# COURSE NAME: DBMS
# COURSE CODE:23AD2102A

Topic: **Entity-Relationship (ER) Modelling**

Session - 4

# AIM OF THE SESSION

To familiarize students with the basic concept of Designing ER diagrams, ER data Model, EER diagram in Entity Relationship (ER) Diagrams.

# INSTRUCTIONAL OBJECTIVES

This Session is designed to:

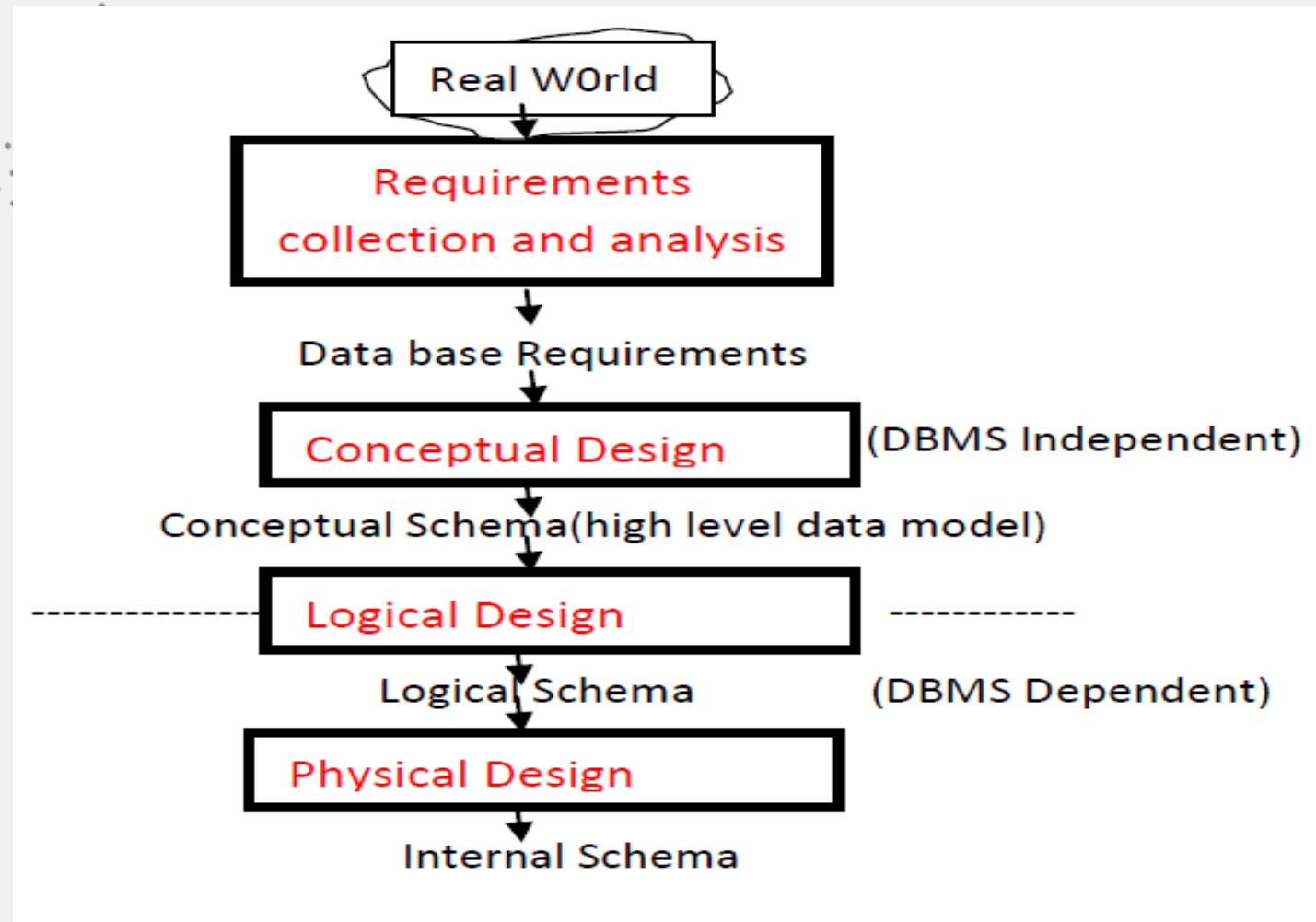
- Understand the concepts of Designing ER diagrams, ER data Model used for Data Modelling.
- Compare and evalu chniques.

# LEARNING OUTCOMES

At the end of this session, you should be able to:

- Identify the ER data Model and Designing ER diagrams.
- ER Data Modeling Diagram from Users Problem Description.

# Data base design process



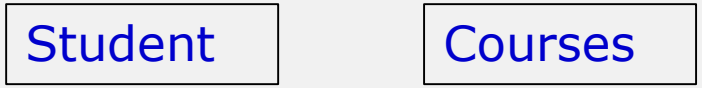
**Conceptual (high-level, semantic) data models**

**ER modeling:** A graphical technique for understanding and organizing the data independent of the actual database implementation

# What is Entity?

- **Entity** is an object in real world which has independent existence.
  - Example: Student, Course, Faculty, Car, House, College, Book, Food

ER Diagram Notation for Entity: Rectangle




Also known as **Entity Type**

# What is Attribute ?

- Attribute is a property that describes Entity.

Attributes:
USN, Name, Email ID,
Mobile Number, DOB

Student <- - - Entity Type

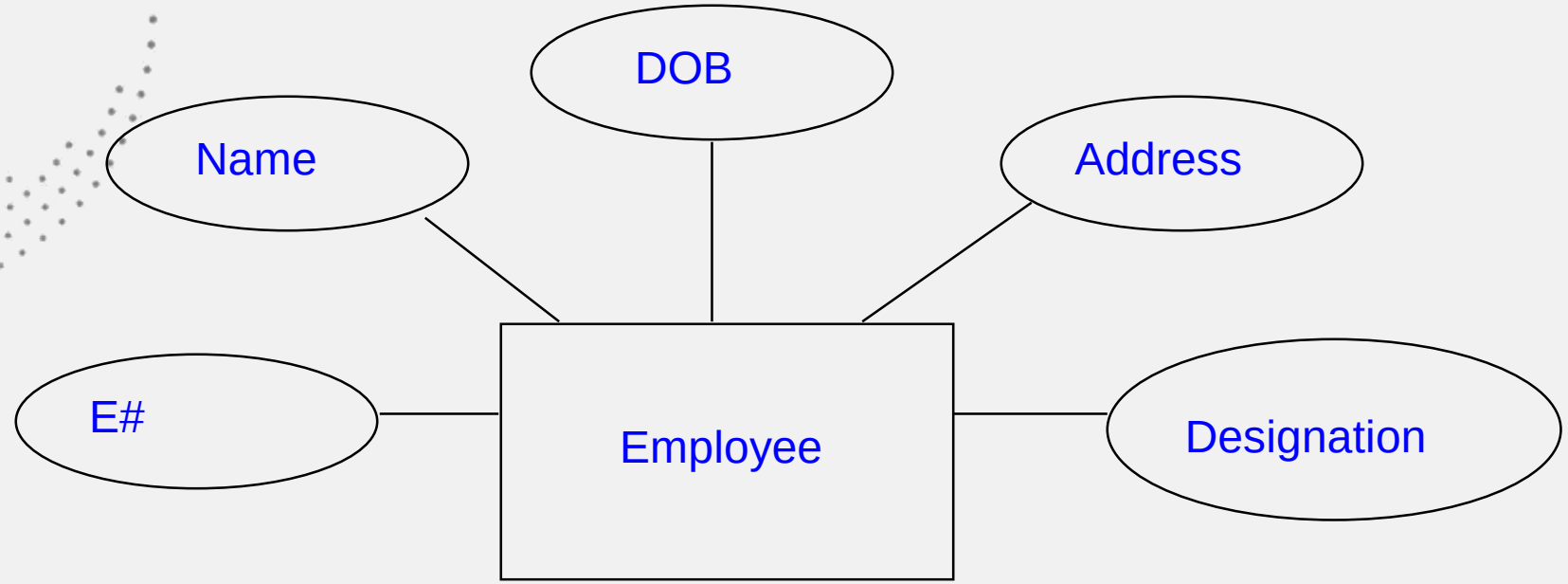
| USN | Name | Email ID | Mobile No. | DOB |
|---|---|---|---|---|
| 1BM14CS001 | Aditya | aditya@bmsce.ac.in | 9448444160 | 1-1-1997 |
| 1BM14CS002 | Bharath | bharath@bmsce.ac.in | 8762244699 | 31-12-1996 |

ER Diagram Notation for Attribute: Ellipse

# Domain of Attribute

- Set of permitted values for an Attribute.
  - Ex : Domain of USN= {190030001, 190030002,…..}
    Domain of EmpID= {00001..10000}

# ER Diagram notation for Entity and Attributes



# What is Entity Instance?

- **Entity instance:** a particular member of the entity type e.g. a particular student

Student ← - - - Entity Type

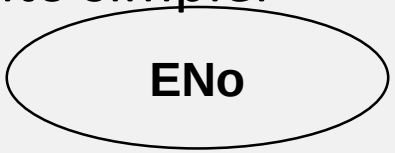
| USN | Name | Email ID | Mobile No. | DOB |
|---|---|---|---|---|
| 1BM14CS001 | Aditya | aditya@bmsce.ac.in | 9448444160 | 1-1-1997 |
| 1BM14CS002 | Bharath | bharath@bmsce.ac.in | 8762244699 | 31-12-1996 |

Entity instance

# Simple vs composite attribute

- **Simple attribute**: cannot be divided into simpler components

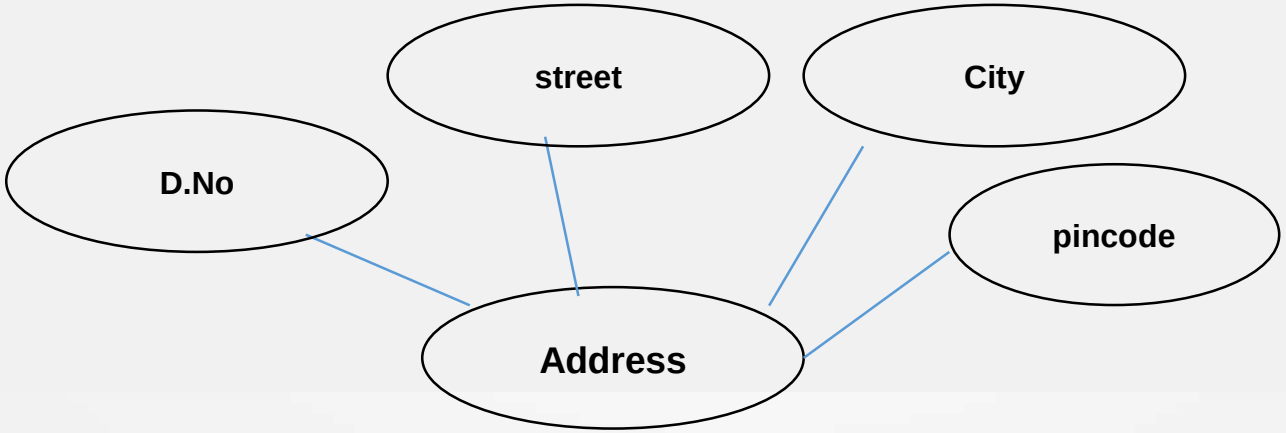
  E.g Eno. of an employee



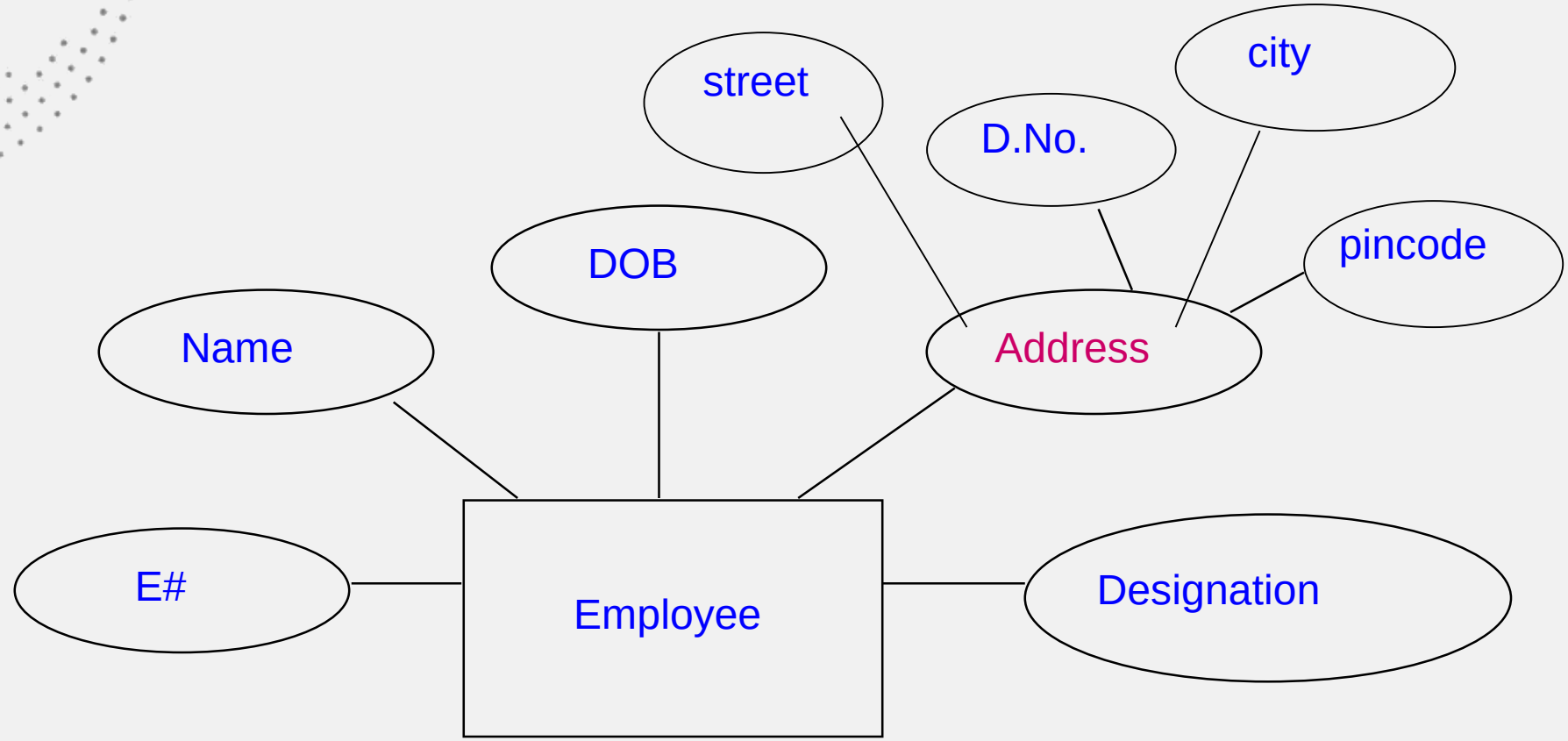

- **Composite attribute**: can be split into components

  E.g Address of an employee.

  - Can be split into D.No., street, city, pincode



# ER with Composite attribute



# Single Vs Multi-valued Attributes

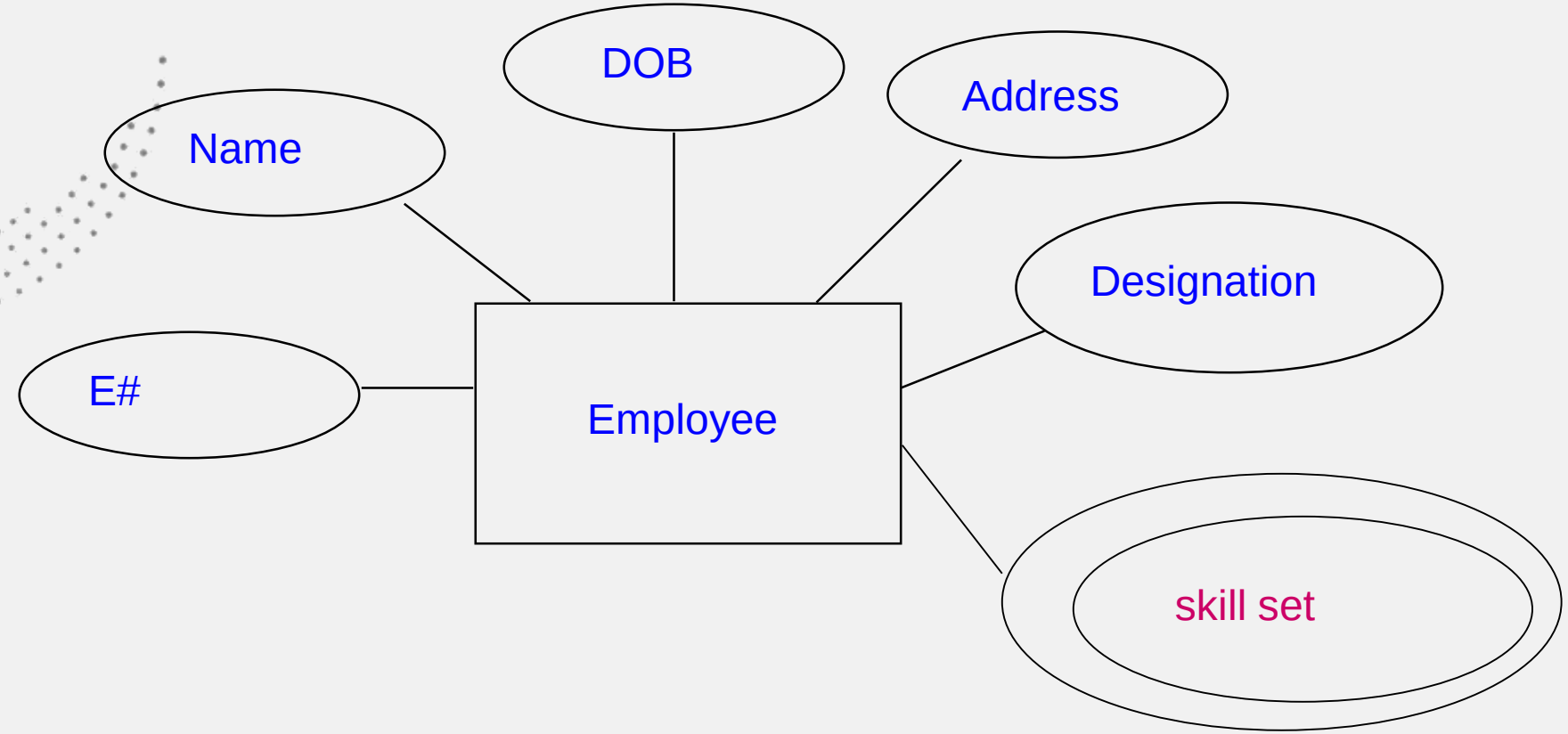
- **Single valued** : can take on only a single value for each entity instance

  E.g. ***age*** of employee. There can be only one value for this

- **Multi-valued**: can take many values

  E.g. ***skill set*** of employee ,car number/colour, phone number

# Multivalued Attribute



# Stored Vs Derived attribute

- **Stored Attribute**: Attribute that need to be stored permanently.
  - E.g. ***name*** of an employee, Dob

- **Derived Attribute**: Attribute that can be calculated based on other attributes
  - E.g. : **age** of an employee  based on DOB and current date
  - ***years of service*** based on the date of joining and current date

# Key Attribute

- Key attribute is an attribute or a combination of attributes which will uniquely identify remaining attributes of entity.

- What are the Key attributes in the following student table ?

| USN | Name | Email ID | Mobile No. | DOB |
|---|---|---|---|---|
| 1BM14CS001 | Aditya | aditya@bmsce.ac.in | 9448444160 | 01-01-1997 |
| 1BM14CS002 | Bharath | bharath@bmsce.ac.in | 8762244699 | 31-12-1996 |
| 1BM14CS003 | Bharath | bharath9@bmsce.ac.in | 8762244699 | 31-12-1996 |

ER Diagram Notation for key attribute: underline attribute

# Regular Vs. Weak entity type

- **Regular Entity**: Entity that has its own key attributes.

  E.g.: Employee, student ,customer, policy holder etc.

- **Weak entity**: Entity that depends on other entity for its existence and doesn't have key attribute of its own

  E.g. : spouse of employee 

  The spouse data is identified with the help of the **employee id** to which it is related

# What is COMPOSITE Key ?

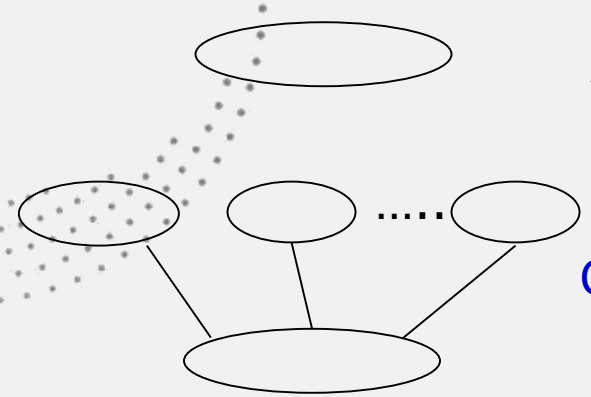
- What are the Key attributes in the following student table ?

| Faculty Name | Department | Salary |
|---|---|---|
| A | CSE | 20K |
| B | CSE | 20K |
| A | EC | 30K |
| B | EC | 27K |
| C | CSE | 22K |

composite key : Combination of Two or More attributes

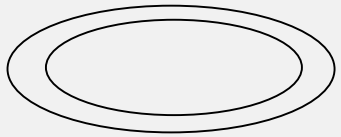
In the example, Faculty Name & Department together is a Composite key

# ER Diagram notations



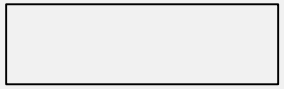
Attribute

Composite Attribute



Multivalued Attribute

Derived Attribute



Entity

Key Attribute

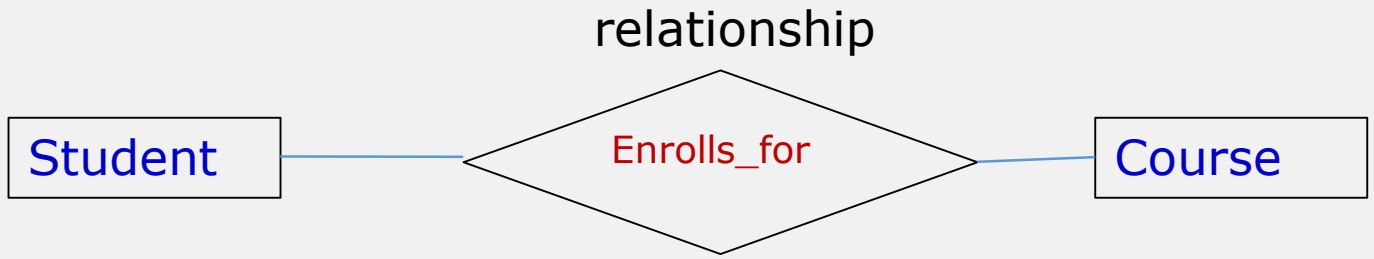
# Group activity

- We will move you into breakout rooms for 10 minutes
  - Introduce each other quickly
  - Appoint a time keeper and recorder

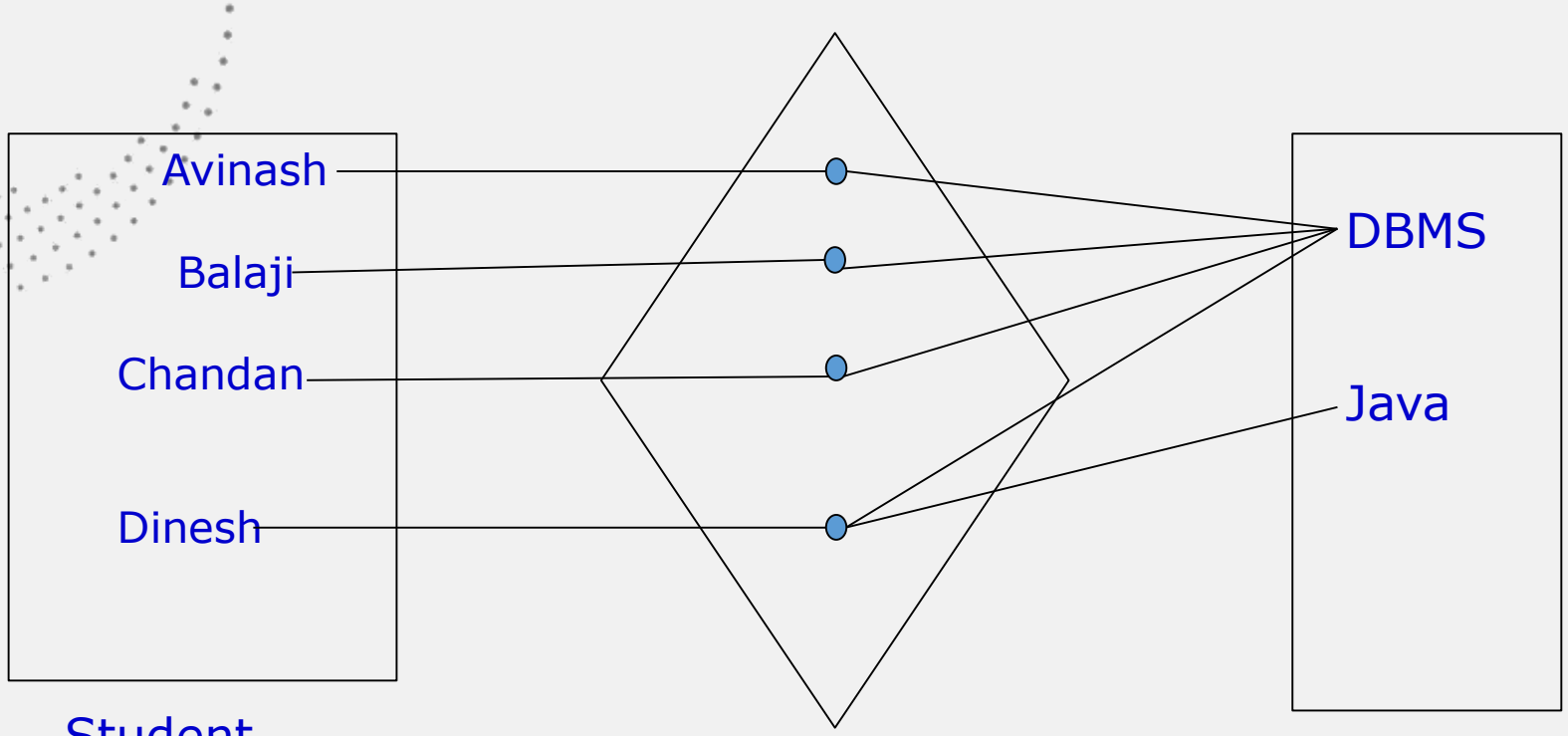
- Answer the following
  - create an entity of your choice with all the attributes discussed so far.
  - Should not use the example entities discussed in the lecture

# Relationship

- The association between entities is called a relationship.

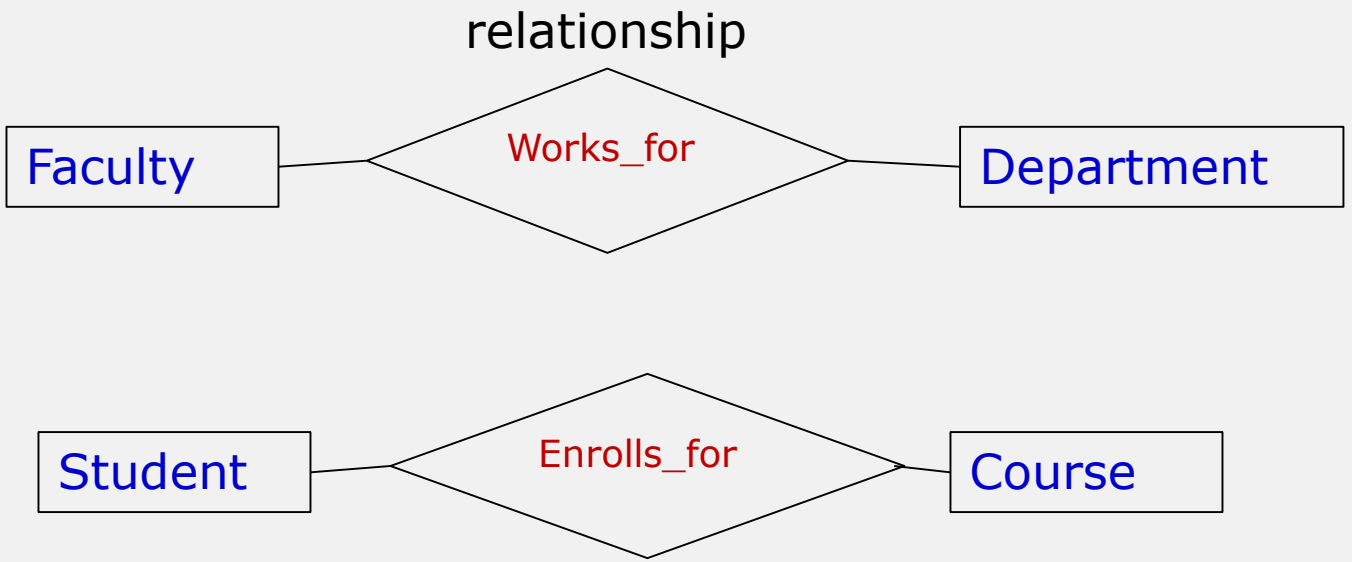


# Relationship - example

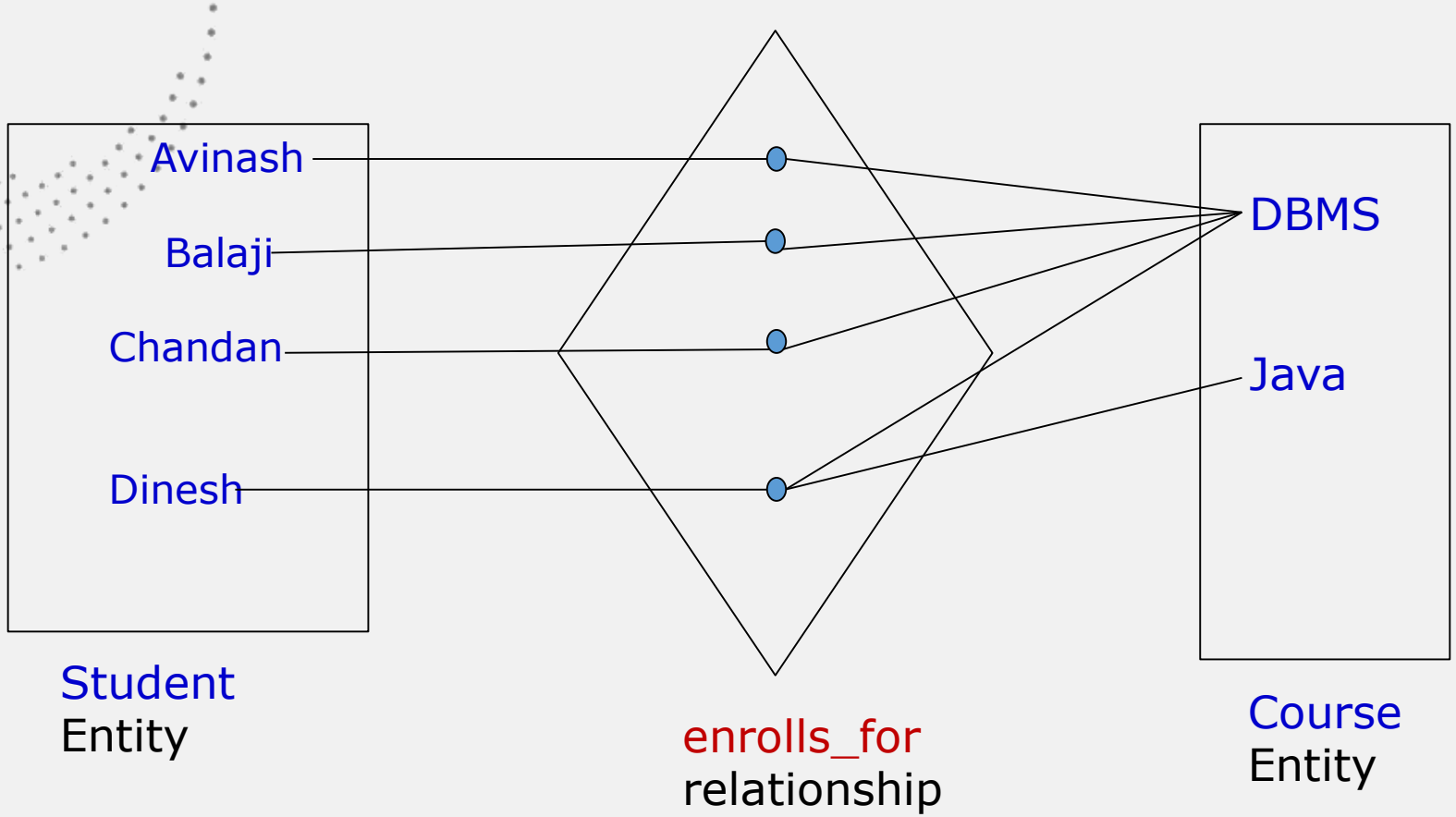


# Relationship Type

- A **relationship type** between two entities defines the set of all associations between these entities

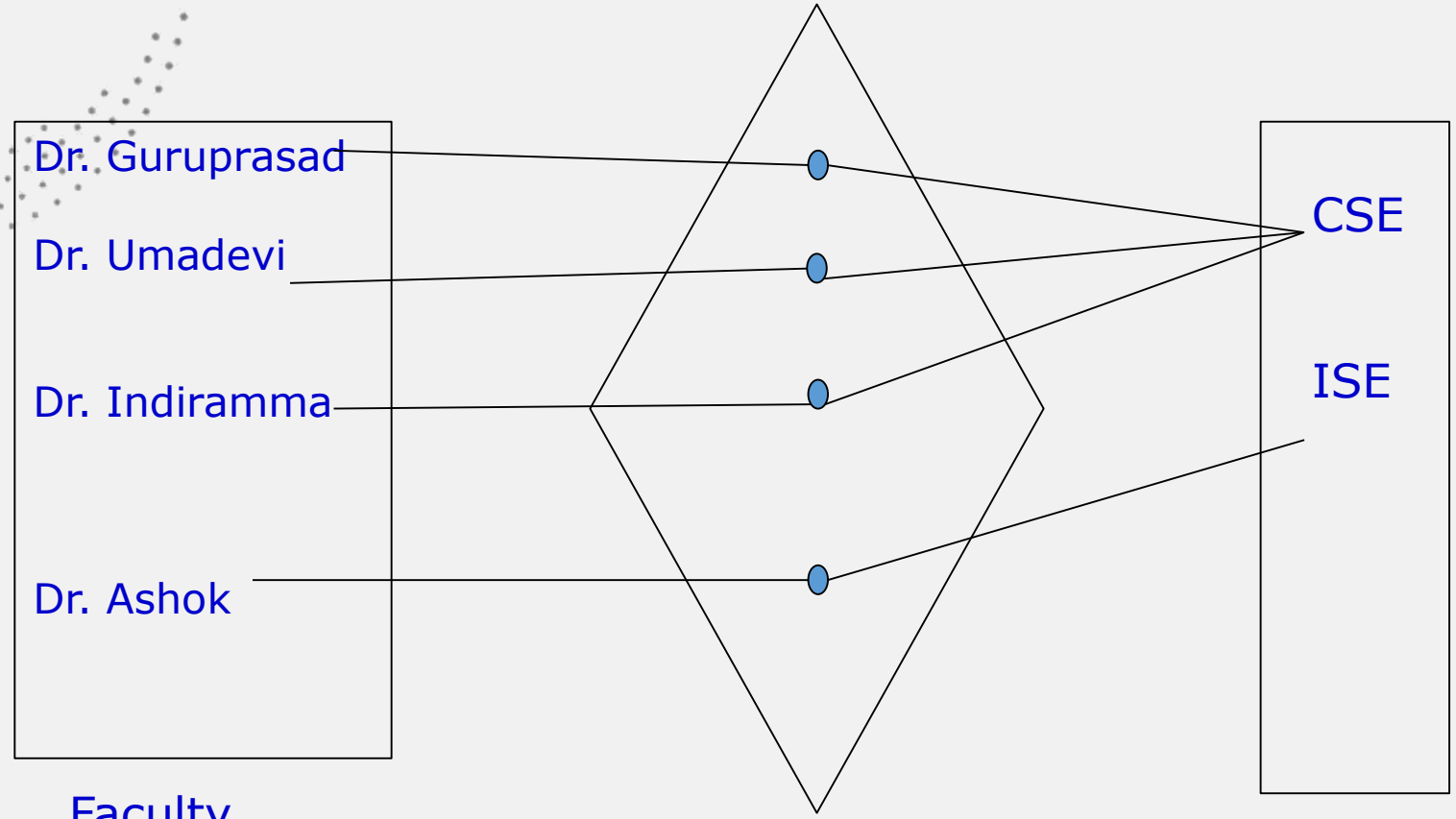


# Relationship Type- example



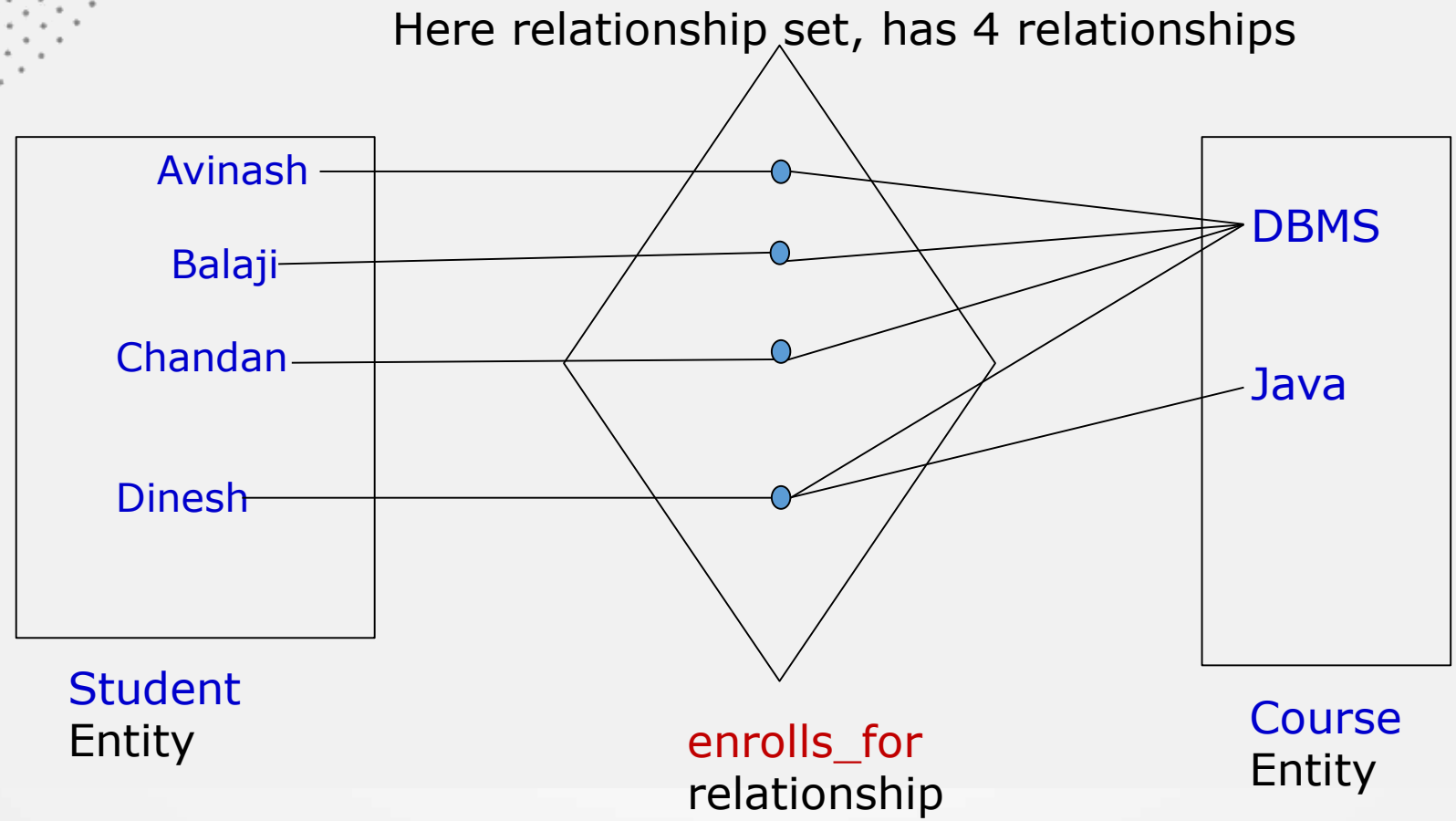
# Relationship instance

- Each instance of the relationship between members of these entity types is called a **relationship instance**



# Relationship Set

- An Relationship Set is a collection of relationships all belonging to one relationship type.



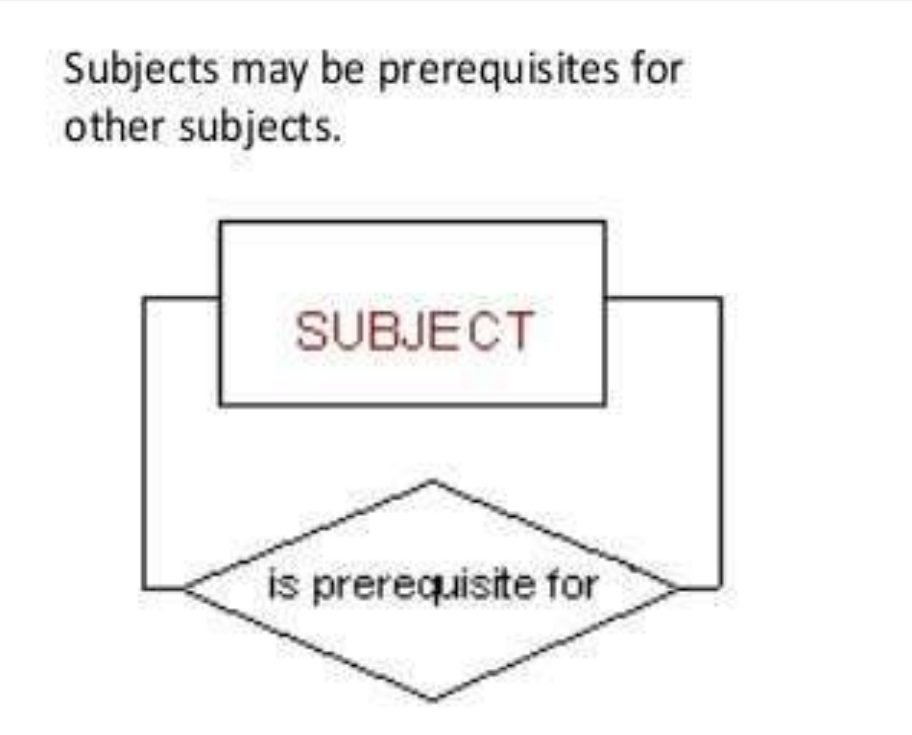
# Relationship Degree

The **degree** of a **relationship** is the number of entity types that participate(associate)in a **relationship**.

- Unary Relationship: Degree One, a entity is related to the same . Also known as recursive.
- Binary Relationship: Degree Two, an entity is related to another entity
- Ternary Relationship: Degree Three, three entities are participating

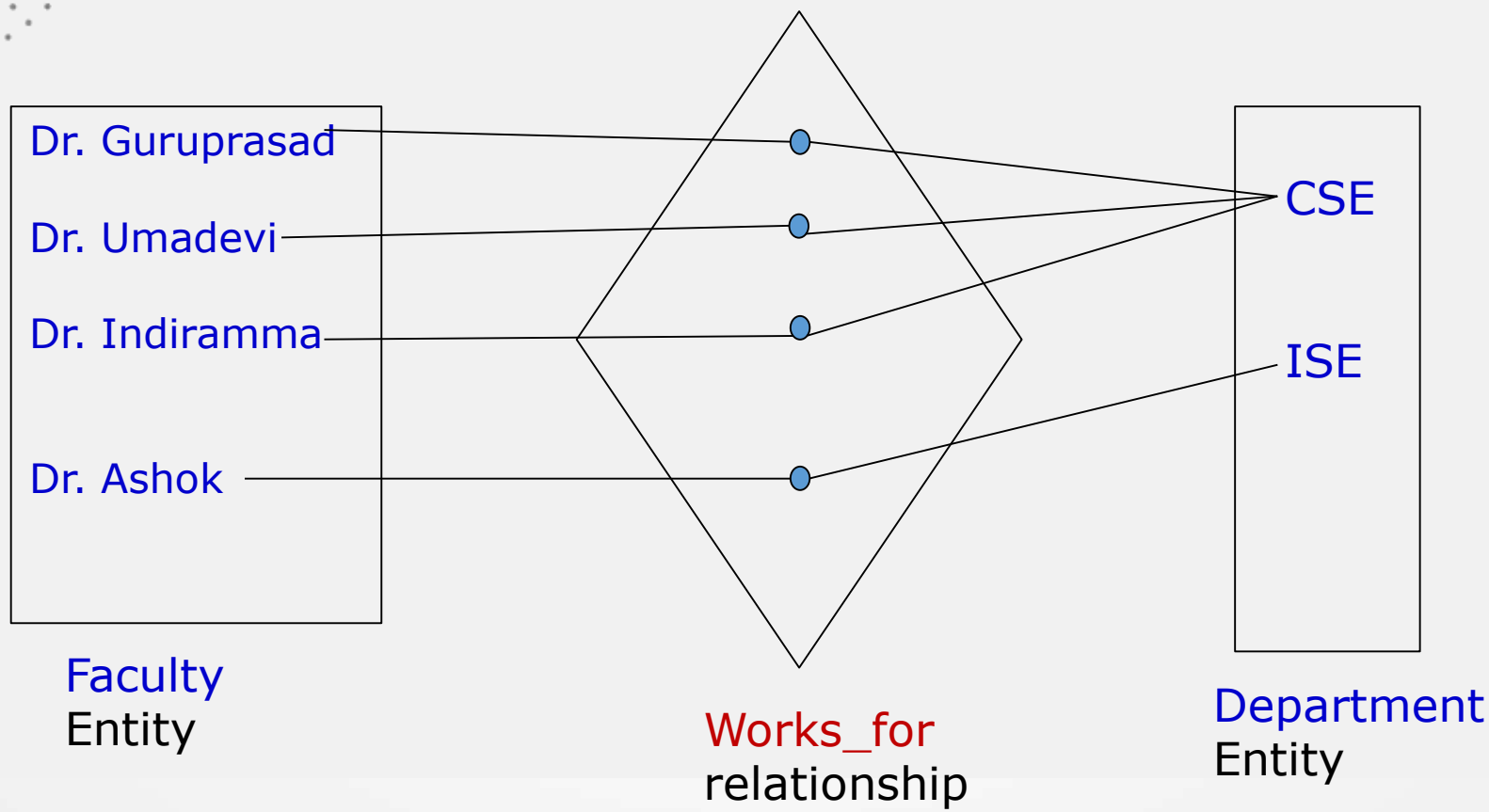
# Unary Relationship - example

- Unary Relationship: Degree One, a entity is related to the same.. ((Recursive relationship)



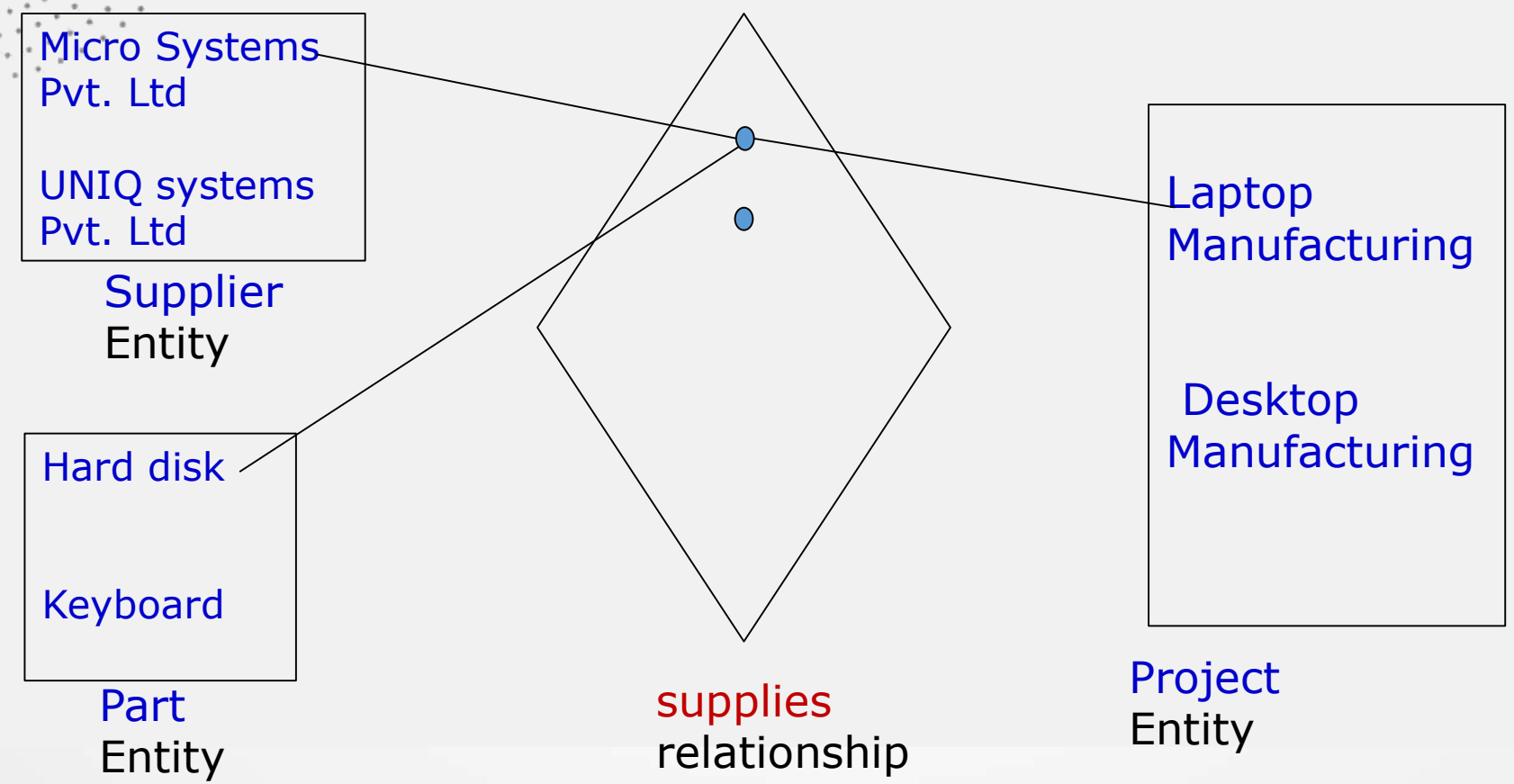
# Binary Relationship example

- Binary Relationship: Degree Two, an entity is related to another entity

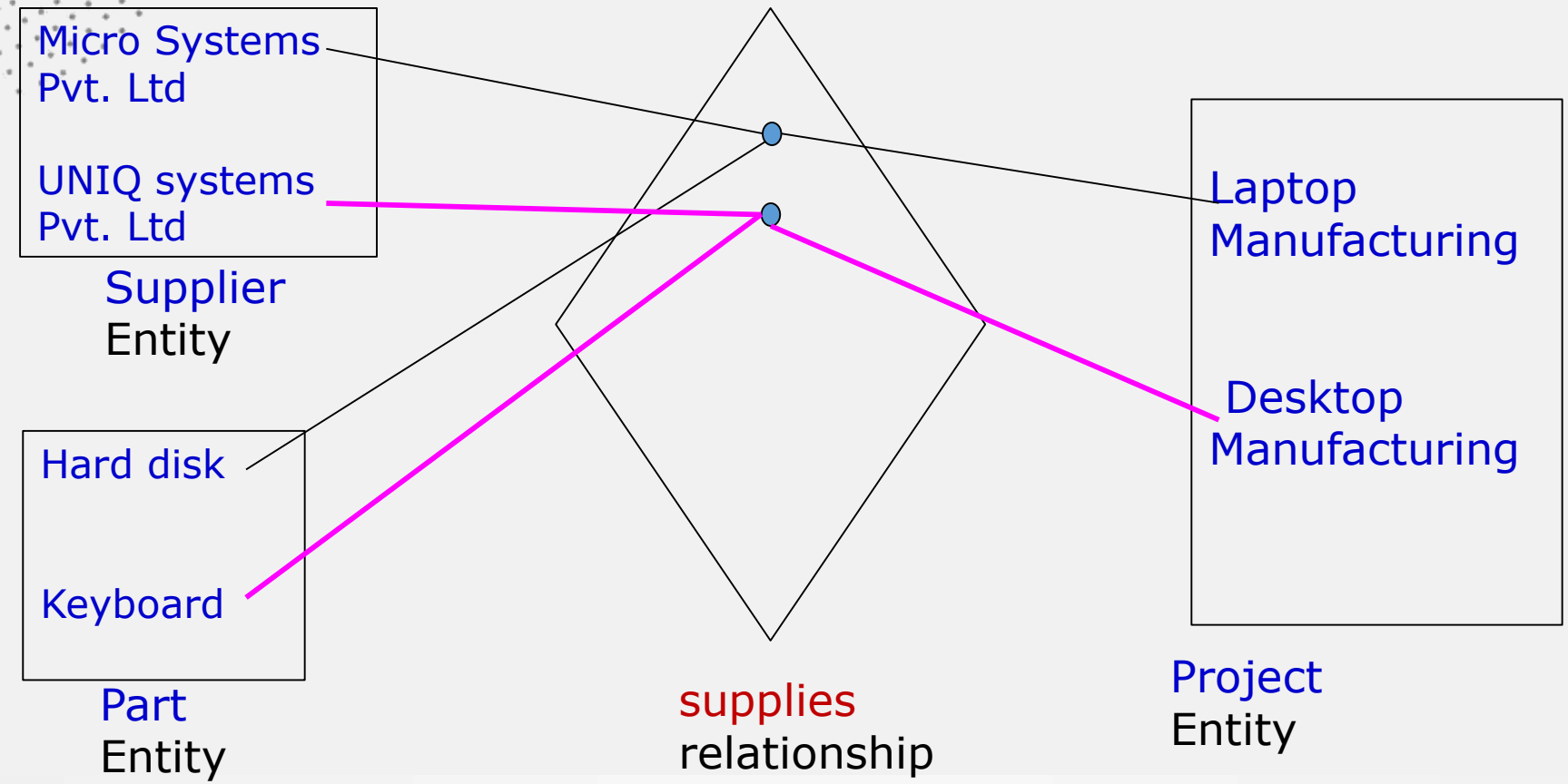


# Ternary Relationship -example

- Ternary Relationship: Degree Three, three entities are participating



# Ternary Relationship -Example



# Two Types of Relationship Constraints

## 1. Cardinality Ratios

a. One to one (1:1)
b. One to Many (1:M)
c. Many to Many (N:M)

## 2. Participation Constraints

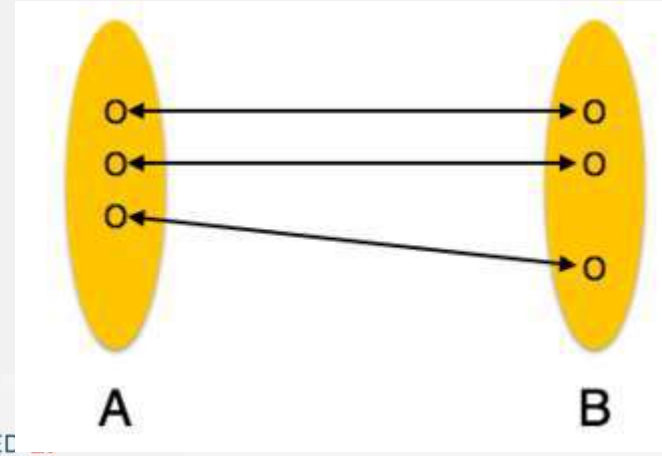
a. Total
b. Partial

# Cardinality Ratios

- Cardinality is a constraint on a relationship specifying the number of entity instances that a specific entity may be related to via the relationship.

## One to One:

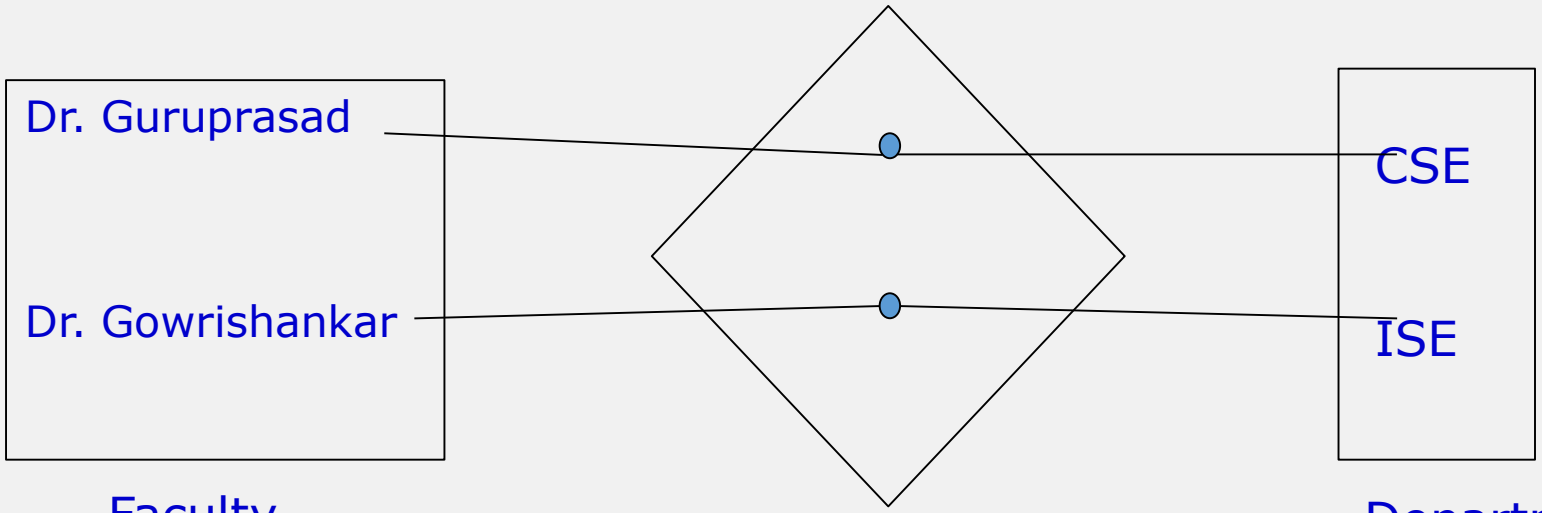
One entity from entity set A can be associated with at most one entity of entity set B and vice versa.



# Cardinality – One to one

# Cardinality Ratios One to One

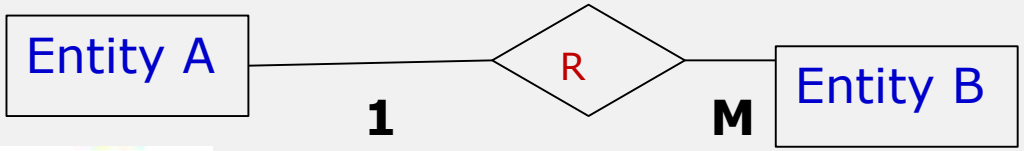
Example

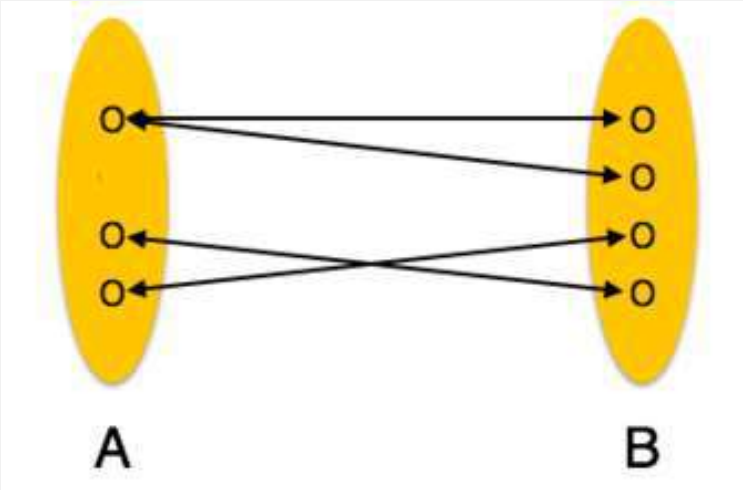


# Cardinality Ratios One to Many

## One to Many:

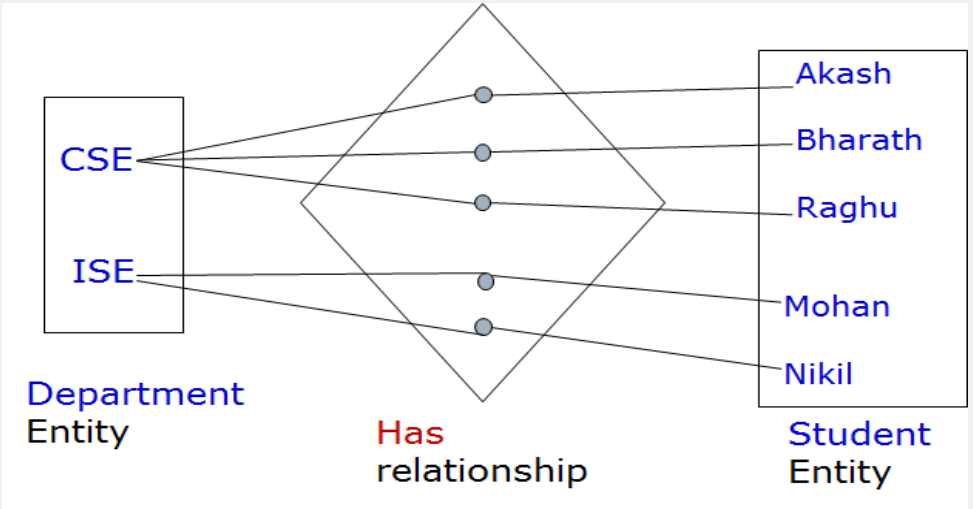
One entity from entity set A can be associated with more than one entities of entity set B however an entity from entity set B, can be associated with at most one entity.



# Cardinality One to Many

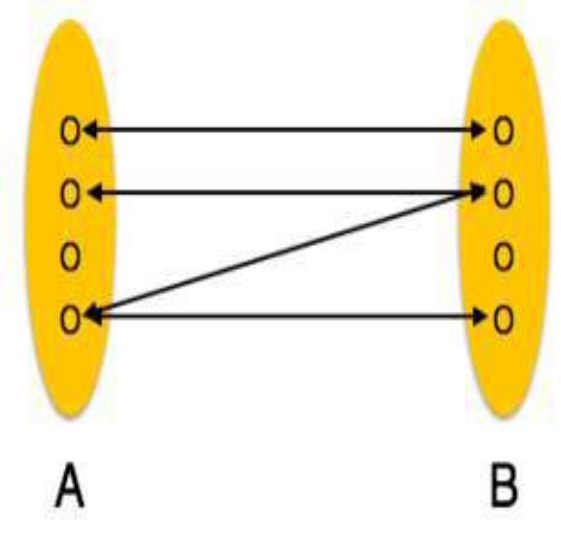
- Example

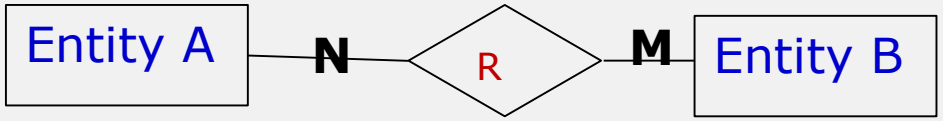



# Cardinality Many to Many

Many to Many:

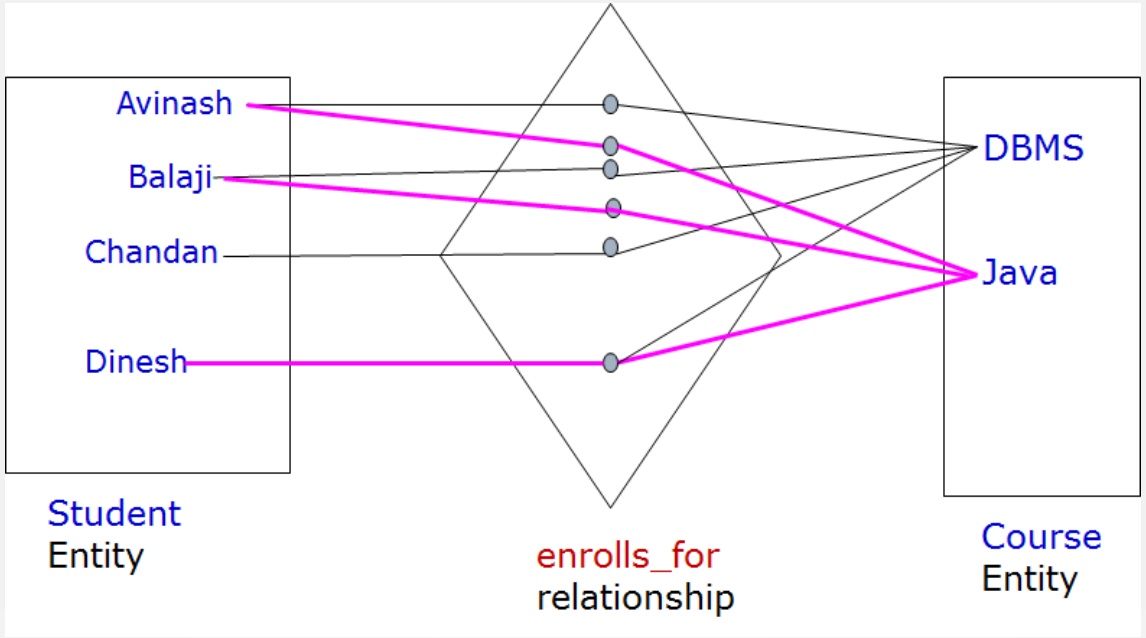
One entity from A can be associated with more than one entity from B and vice versa.



# Cardinality Many to many

- Example

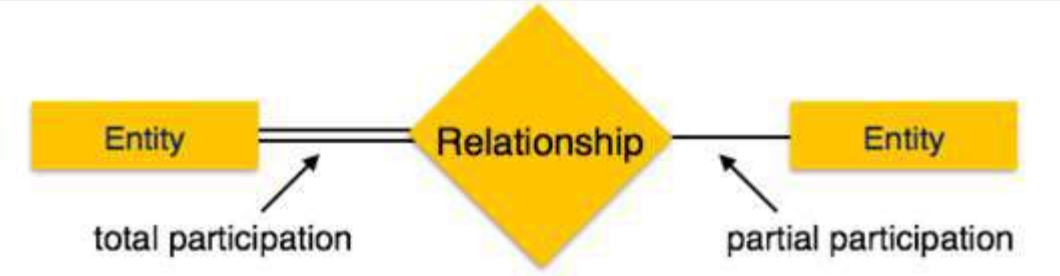


# Participation Constraint

- Minimum number of relationship instance that each entity can participate in.

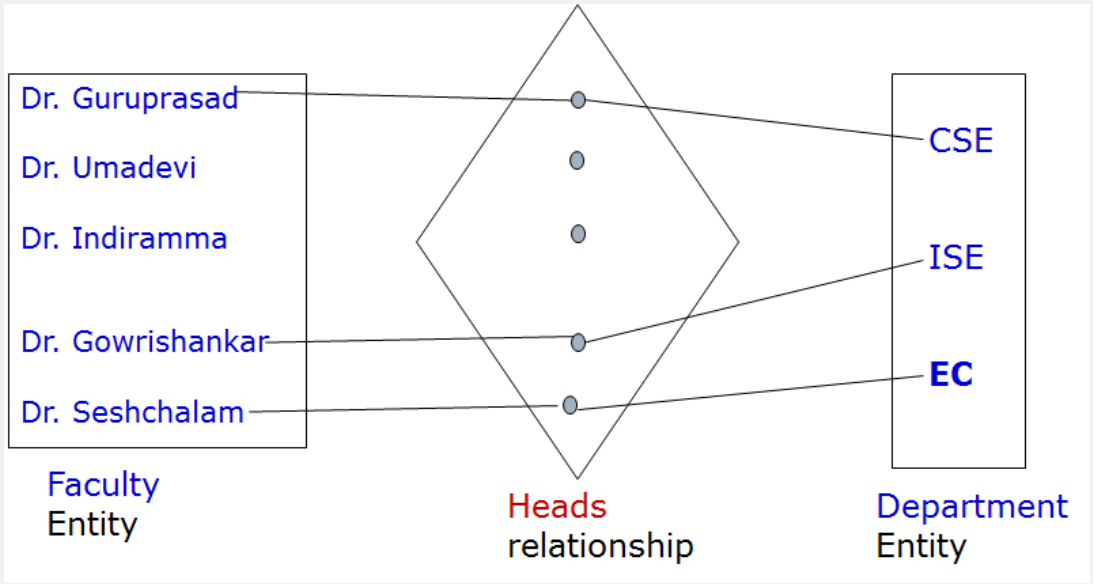
- **Total Participation** – Each entity is involved in the relationship. Total participation is represented by double lines.

- **Partial participation** – Not all entities are involved in the relationship. Partial participation is represented by single lines.

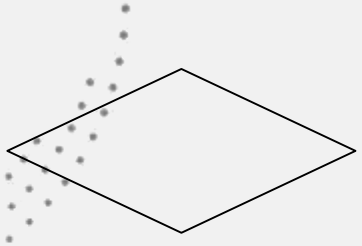


# Participation Constraint

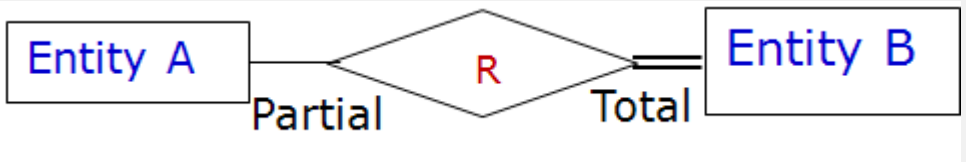
Example



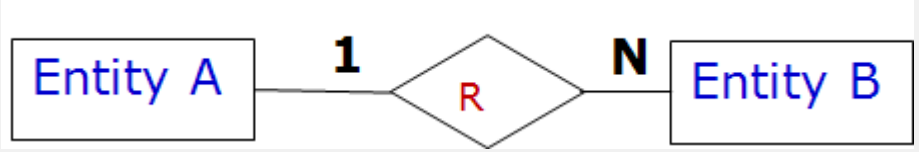

# ER Diagram Symbols



Relationship



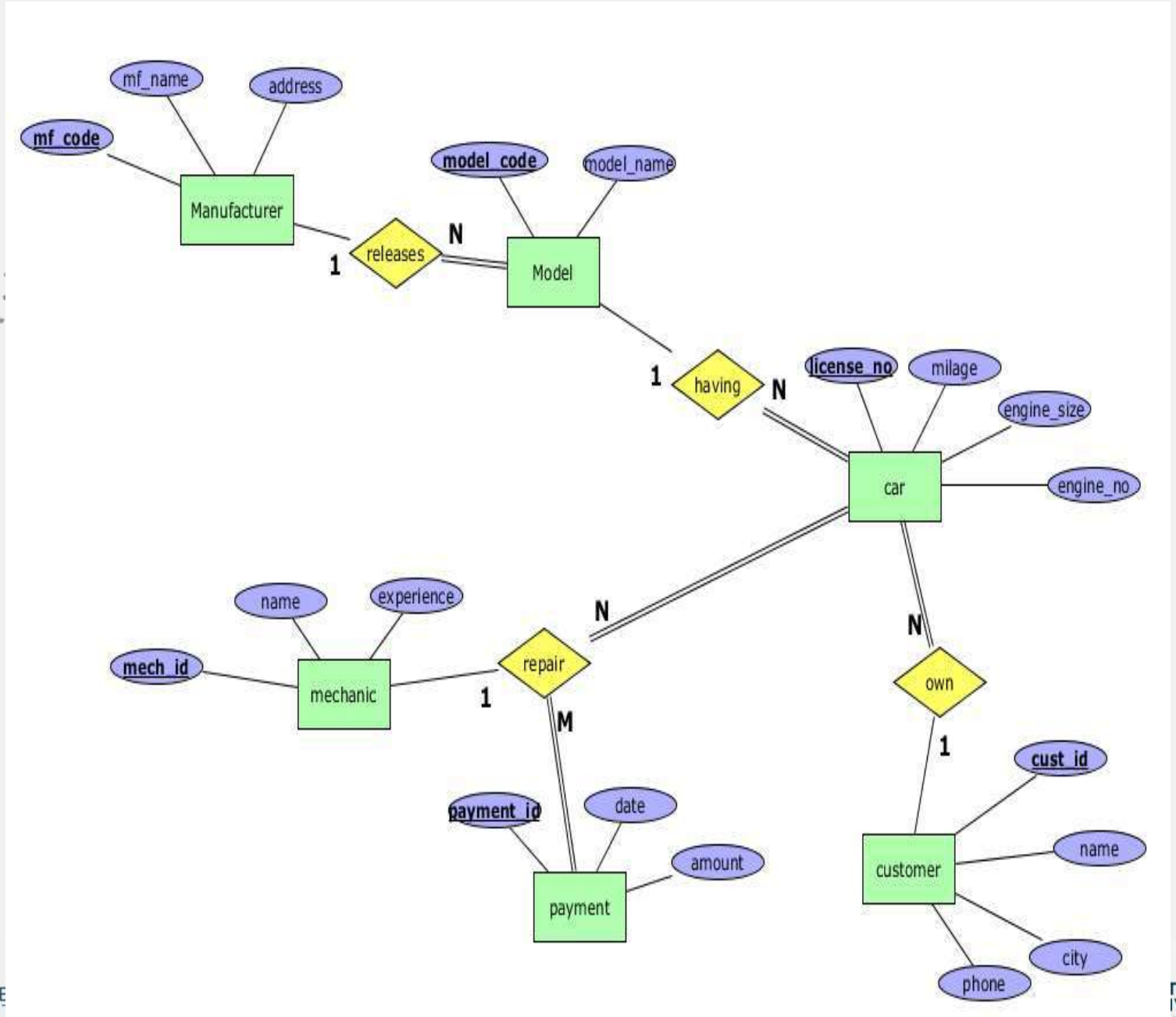

Total Participation of Entity A in R




Cardinality Ratio 1:N for Entity A : B in R

## Exercise- Draw an ER diagram

- A popular car service centre wanted maintain the complete information about their customers and serviced cars. Car manufacturer makes different model cars and sell to various customers. Customer owns one or more cars with same or different companies. Customer approaches XYZ car service centre for repair. Service centre assign a mechanic for the repairs cars belongs to customer. After the service customers will be charged.


mf_name
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1
payment_id
date
amount
payment
cust_id
name
customer
city
phone

# SUMMARY

- Visual aids such as diagrams can help to explain the concepts and illustrate how entities, classes, and relationships are organized in an EER model.
- Additionally, it is important to highlight the potential challenges and limitations of EER modeling, such as the complexity of modeling and the need for specialized software tools.
- By providing a balanced and informative presentation on EER modeling, you can help your audience better understand the benefits and challenges of this advanced approach to database design.

# SELF-ASSESSMENT QUESTIONS

1. What are participation constraints in EER modeling?

(a) Constraints that specify the minimum and maximum number of entities that must participate in a relationship Answer: a.

(b) Constraints that specify the type of relationship between entities

(c) Constraints that specify the uniqueness of values in an attribute

(d) Constraints that specify the order of values in an attribute

2. What is the purpose of disjoint constraints in EER modeling?

(a) To ensure that subclasses do not have overlapping sets of attributes and relationships… Answer: a

(b) To specify the minimum and maximum number of entities that must participate in a relationship

(c) To ensure that entities have unique values in a particular attribute

(d) To specify the type of relationship between entities

# TERMINAL QUESTIONS

1. How does EER modeling extend the original ER model, and what benefits does it offer for database design?
2. What are subclasses and superclasses in EER modeling, and how do they help to organize and classify data?
3. Can you provide an example of how inheritance relationships can be used in EER modeling to simplify and streamline database design?
4. What are multivalued attributes, and how do they differ from other types of attributes in EER modeling?
5. What are participation constraints, and how do they ensure that relationships between entities are correctly defined and maintained?

# REFERENCES FOR FURTHER LEARNING OF THE SESSION

**Reference Books:**

1. "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan.

2. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke.

3. "Fundamentals of Database Systems" by Ramez Elmasri and Shamkant Navathe.

**Sites and Web links:**

1. Stanford Database Course: https://cs.stanford.edu/people/widom/cs145/

2. MIT OpenCourseWare - Database Systems: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/

3. Database Systems Concepts by Silberschatz, Korth and Sudarshan: http://www-db.cs.wisc.edu/courses/cs564-2009a/textbook/

# THANK YOU

(DEEMED TO BE UNIVERSITY)

Team - DBMS