERD



EMP_NUM
EMP_LNAME
EMP_FNAME
EMP_INITIAL
EMP_DOB
EMP_HIREDATE

EMP_NUM
DEP_NUM
DEP_FNAME
DEP_DOB



Phases of Database Design

- Analysis
- Logical Design
- Physical Design

Analysis

- Develop an ER model
 - Discover entities, relationships, and attributes
 - Determine cardinality
 - Distinguish independent and dependent entities
 - Create supertype and subtype entities

Logical Design

- Convert the ER model into tables, columns, and keys
 - Implement entities
 - Implement relationships
 - Implement attributes
 - Normalize tables

Physical Design

- Add indexes
- Specify how tables are organized

Discovery (Starting Analysis)

- Interview the database users and managers
 - Entities are usually nouns
 - Not all nouns are entities
 - Relationships are usually verbs
 - Describe connection between entities
 - Attributes are usually nouns
 - Denote specific data (names, dates, etc)

Names

- Entity Names
 - Singular noun
 - Easily understood
 - Consistent (don't use synonyms)
- Relationship Names
 - Entity-Verb-Entity
 - Verb (if the entities are obvious)
 - Should be active (owns, rather than owned-by)
- Attribute Names
 - EntityQualifierType (EmployeeFirstName, Or VehicleIdentificaionNumber)
 - When obvious, parts can be omitted

Cardinality

- Relationship maximum
 - Usually 1 or M
 - One maximum for each entity in a relationship
- Relationship minimum
 - Usually 0 or 1
 - One minimum for each entity in a relationship

Cardinality

- Attribute maximum, can be described by:
 - Singular - each entity has at most one attribute instance
 - Plural - each entity can have multiple attribute instances
 - Unique - No two entities can have the same attribute instance
- Attribute minimum
 - Either required or optional
- Examples:
 - EmployeeNumber 1-1(1) - Unique, max of 1, required
 - PassportNumber 1-M (0) - Unique, max of many, not required
 - FullName M-1 (1) - Not unique, max of 1, required

Independent and dependent entities

- Dependency relations exist if one entity exists only in relation to another instance
 - A passport doesn't make sense without a person and a country, so it would be dependent on both
 - A music album doesn't make sense without the songs in that album, so 'Album' would depend on 'Song'
- Independent entities are sometimes called strong
- Dependent entities are sometimes called weak

Supertype and subtype entities

- A subtype is an entity that is usually specialized version of an entity
 - Managers are employees, but not all employees are managers
 - Employee is the supertype
 - Manager is the subtype