

# Database Design

## **Lecture 11: Constructing ER Diagram**

# Contents

- Steps of ER Diagram
- Understanding Requirements
- Demonstration all steps

# Steps of Constructing ERD

1. Identify the Entities Required
2. Identify the Attributes and Primary key for each Entity
3. Identify the Relationship needed
4. Identify the Cardinality Ratio and Participation
5. Draw the Diagram

# ***Requirements*** (Project HRM)

- You have to develop a database for a company including some information of departments, employees and projects of the company. As mentioned that every department has many employees and each employee work for a department and each department is leading by only one manager who is also an employee. Initially a new department need not have any employee. Here, though an employee belongs a department but they can work for different projects at the same time.

# ***Step 1: Identify Entities***

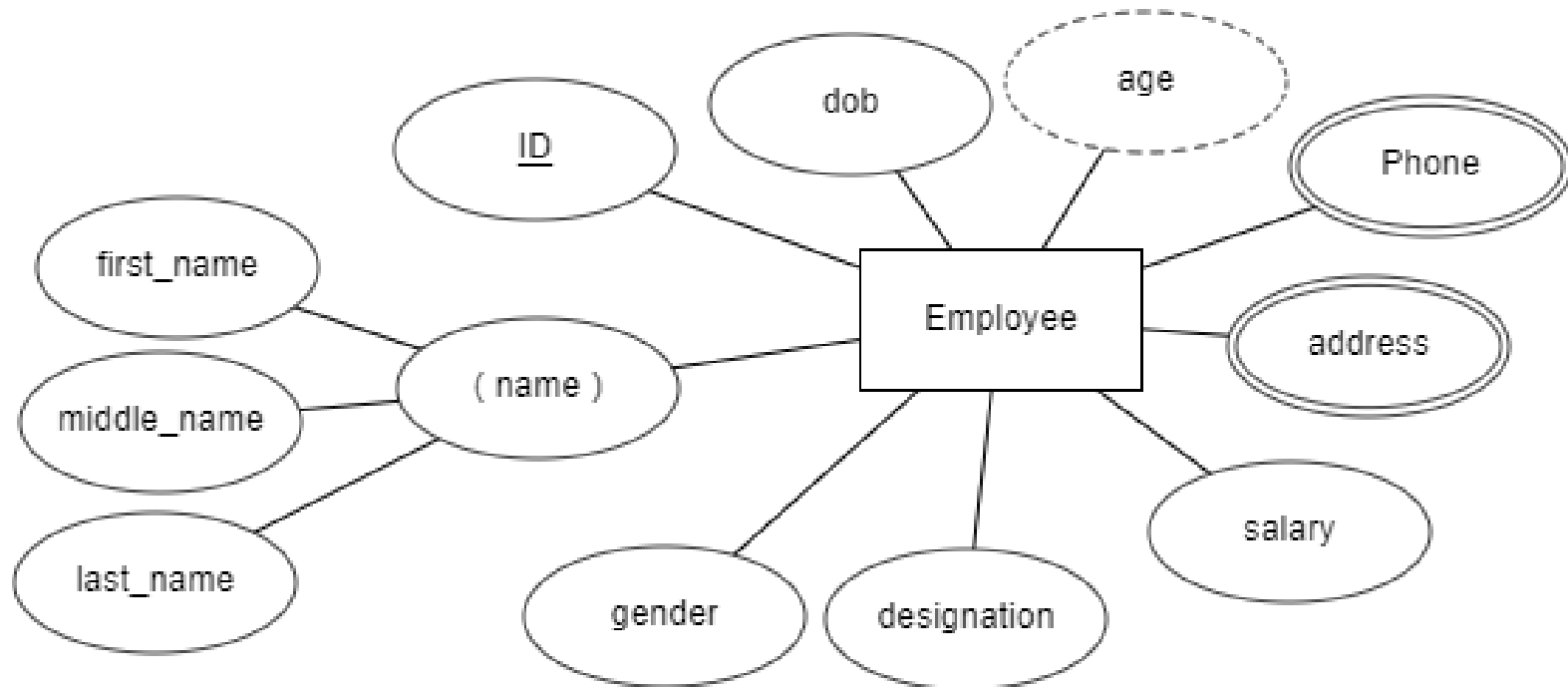
- You have to develop a database for a company including some information of departments, employees and projects of the company. As mentioned that every **department** has many **employees** and each employee work for a department and each department is leading by only one **manager** who is also an employee. Initially a new department need not have any employee. Here, though an employee belongs a department but they can work for different **projects** at the same time.

## ***Step 2: Identify Attributes and PK***

- **Employees**(id, name, email, phone, address, dob, gender, designation, salary)
- **Departments**(id, name, number, locations, num\_of\_employee, hod)
- **Projects**(id, name, num\_of\_employee, description)

# Representing Attributes with Entities

**Employees**(id, name, email, phone, address, dob, gender, designation, salary)



## ***Step 3: Identify Relationship***

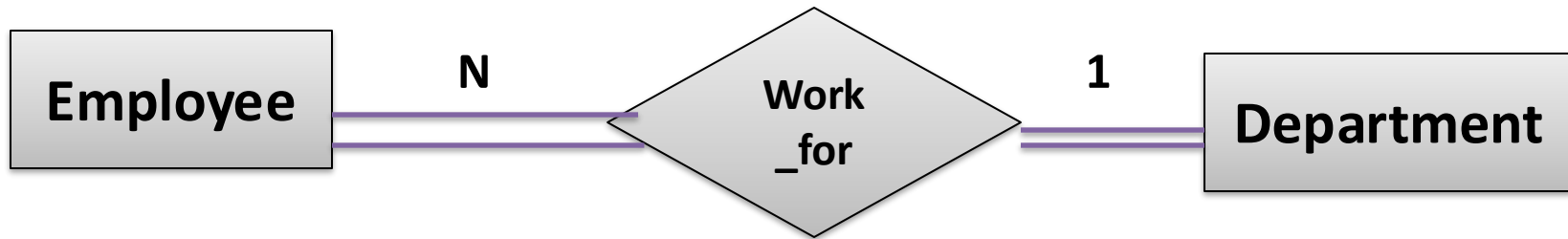
- 1. Employees ***work\_for*** Department
- 2. Employee ***Manages*** Department
- 3. Employees ***work\_on*** Project
- 4. Department ***Controls*** Project



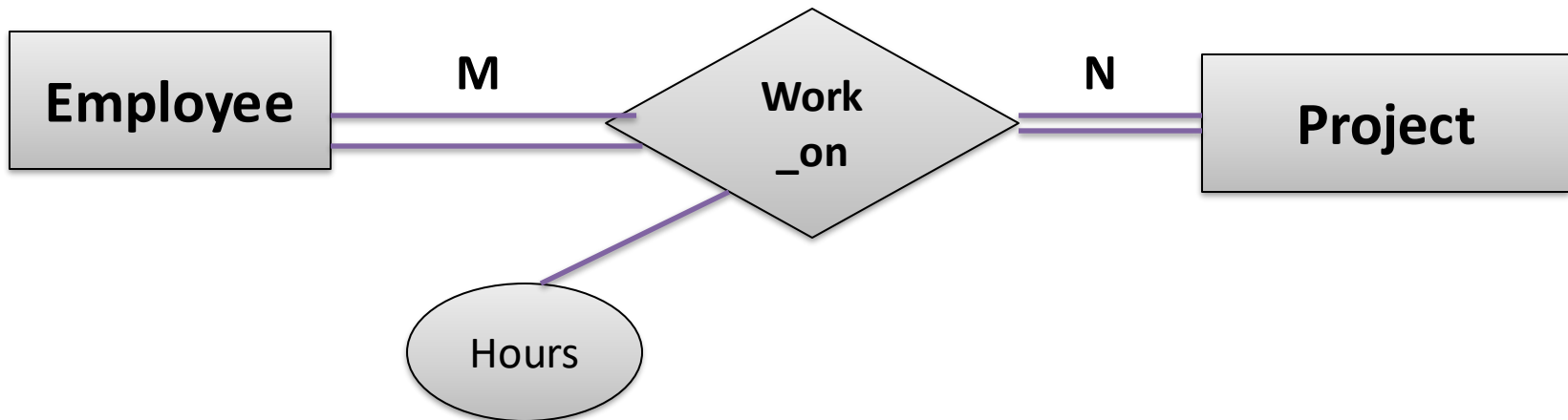
## ***Step 4: Cardinality Ratio and Participation (Constraints)***

- Types of Relationship/Mapping Cardinalities Ratio
  - Ask for maximum participation in a relationship
- Partial and Total Participation (Logically Think)
  - Ask for a minimum participation in a relationship

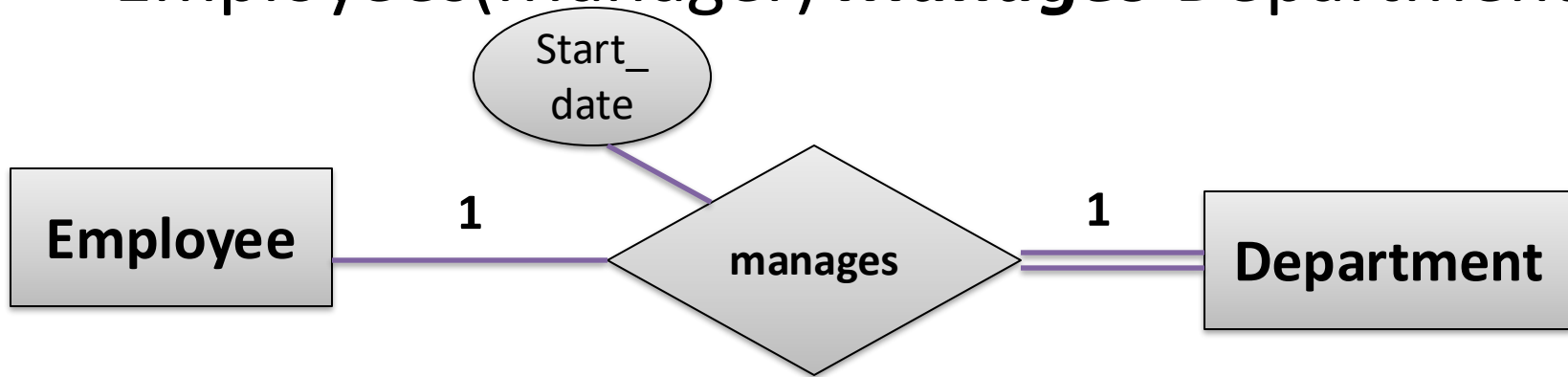
- Employees *work\_for* Department



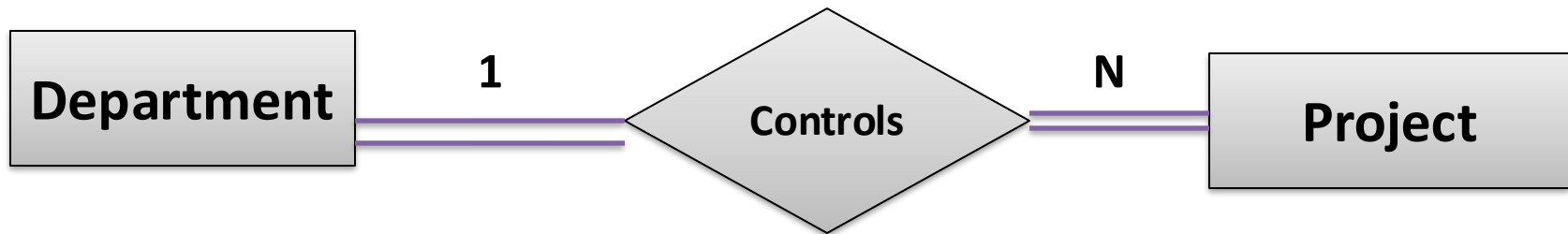
- Employees *works\_on* Projects



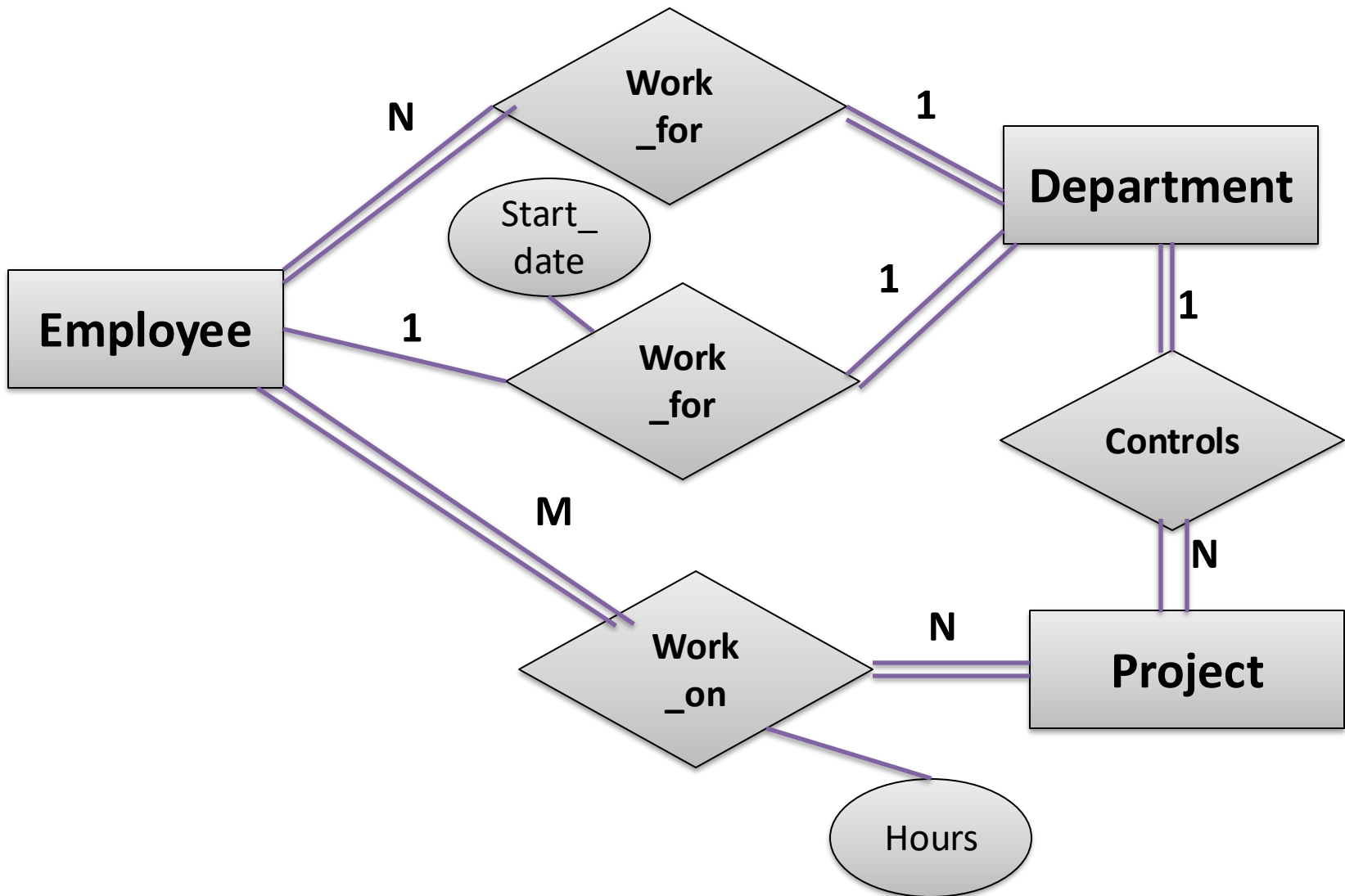
- Employees(Manager) ***Manages*** Department



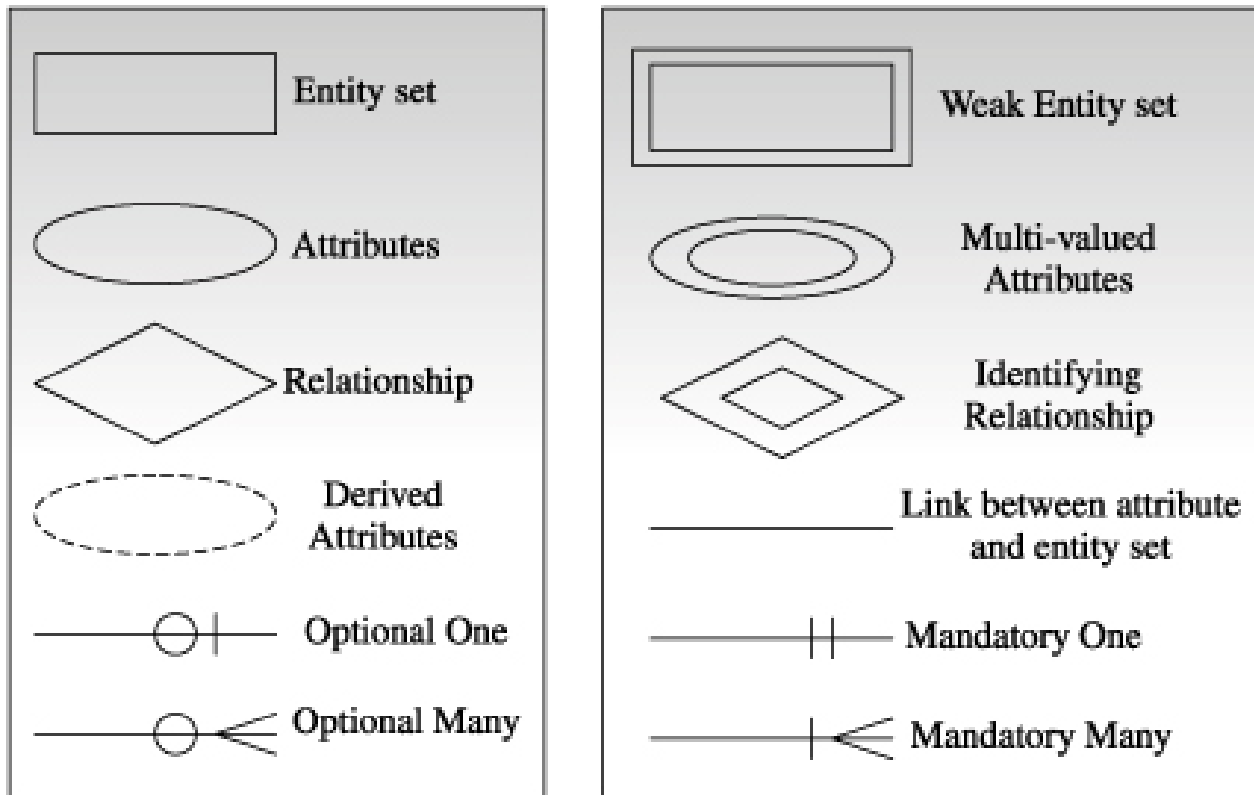
- Department ***Controls*** Project



**R: All**



# Drawing ER Diagram (Notation)

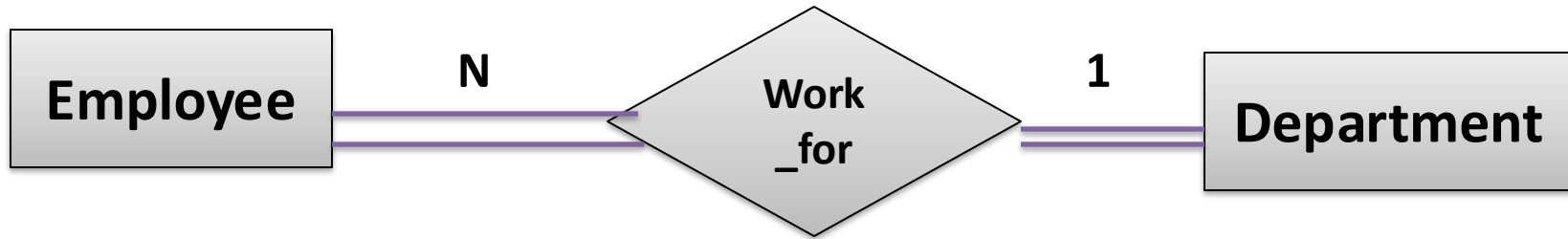


**Total Participation: Double Line and**  
**Partial Participation: Single Line**

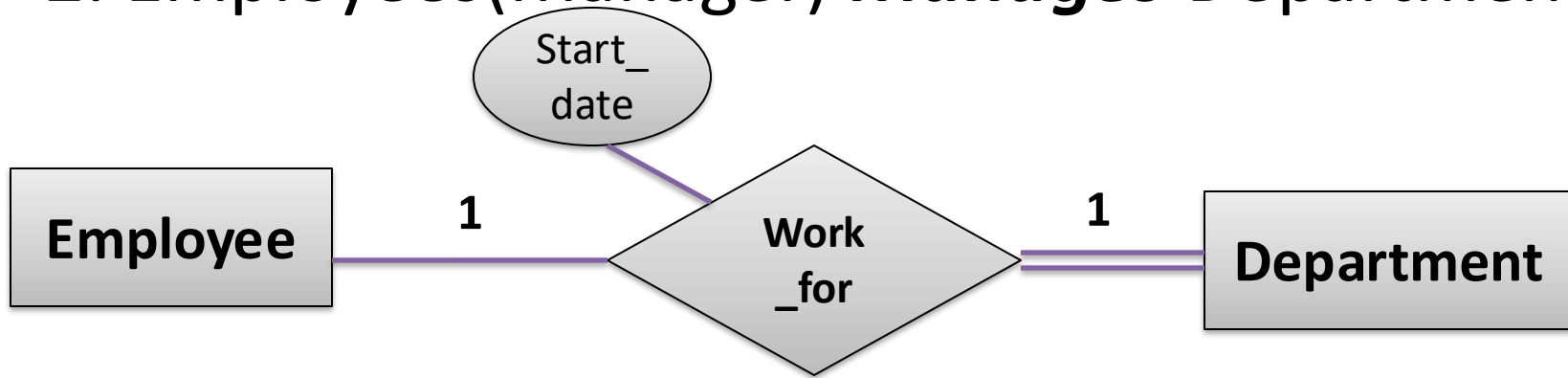
# Demonstration

- Show all relationships in a single diagram step by step.

# 1. Employees *work\_for* Department

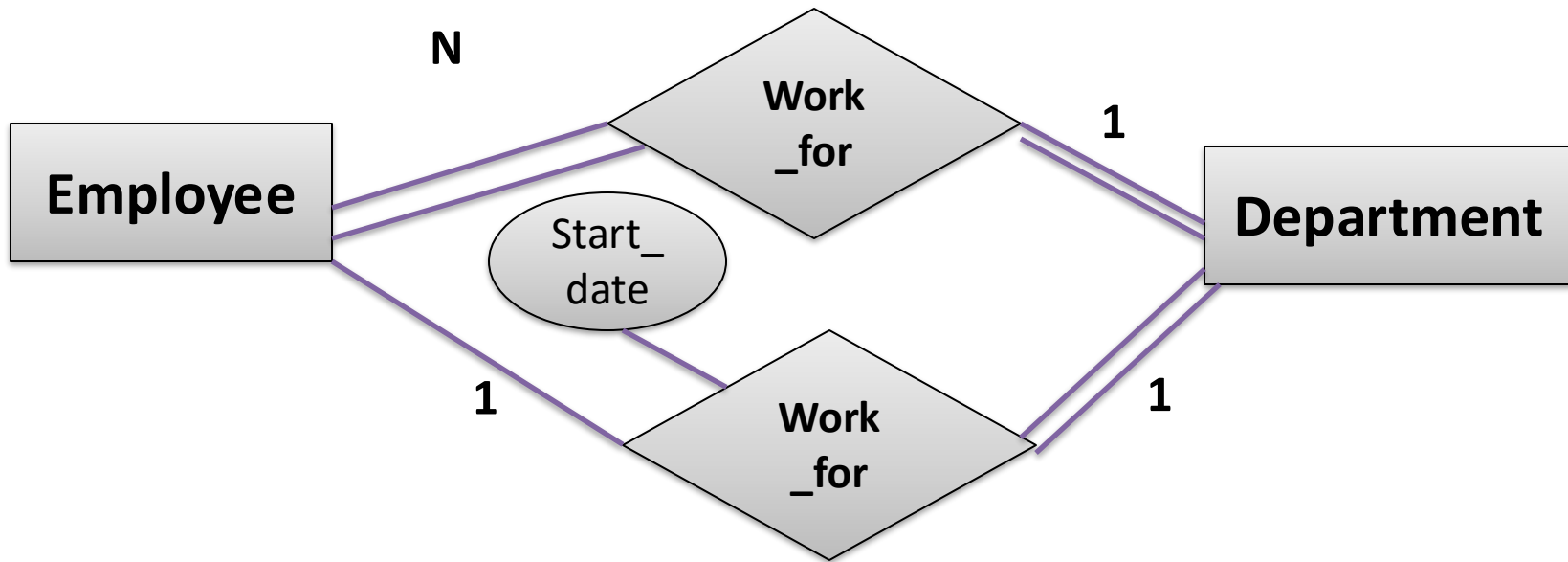


## 2. Employees(Manager) *Manages* Department

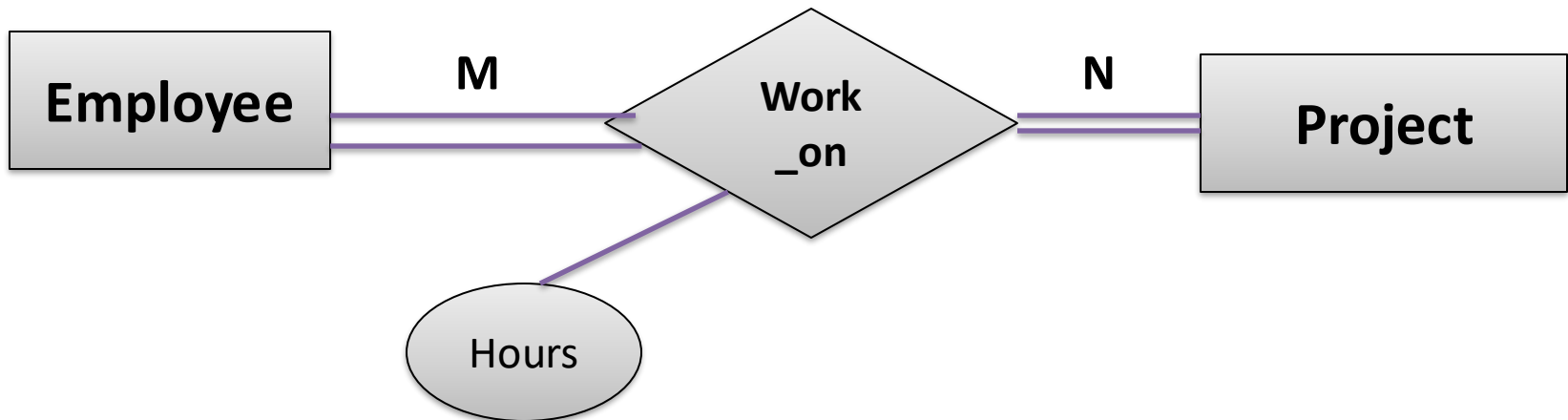




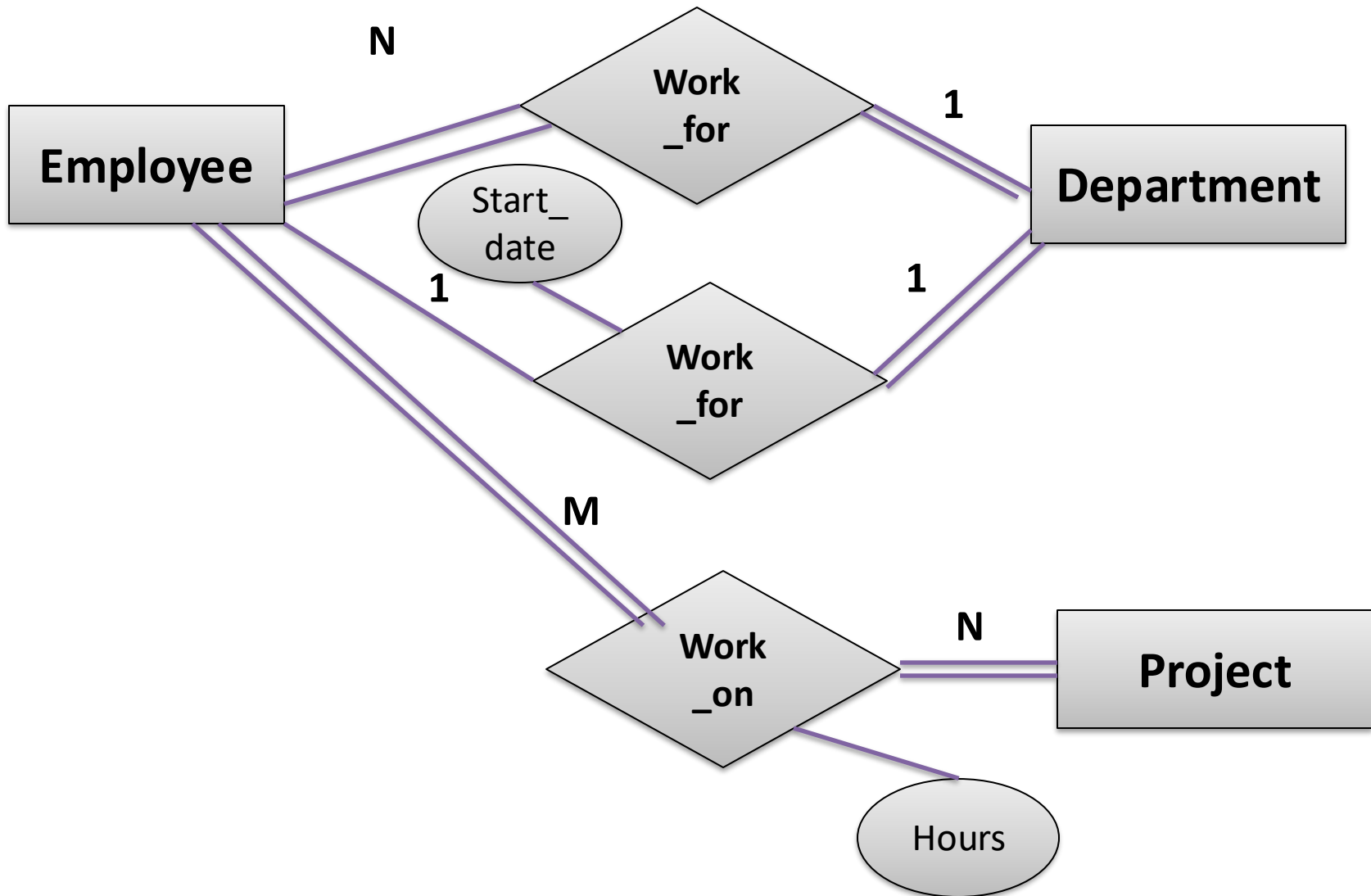
## *Relationship: 1 and 2*



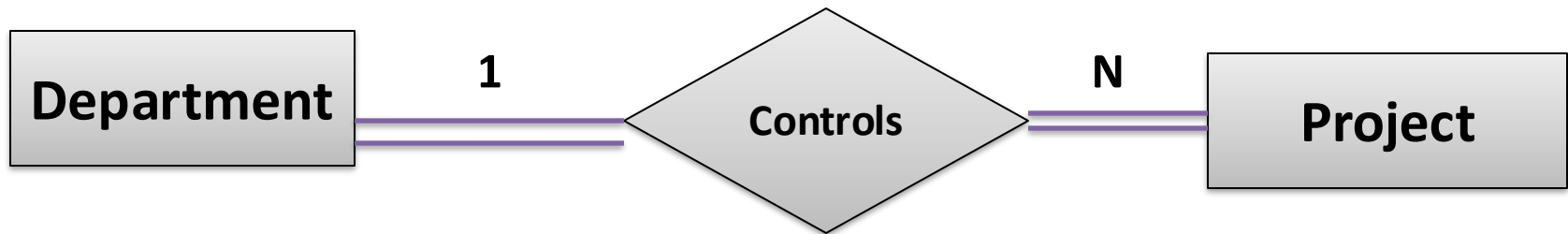
### 3. Employees *works\_on* Project



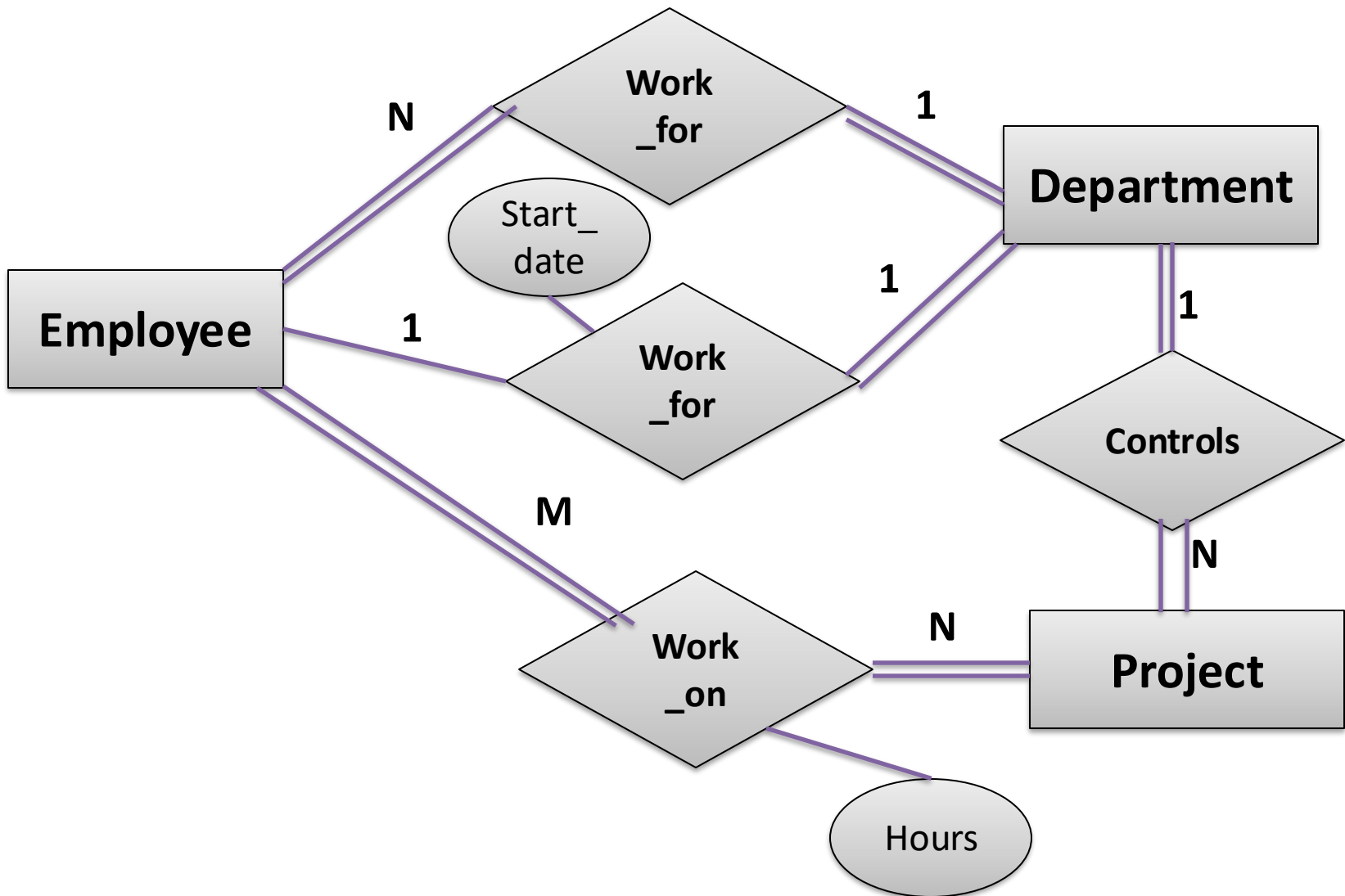
## *Relationship: 1, 2 and 3*



## 6. Department *Controls* Project



**R: All**





# ERD to Table

# ERD to Table

- Steps of Reducing table from ERD
  - Step 1: *Map Entities to Tables*
  - Step 2: *Handle Multi-valued and Complex attributes*
  - Step 3: Map Relationships to Foreign Keys
  - Step 4: *Map Attributes of Relationships*



# ERD to Table (Cont..)

Step 1: *Map Entities to Tables:*

- **Entities** in the ERD become **tables** in the relational schema.
- Each entity's attributes become columns in the table.
- Assign a **primary key** for each table using the entity's unique identifier.
- Example: `Employees(id, name, email, phone, address, dob, gender, designation, salary)`

# ERD to Table (Cont..)

## Step 2: *Handle Multi-valued and Complex attributes*

- Create new **tables** for multivalued and complex attributes.
- Map foreign key relationship with the primary key of associated entity.
- Example: `phone (id, phone_number, employee_id)`
- `Address ()`

# ERD to Table(Cont..)

## Step 3: Map Relationships to Foreign Keys

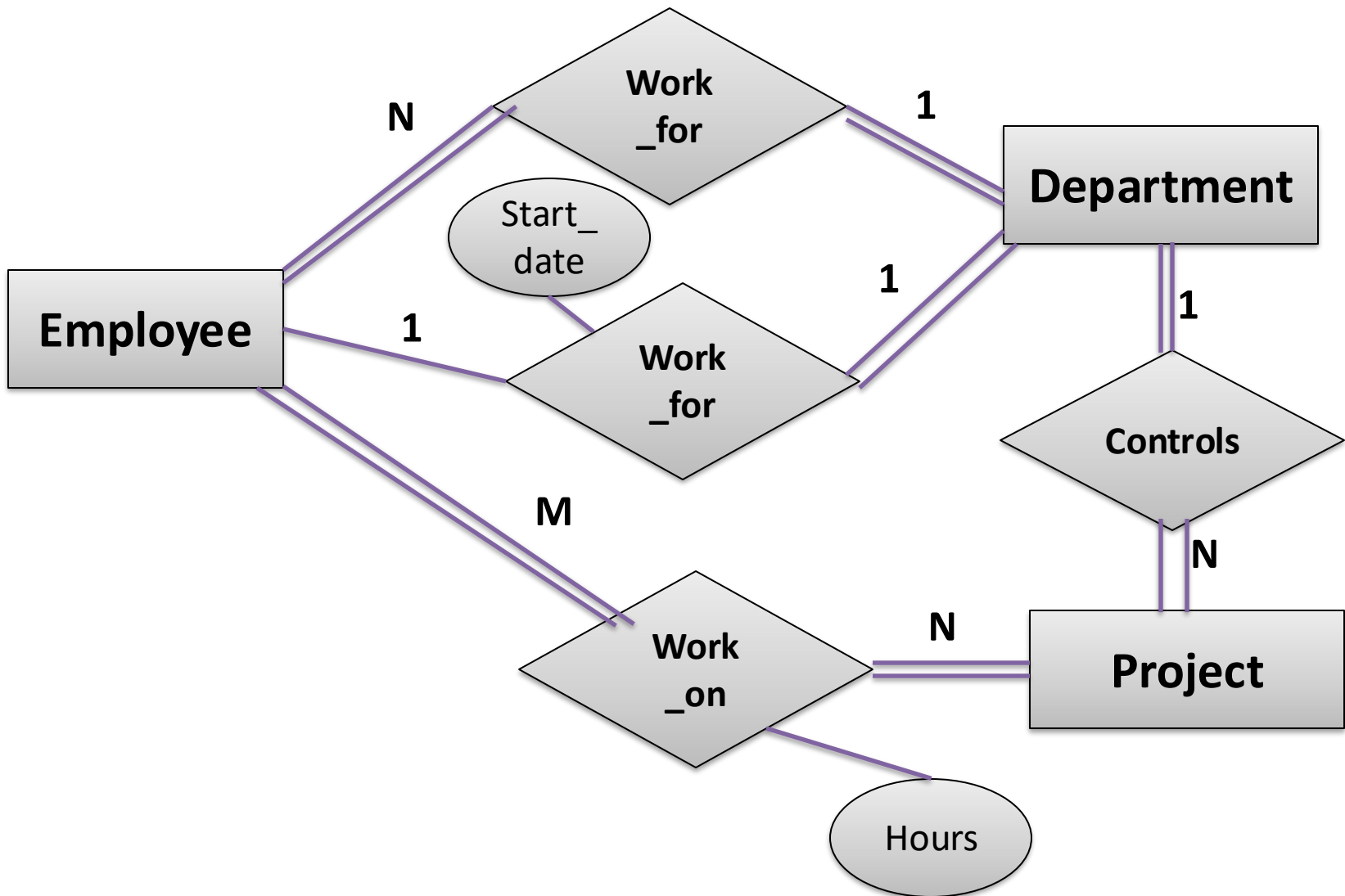
- **One to one (1-1):** Add the primary key of the one table to another table.
- **One to Many (1-N):** Add the primary key of the "one" side as a foreign key to the "many" side.
  - Example: Employee works for department [Pk of dept to Emp as FK]
- **Many to Many (M-N):** Create a new table (also known as **junction table**) to handle many-to-many relationships. This table includes the primary keys of both related tables as foreign keys.
  - Example: Employee works in projects [create a new table]

# ERD to Table(Cont..)

## Step 4: *Map Attributes of Relationships*

- If a relationship has attributes (e.g., working\_hours in a work\_on relationship), add those attributes to the table created for the relationship [***It happens in M-N Relationship***].
- Example: `work_on(id, employee_id, project_id, hours)`

## *R: All*



# Final Tables for HRM

## **All Tables**

**Employee(id, name, email, dob, gender, designation, salary, joining\_date, *dept\_id*)**

**Phone(id, phone\_number, *employee\_id*)**

**Address(id, *employee\_id*, post\_code, upzilla, district, division)**

**Department(id, name, contact\_number, locations, *manager\_id*)**

**Project(id, name, description)**

**Work\_on(id, *project\_id*, *employee\_id*, hours)**

**\*\*Now Create a Database of HRM using MySQL**

## **Database Name: hrm**

### **Tables:**

`Employee(id, name, email, dob, gender, designation, salary, joining_date, dept_id)`

`Phone(id, phone_number, employee_id)`

`Address(id, employee_id, post_code, upzilla, district, division)`

`Department(id, name, contact_number, locations, manager_id)`

`Project(id, name, description)`

`Work_on(id, project_id, employee_id, hours)`

# ERD Drawing Tools

<https://erdplus.com/standalone> (Recommended)

<https://online.visual-paradigm.com/diagrams/solutions/free-erd-tool/>

<https://www.smartdraw.com/entity-relationship-diagram/er-diagram-tool.htm>

<https://www.lucidchart.com/pages/examples/er-diagram-tool>



# EDGE training application platform

- Design a database for edge online application platform for university of barishal. Consider the following requirements:
  - Edge will offer various training programs through circular
  - There may be different training centers and any student can apply in any training module in any center when their they meet the eligibility.
  - Instructors will be assigned for any training module
  - This platform will provide a class routine for all batches
  - Student can find their result after finishing the training
  - Any notice regarding this program will be shared in this platform

# Entity

- Design a database for edge online application platform for university of barishal. Consider the following requirements:
  - Edge will offer various training **programs** through **circular**
  - There may be different training **centers** and any **student** can apply in any training module in any center when their they meet the **eligibility**.
  - **Instructors** will be assign for any training module
  - This platform will provide a class **routine** for all **batches**
  - Student can find their **result/Exam** after finishing the training
  - Any **notice** regarding this program will be shared in this platform

# Assignment 1

**1.** You have to develop a **Human Resource Management** database for a company. It requires that you have to add some information of departments, employees and projects including company. As mentioned that every department has many employees and each employee work for a department and each department is leading by only one manager who is also an employee. Initially a new department need not have any employee. Here, though an employee belongs a department but they can work for different projects at the same time. Each employee can work for different job position like Developer, Programmer and front-end designer.

**2.** ER diagram for university management system

**3.** Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars, and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received

**END OF LECTURE**