Overview of ER Diagram Concepts:

ER Model Definition:

The **Entity-Relationship (ER) Model** is a conceptual framework used to represent and structure data in a database. It identifies entities, relationships, and attributes, providing a clear schema for database design.

Entity and Its Types

An **entity** in an ER Diagram represents a real-world object or concept with distinct characteristics. Entities are typically depicted as rectangles.

Types of Entities:

1. **Strong Entity:**
   - An entity that can exist independently without relying on another entity.
   - Example: *Student, Employee.*
2. **Weak Entity:**
   - An entity that depends on a strong entity for its existence.
   - It does not have a sufficient key and relies on a foreign key relationship.
   - Example: *Dependent* (related to Employee).
3. **Associative Entity:**
   - An entity that represents a many-to-many relationship between two entities.
   - Example: *Enrollment* (connecting Student and Course).

Relationships :

A **relationship** in an ER Diagram represents an association between two or more entities. Relationships are depicted as diamonds.

Types of Relationships:

1. **One-to-One (1:1):**
   - A single entity in set A is associated with a single entity in set B, and vice versa.
   - Example: *Person and Passport.*
2. **One-to-Many (1:N):**
   - A single entity in set A is associated with multiple entities in set B, but an entity in set B is associated with only one entity in set A.
   - Example: *Department and Employee.*
3. **Many-to-Many (M:N):**
   - Multiple entities in set A are associated with multiple entities in set B.
   - Example: *Student and Course.*
4. **Recursive Relationship:**
   - An entity is related to itself.
   - Example: *Employee supervises another Employee.*
5. **Ternary Relationship:**
   - A relationship between three entities.
   - Example: *Supplier supplies Product to a Project.*

Attributes :

An **attribute** is a property or characteristic of an entity or relationship. Attributes are depicted as ovals.

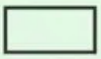
Types of Attributes:

1. **Simple Attribute:**
   - Cannot be divided further.
   - Example: *Name, Age.*
2. **Composite Attribute:**
   - Can be divided into smaller sub-parts.
   - Example: *Full Name (First Name, Last Name).*
3. **Derived Attribute:**
   - Value can be derived from other attributes.
   - Example: *Age (derived from Date of Birth).*
4. **Single-Valued Attribute:**
   - Holds a single value for each entity.
   - Example: *Social Security Number.*
5. **Multi-Valued Attribute:**
   - Can hold multiple values for a single entity.
   - Example: *Phone Numbers, Email Addresses.*
6. **Key Attribute:**
   - Uniquely identifies an entity in a set.
   - Example: *Student ID, Employee ID.*

Symbols Used in ER Model

The ER Model is used to model the logical view of the system from a data perspective, which consists of these symbols:

- **Rectangles:** Represent Entities in the ER Model.
- **Ellipses:** Represent Attributes in the ER Model.
- **Diamond:** Represent Relationships among Entities.
- **Lines:** Represent attributes to entities and entity sets with other relationship types.
- **Double Ellipse:** Represent Multi-Valued Attributes.
- **Double Rectangle:** Represent a Weak Entity.

Figures	Symbols	Represents
Rectangle		Entities in ER Model
Ellipse		Attributes in ER Model
Diamond		Relationships among Entities
Line		Attributes to Entities and Entity Sets with Other Relationship Types
Double Ellipse		Multi-Valued Attributes
Double Rectangle		Weak Entity

(Source: https://media.geeksforgeeks.org/wp-content/uploads/20230428115454/Introduction-to-ER-Model-2-768.webp)

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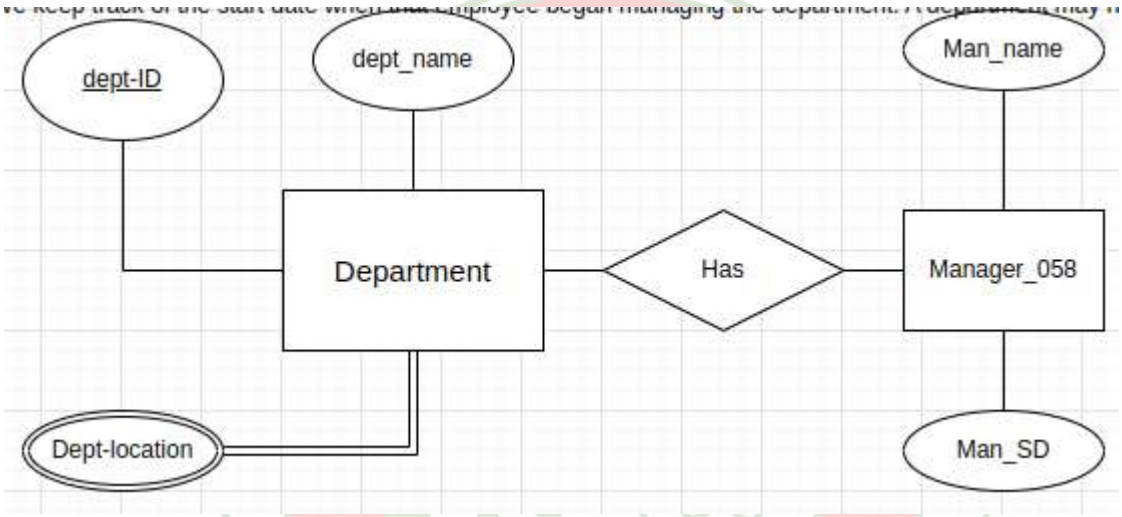
Practice problems:

1. Draw an ERD for the following description:

Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations.



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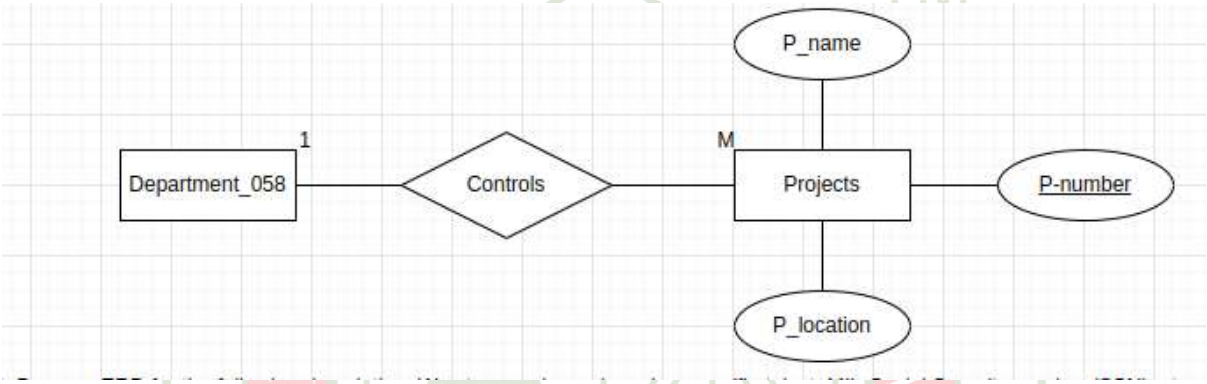
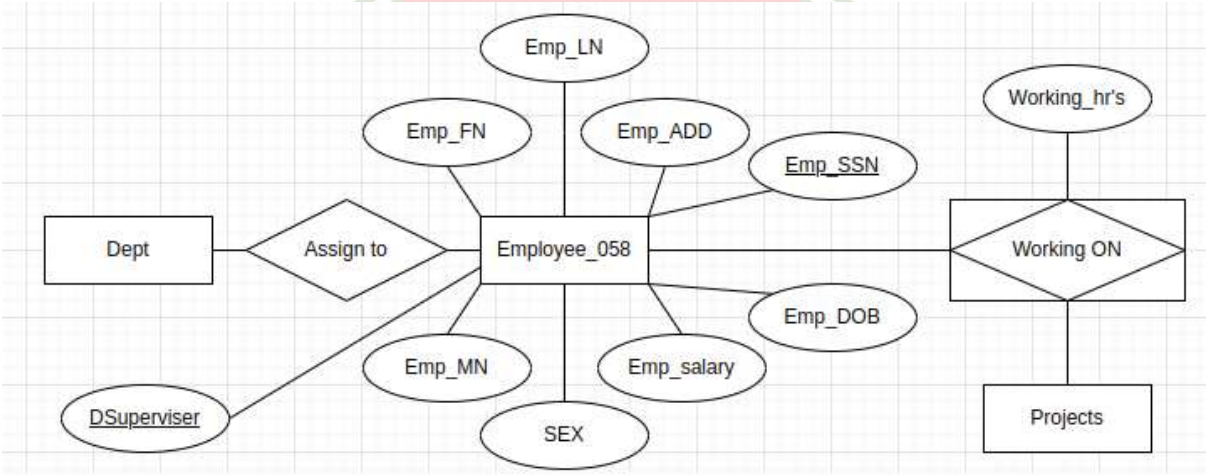
2. Draw an ERD for the following description:

A department controls several projects, each of which has a unique name, a unique number, and a single location.



3. Draw an ERD for the following description:

We store each employee's name (first, last, MI), Social Security number (SSN), street address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).



4. Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):

• the NHL has many teams,

• each team has a name, a city, a coach, a captain, and a set of players,

• each player belongs to only one team,

• each player has a name, a position (such as left wing or goalie), a skill level,

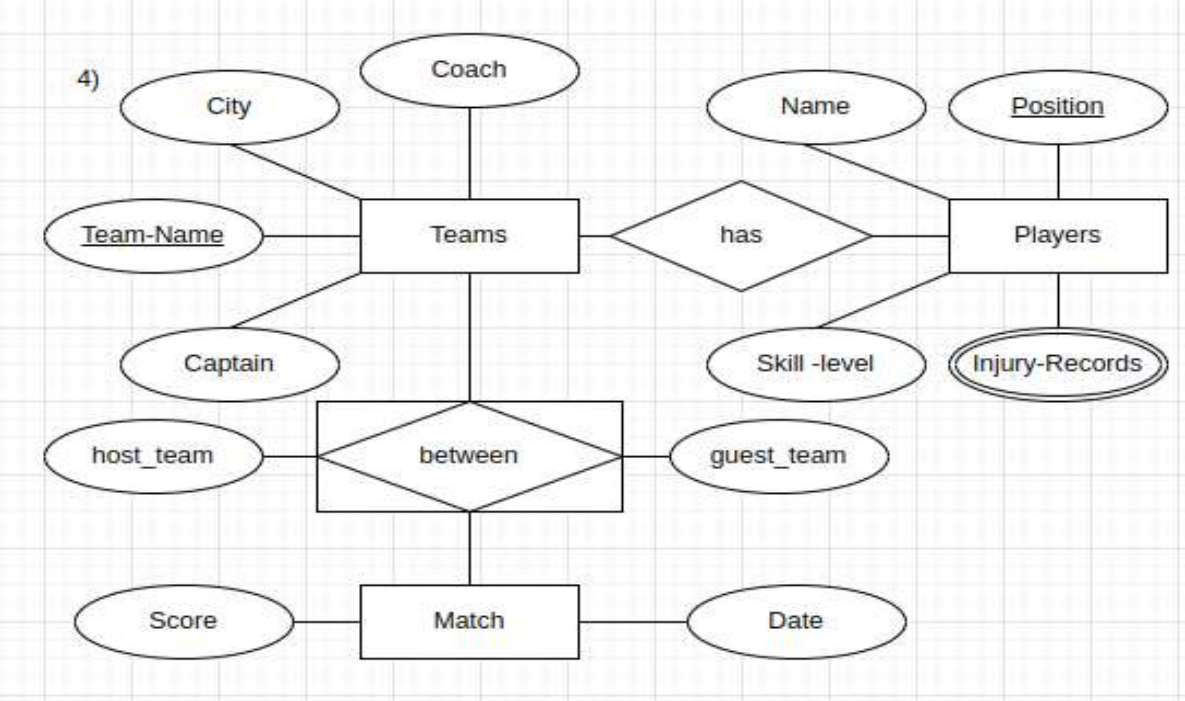
and a set of injury records,

• a team captain is also a player,

• a game is played between two teams (referred to as host_team and

guest_team) and has a date (such as May 11th, 1999) and a score (such as 4 to2).

Construct a clean and concise ER diagram for the NHL database. List your assumptions and clearly indicate the cardinality mappings as well.



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