12.3 The ER model uses several notations and tags to represent different concepts.

Outline how the basic ER components are represented in an ER diagram.

1. **Entities**:

   o **Representation**: Entities are represented by rectangles.

   o **Description**: Each entity represents a real-world object or concept (e.g., *Customer*, *Product*) that has a distinct existence within the system.

2. **Attributes**:

   o **Representation**: Attributes are shown as ovals connected to their respective entities.

   o **Description**: Attributes describe the properties or characteristics of an entity (e.g., *Customer Name*, *Address*). If an attribute is a primary key, it's often underlined.

3. **Relationships**:

   o **Representation**: Relationships between entities are shown as diamonds, with lines connecting to the related entities.

   o **Description**: A relationship defines how two or more entities are associated (e.g., *Purchases*, *Enrolled In*).

4. **Cardinality and Participation**:

   o **Representation**: Notations such as 1:1, 1, or M next to relationships indicate cardinality.

   o **Description**: These specify the number of instances of one entity that can be associated with instances of another entity, helping to clarify the nature of the relationship.

5. **Weak Entities**:

   o **Representation**: Weak entities are shown as rectangles with a double border.

   o **Description**: A weak entity depends on another (strong) entity for its existence and has a partial key.

6. **Multivalued and Derived Attributes**:

   o **Representation**: Multivalued attributes are depicted with a double oval, while derived attributes are shown with a dashed oval.

   o **Description**: A multivalued attribute can have multiple values, and a derived attribute is calculated from other attributes.

12.8 Distinguish between the ER model and ER diagram

The **Entity-Relationship (ER) Model** and the **Entity-Relationship (ER) Diagram** are related concepts in database design, but they serve different purposes and represent data in different ways. Here's a comparison:

1. **Entity-Relationship (ER) Model**:

   o **Definition**: The ER model is a theoretical framework used to describe the structure of a database in terms of entities, attributes, and relationships.

   o **Purpose**: It provides an abstract, conceptual view of the data and relationships, independent of any specific database technology.

   o **Components**: Defines entities (objects), attributes (properties), and relationships between entities. It also includes rules for cardinality, participation, and constraints on how data is related.

   o **Usage**: The ER model is used as a blueprint for database design, guiding how data is structured and how relationships are defined.

2. **Entity-Relationship (ER) Diagram**:

   o **Definition**: The ER diagram is a visual representation of the ER model using graphical symbols like rectangles, ovals, and diamonds to illustrate entities, attributes, and relationships.

   o **Purpose**: It translates the conceptual model into a diagram that makes the structure of the database easy to understand at a glance.

   o **Components**: Includes shapes and connectors to visually represent entities (rectangles), attributes (ovals), and relationships (diamonds), along with symbols indicating cardinality and constraints.

   o **Usage**: The ER diagram is used as a communication tool, making it easier for stakeholders to understand the database structure and visualize data relationships.
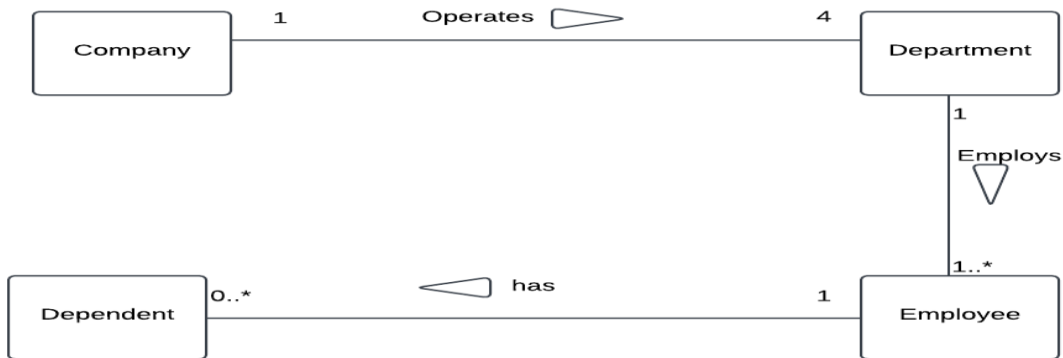
12.10

a) Each company operates four department, and each department belongs to one company

b) Each department in part (a) employs one or more employees and each employee works for one department.
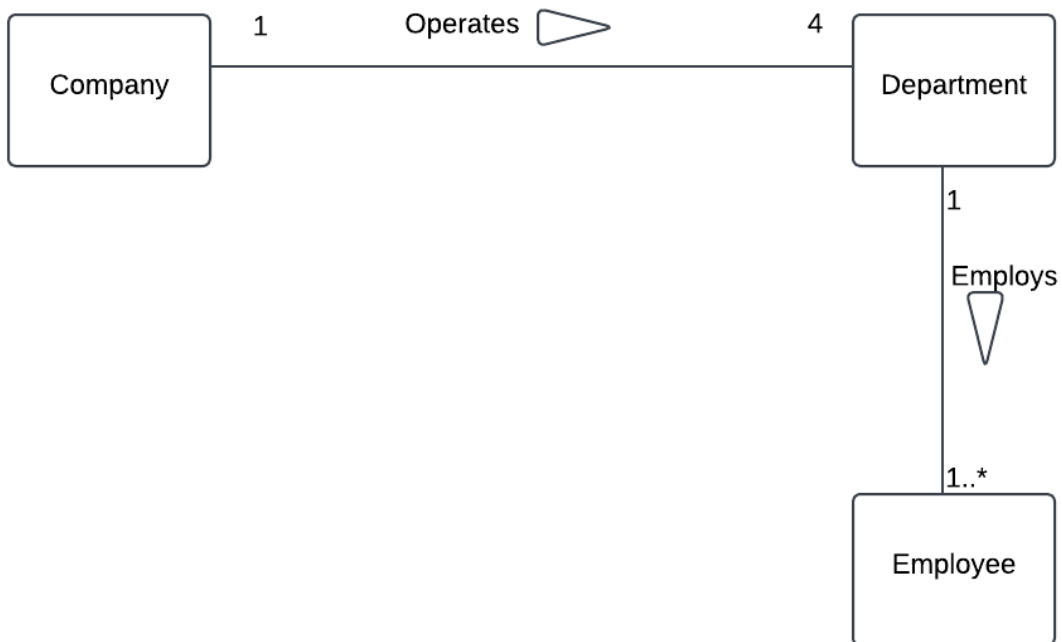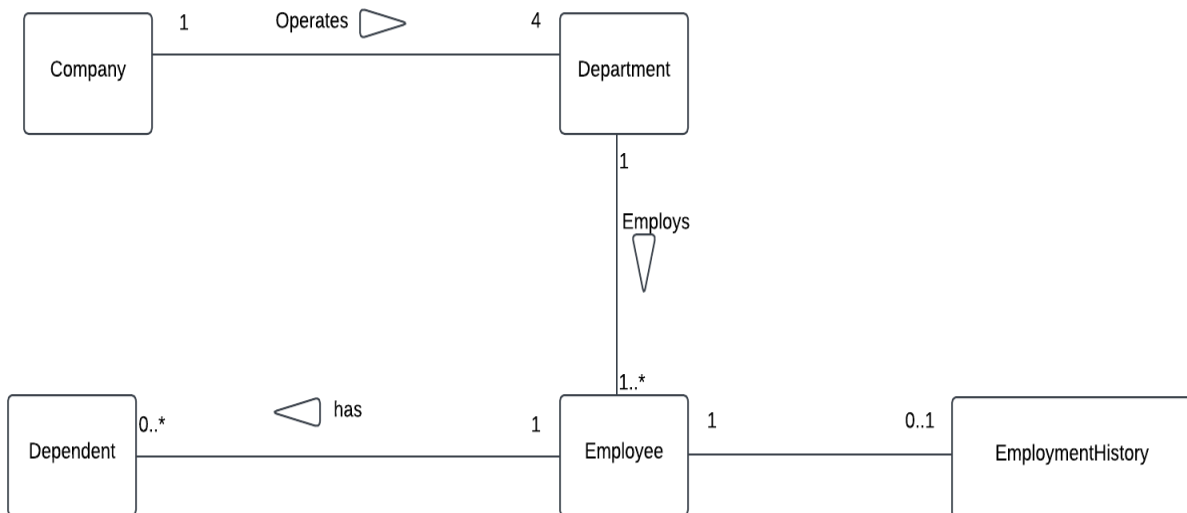
c) Each of the employee in part (b) may or may not have one or more dependents and each dependent belongs to one employee

d) Each employee in part (c) may or may not have an employment history
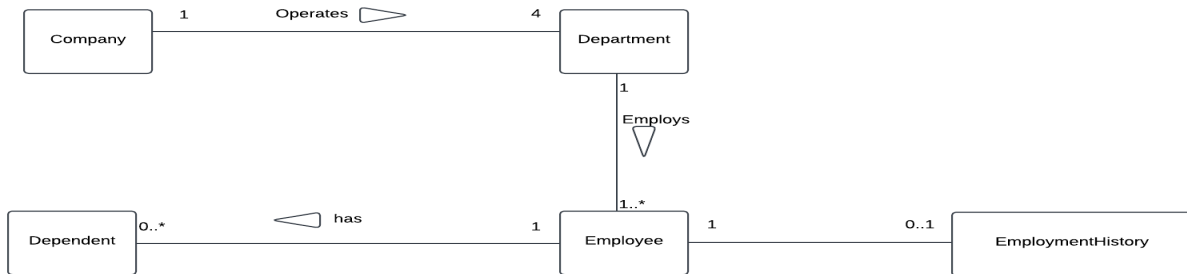
e) Represent all the ER models described in a, b, c and d as a single ER model

12.12)

a) Identify the main entity types of the DVD rental company.

- Branch:
    - Address-street, city, state, zip code
    - Phone
    - Branch Number # (PK)
    - Allocated staff including a manager-runs a branch.
    - Has stock of DVDs
- Staff:
    - Name
    - Position
    - Salary
    - Staff Number (PK)
- DVD:
    - Catalog Number (PK)
    - DVD Number (Secondary key)
    - Title
    - Category - action, adult, children, drama, horror, Sci-Fi
    - Daily Rental
    - Cost
    - Status - available for rent or not.
    - Names of Main Actors and Directors

- Member:
  - First Name
  - Last Name
  - Address
  - Registration Date
  - Member Number (PK)
- DVD Rental
  - Rental Number (PK)
  - Full Name
  - Member Number (FK)
  - DVD Number (Secondary Key)
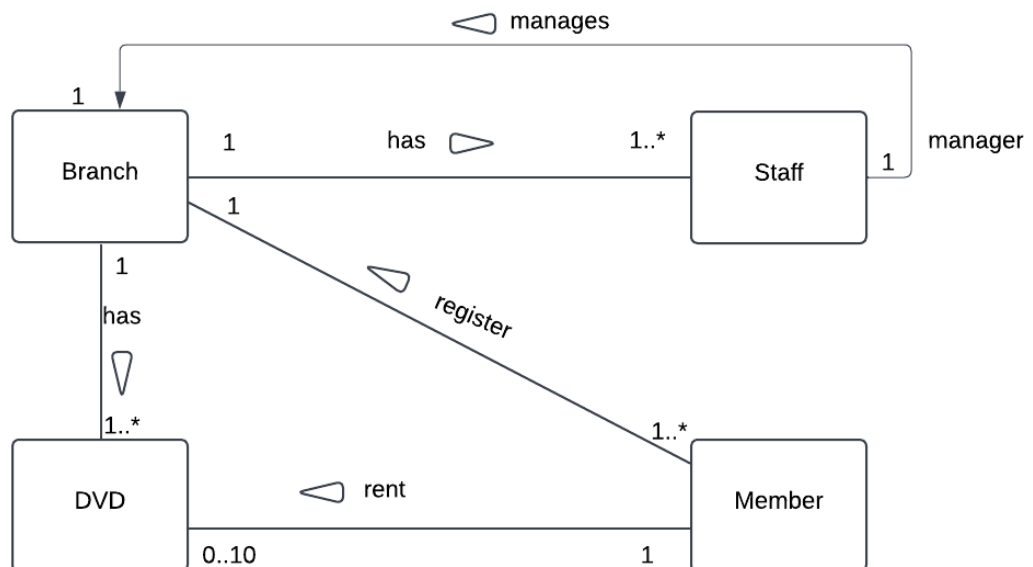 - Title
  - Daily Rental
  - Rental Date
  - Return Date

Main Entity Types

- Branch
- Staff
- DVD
- Member

B. Identify the main relationship types and describe each relationship type as an ER diagram.
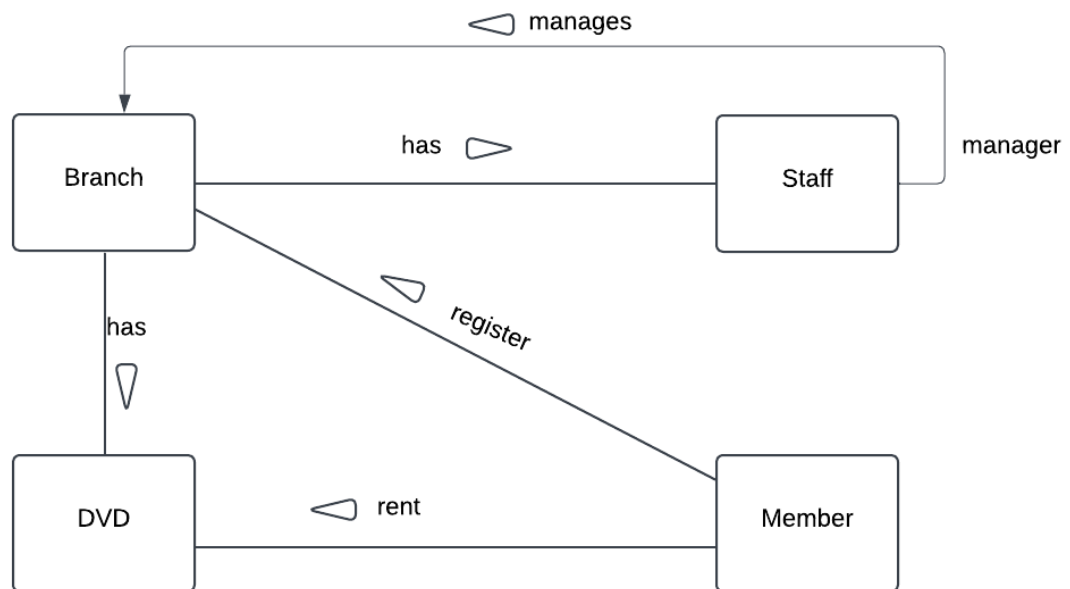
C. Determine the multiplicity constraints for each relationship and represent them in ER diagram.

D. Identify attributes and associate them with entity or relationship types and represent them
    in ER diagram.

E. Determine candidate or primary key attribute for each strong entity type.

F. Represent the data requirements of DVD company as a single ER diagram.