Department of CSE

COURSE NAME: DBMS

COURSE CODE:23AD2102R

Topic: Relationship types, cardinality and cardinality constraints.

Session - 5

AIM OF THE SESSION

To familiarize students with the basic concept of Constraint types and Relationships in Entity Relationship (ER) Diagrams.

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

- Understand that what Constraint types and Relationships used for Data Modelling.
- Compare and evalu chniques.

LEARNING OUTCOMES

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

- Identify the Constraint types and Relationships.
- ER Data Modeling Diagram from Users Problem Description.

INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

Constraints in an Entity-Relationship (ER) model are used to define rules that the data in the database must follow. There are several types of constraints in an ER model, including:

1. Entity Integrity Constraints: Entity integrity constraints ensure that each row or instance in a table represents a unique entity by enforcing primary key constraints. A primary key constraint requires that each entity in a table has a unique identifier that can be used to identify it uniquely.

2. Referential Integrity Constraints: Referential integrity constraints ensure that the relationships between entities are valid by enforcing foreign key constraints. A foreign key constraint requires that each reference to an entity in another table must exist in that table. This means that a foreign key column in one table must match a primary key column in another table.

INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

- Domain Constraints:

Domain constraints specify the allowable values for a column or attribute. For example, a domain constraint can specify that a column can only contain values between 0 and 100 or that a column can only contain alphanumeric characters.

- Check Constraints:

Check constraints specify a condition that must be true for each row in a table. For example, a check constraint can specify that the value of a column must be greater than zero or that the sum of values in two columns must be less than a certain value.

- Business Rules Constraints:

Business rules constraints define the rules that govern the behavior of the organization or business. These constraints are often unique to a particular business and may not be directly related to the database structure.

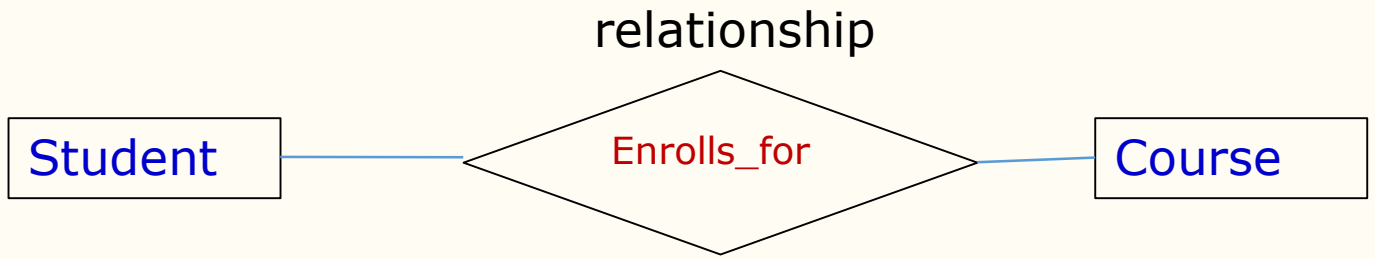
INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

- For example, a business rule constraint can specify that a customer must have a valid credit card to make a purchase.

- Understanding the different types of constraints in an ER model is crucial for ensuring the accuracy and integrity of the data in a database. By enforcing constraints, it is possible to prevent invalid or inconsistent data from being entered into the database, which can help to ensure that the database remains reliable and effective.

Relationship

- The association between entities is called a relationship.

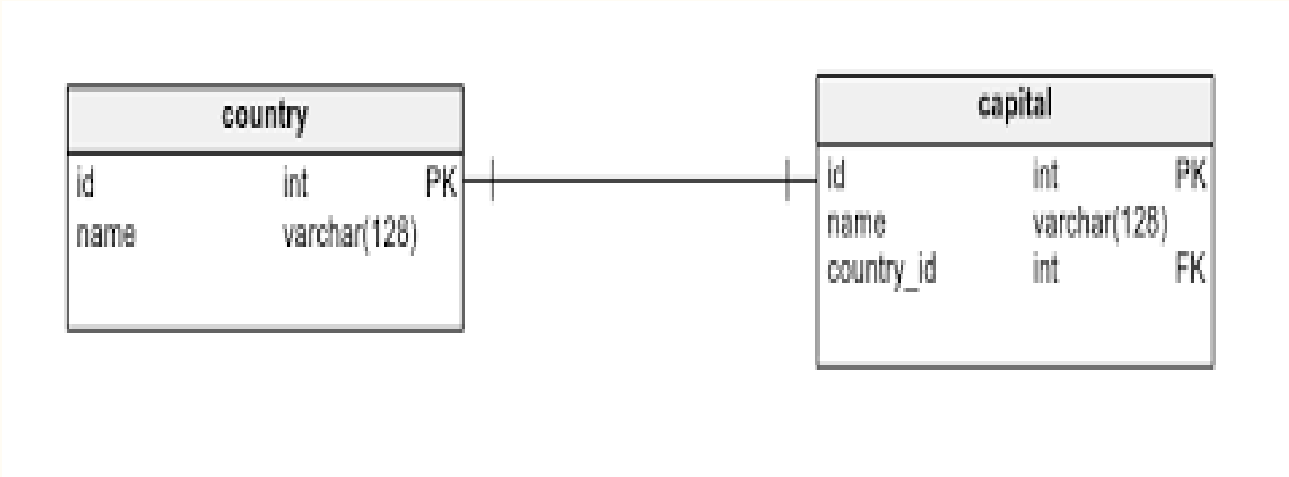


INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

In an Entity-Relationship (ER) model, relations represent the connections or associations between entities. There are three main types of relations in ER models: one-to-one (1:1), one-to-many (1:N), and many-to-many (N:M).

1. One-to-One (1:1) Relation: A one-to-one relation exists when each entity in the first set is related to only one entity in the second set, and vice versa. This type of relationship is not very common in practice but can be used in cases where there is a unique relationship between two entities.

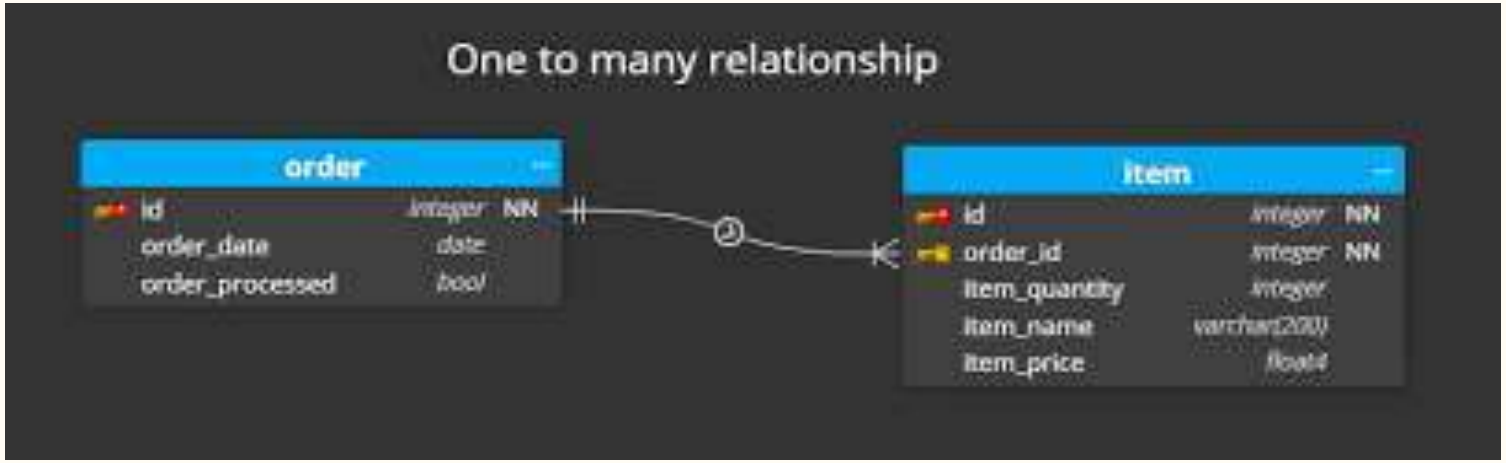
Example:



INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

2. One-to-Many (1:N) Relation: In a one-to-many relation, each entity in the first set can be related to many entities in the second set, but each entity in the second set can only be related to one entity in the first set. This type of relationship is very common in practice, and it is used to model hierarchical structures, such as a customer who can have many orders, but each order belongs to only one customer.

Example:



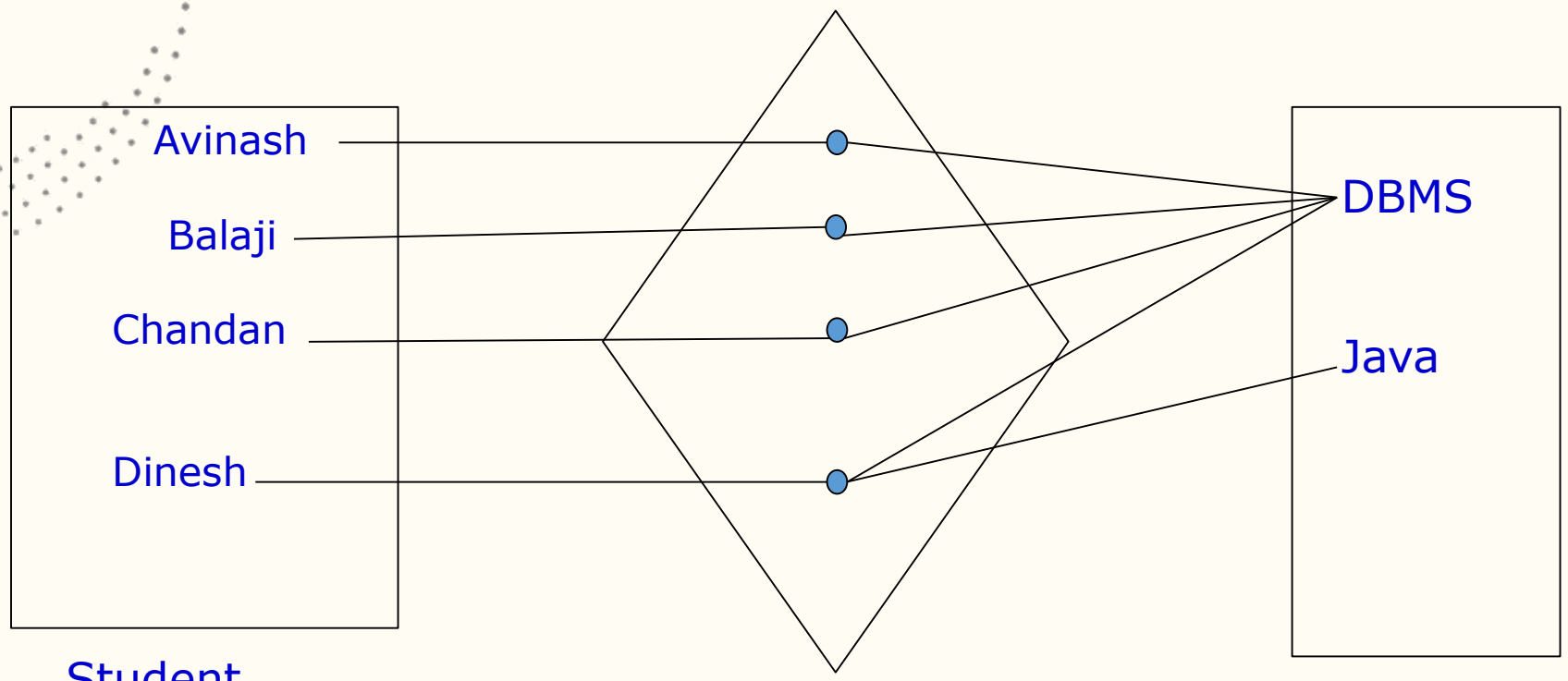
INTRODUCTION TO CONSTRAINTS AND RELATIONSHIP

3. Many-to-Many (N:M) Relation: In a many-to-many relation, each entity in the first set can be related to many entities in the second set, and each entity in the second set can be related to many entities in the first set.

This type of relationship is also common in practice and is used to model complex associations between entities. To represent a many-to-many relation, a bridge or junction entity is required to link the two sets of entities.

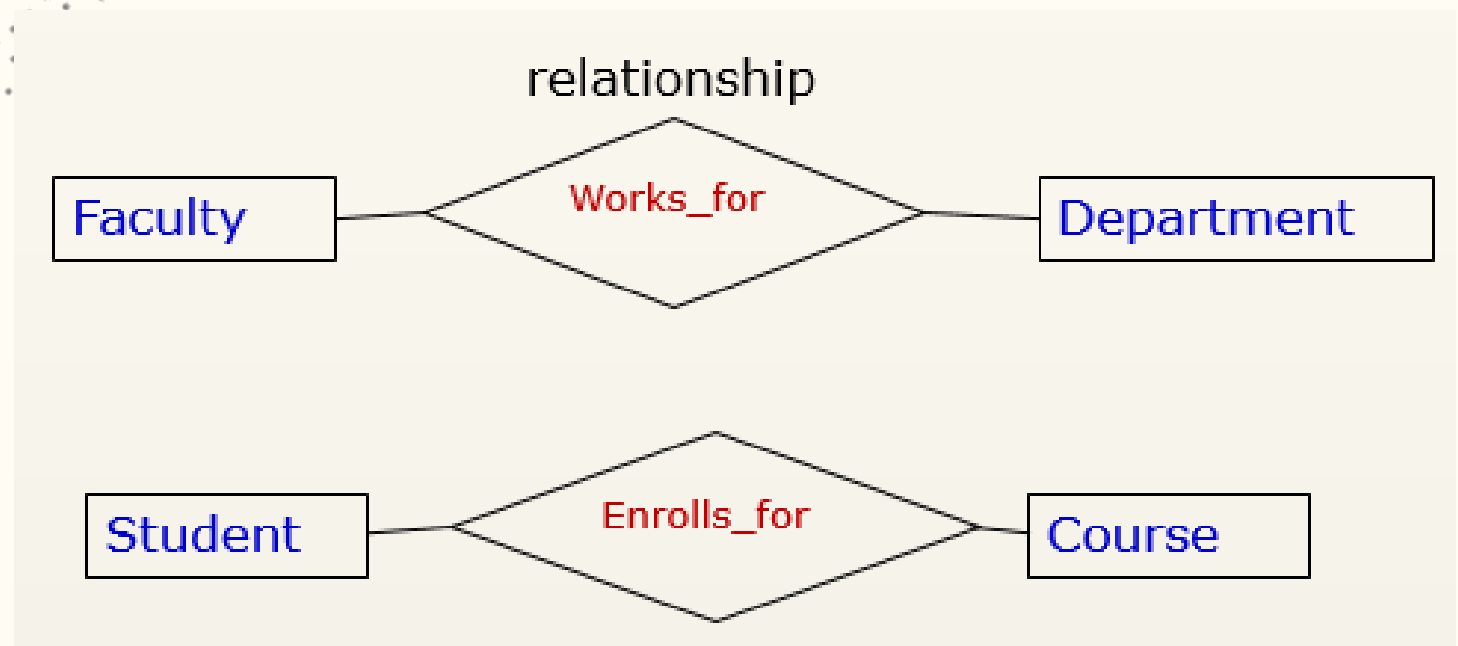
Exampl

RELATIONSHIP - EXAMPLE

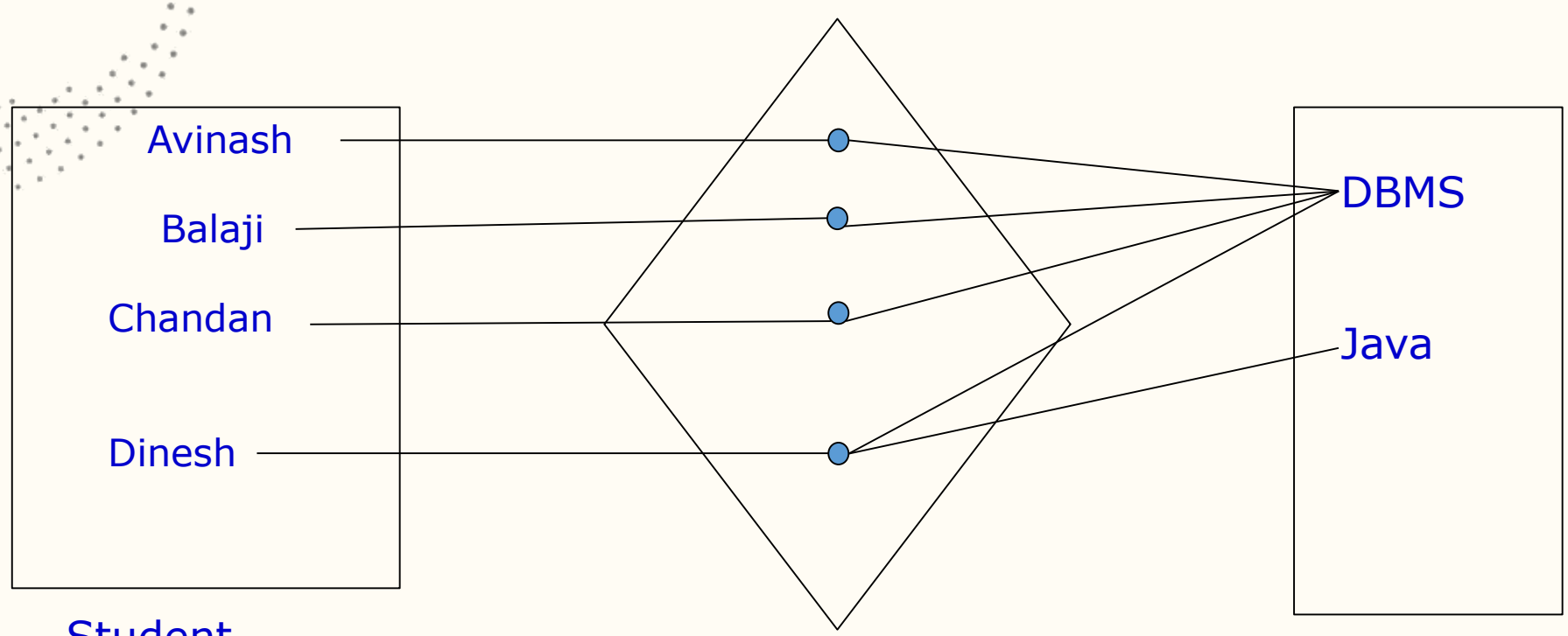


RELATIONSHIP TYPE

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



RELATIONSHIP TYPE - EXAMPLE



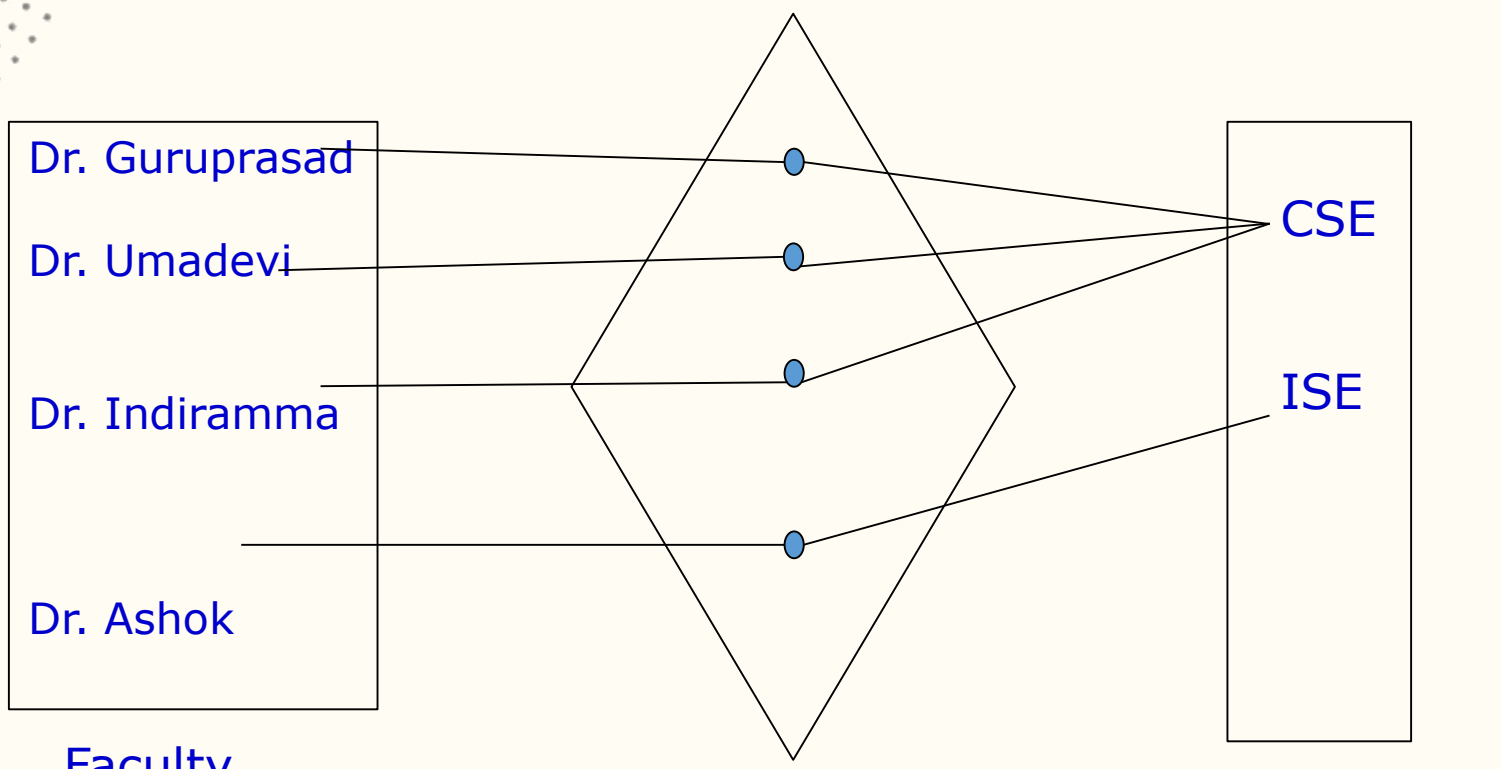
Student
Entity

enrolls_for
relationship

Course
Entity

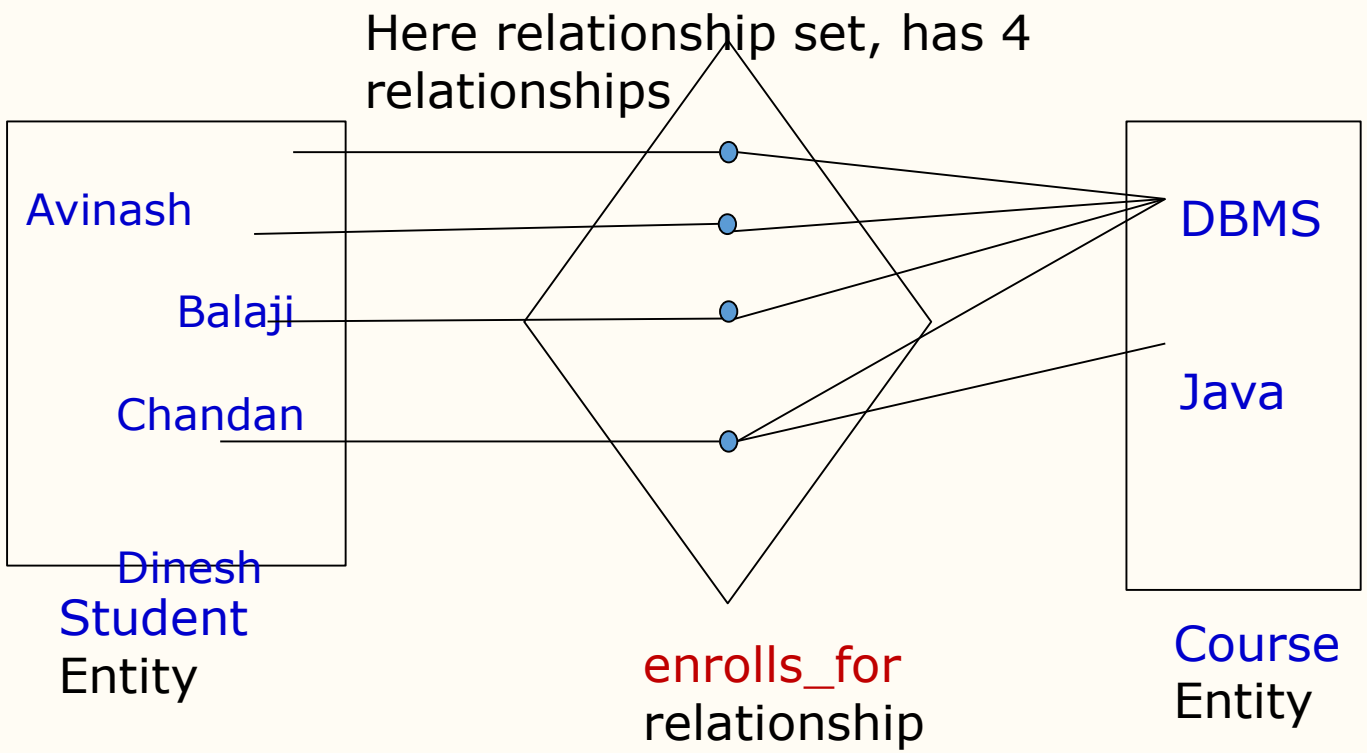
RELATIONSHIP INSTANCE

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



RELATIONSHIP SET

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



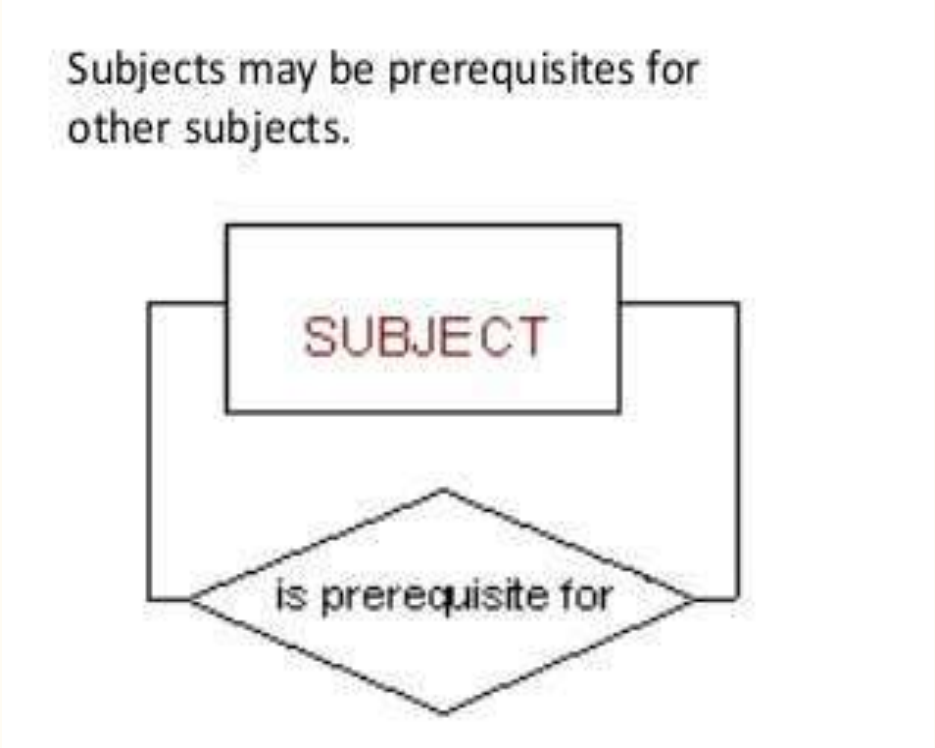
RELATIONSHIP DEGREE

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

- Unary Relationship: Degree One, only one entity is related to the same . Also known as recursive.
- Binary Relationship: Degree Two, Relationship between the two entities.
- Ternary Relationship: Degree Three, three entities are participating in the relationship.

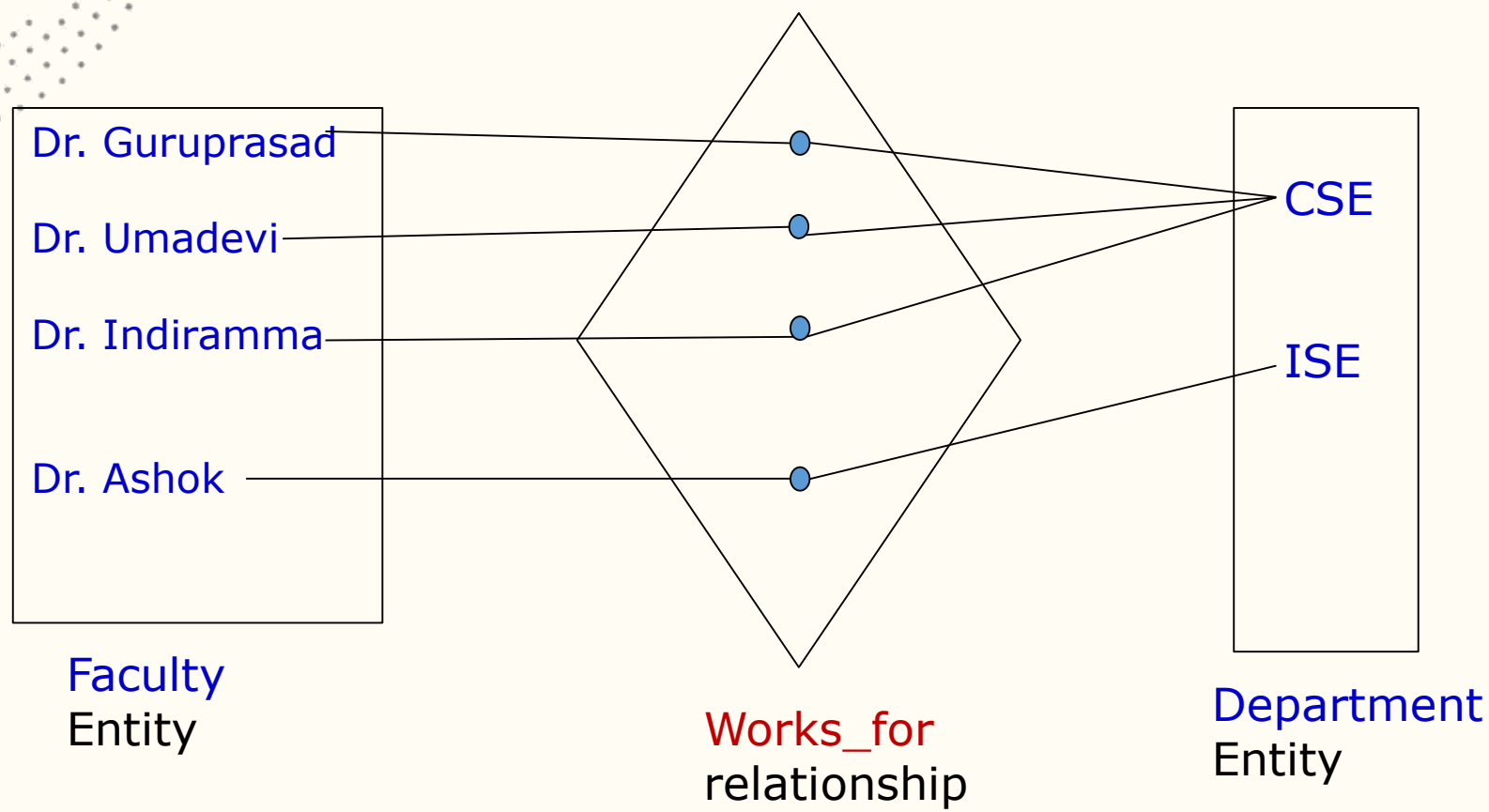
UNARY RELATIONSHIP - EXAMPLE

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



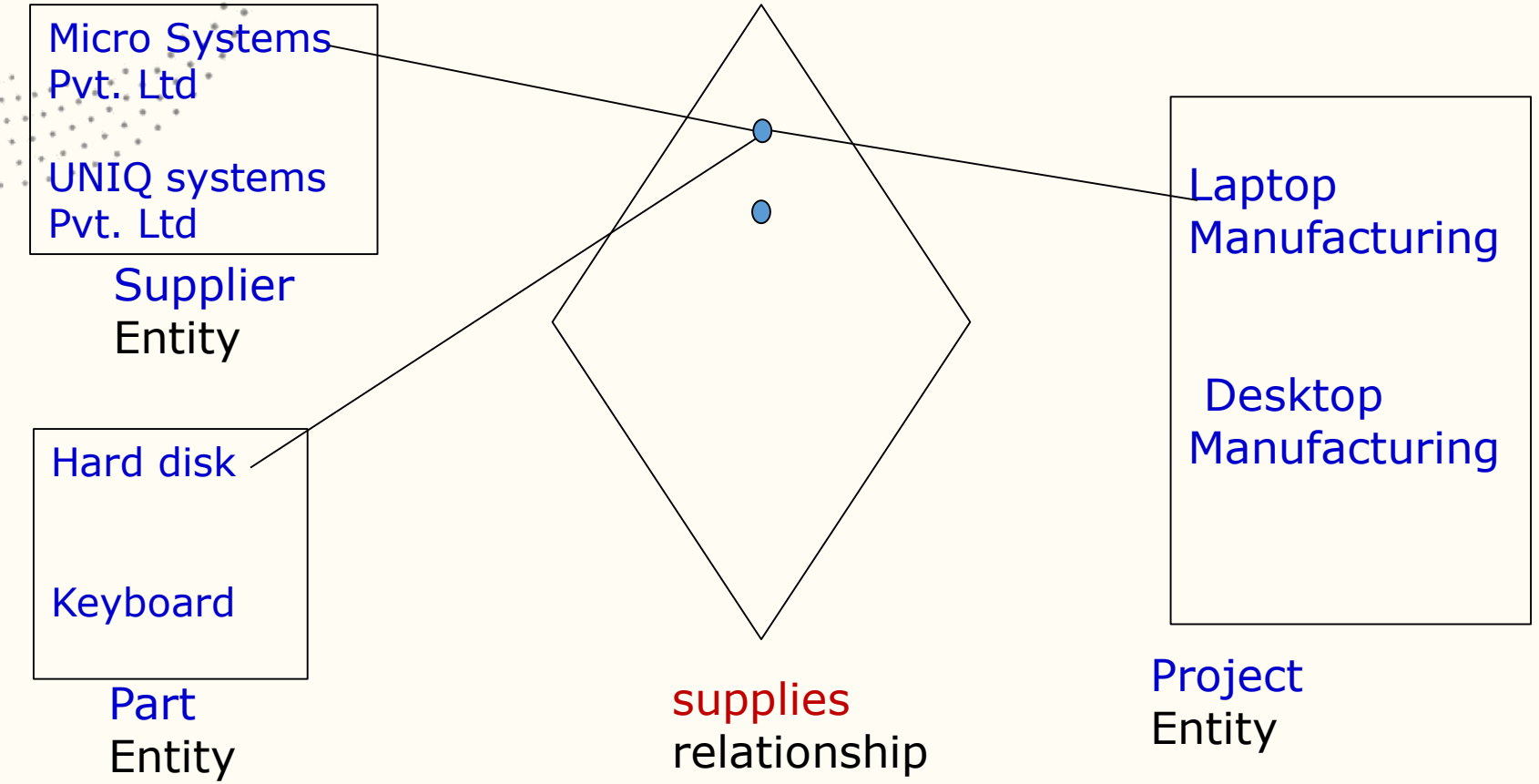
BINARY RELATIONSHIP EXAMPLE

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

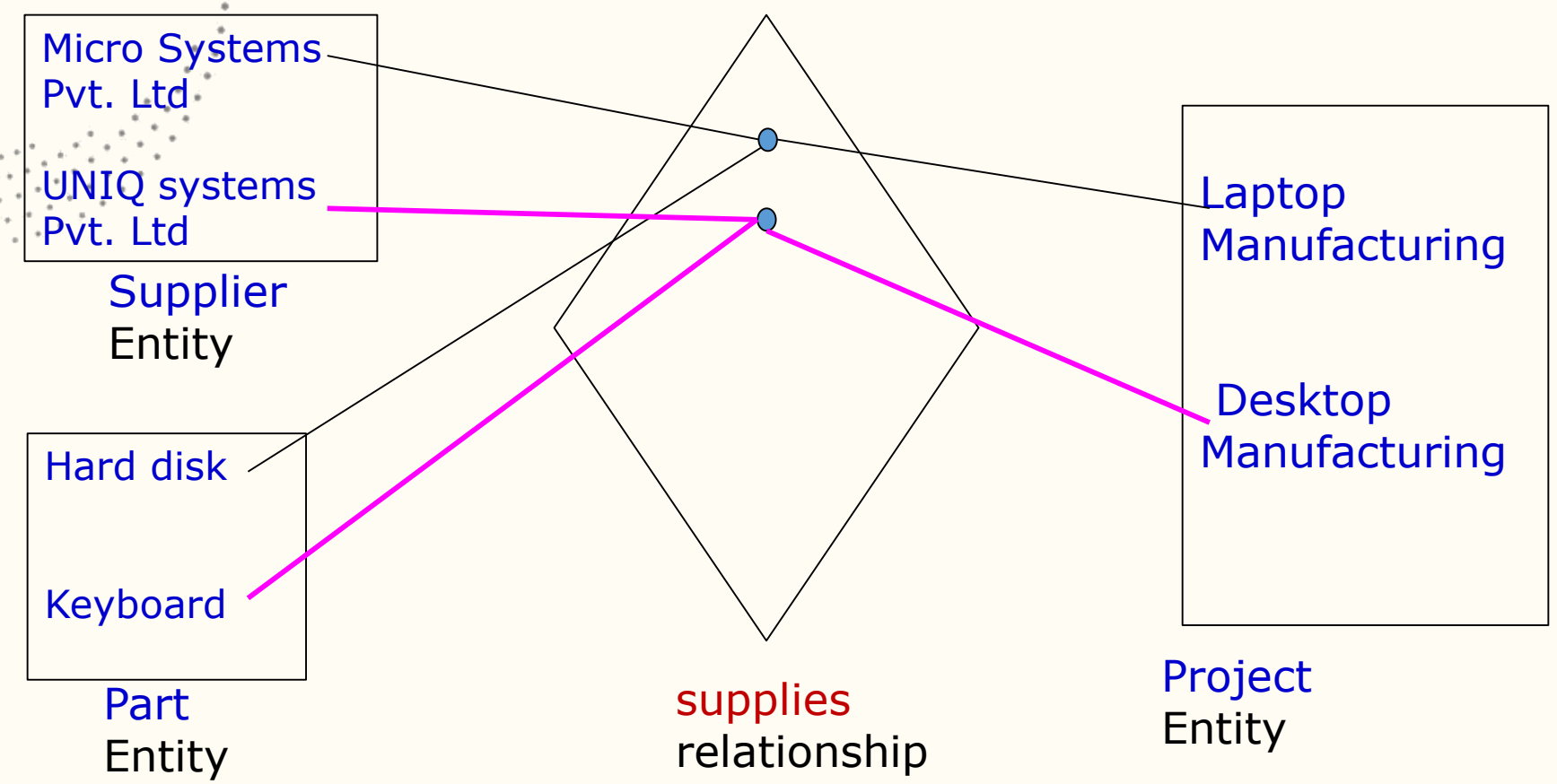


TERNARY RELATIONSHIP - EXAMPLE

- Ternary Relationship: Degree Three, three entities are participating



TERNARY RELATIONSHIP - EXAMPLE



RELATIONSHIP CONSTRATINTS OR STRUCTURAL CONSTRAINTS

Two Types of Relationship Constraints

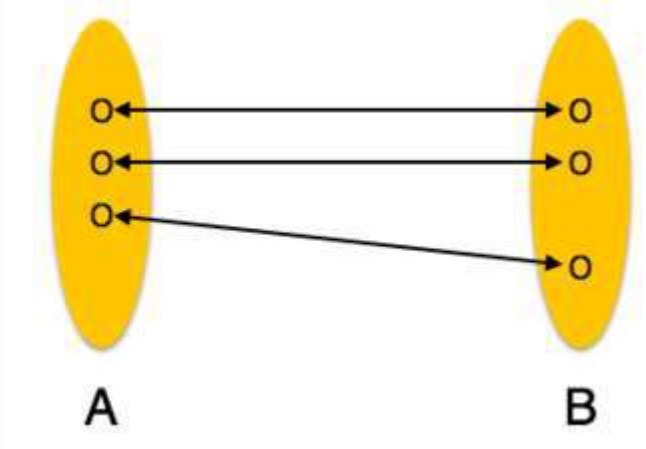
1. **Cardinality Ratios**
   a. One to one (1:1)
   b. One to Many (1:M)
   c. Many to Many (N:M)
2. **Participation Constraints**
   a. Total
   b. Partial

CARDINALITY RATIOS

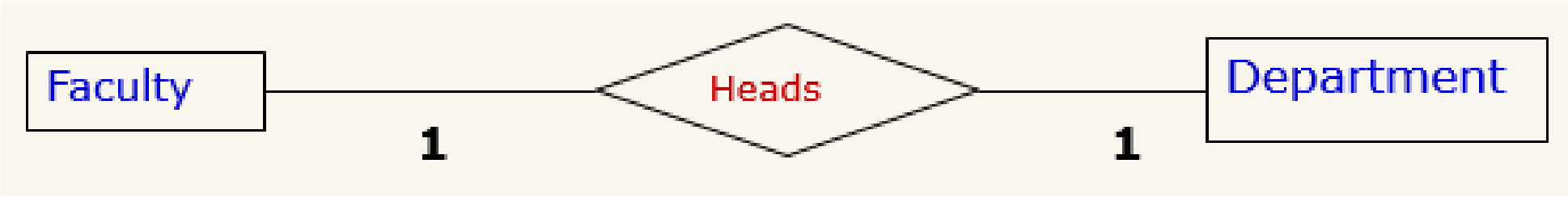
- Cardinality is a constraint on a relationship specifying the number of entity instances that a specific entity may be related to via the relationship.

One to One:

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

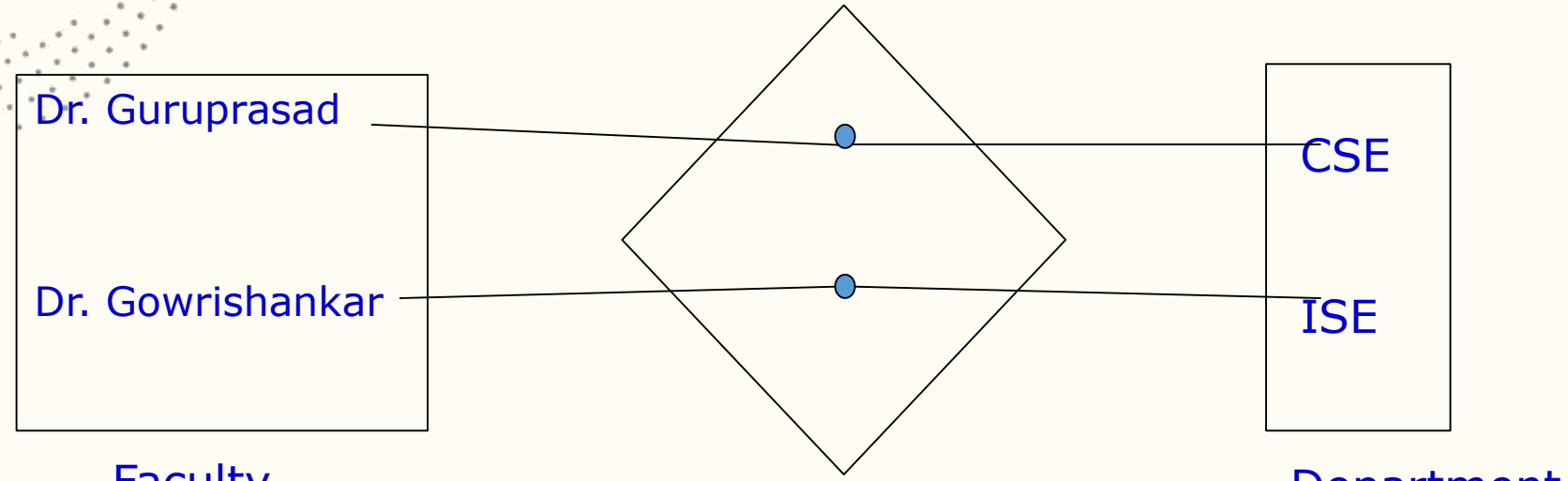


CARDINALITY – ONE TO ONE



CARDINALITY RATIOS

Example:



Faculty
Entity

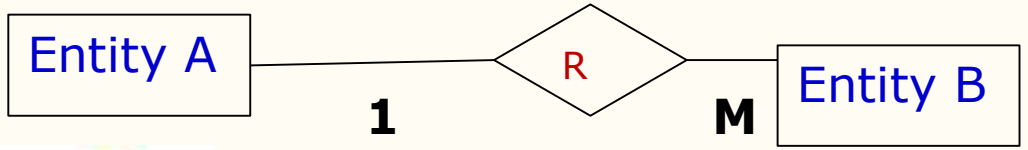
Heads
relationship

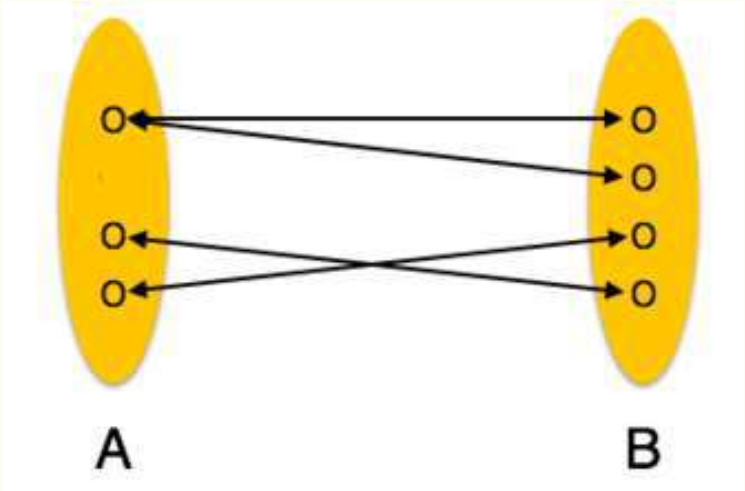
Department
Entity

CARDINALTY RATIOS: ONE TO MANY

One to Many:

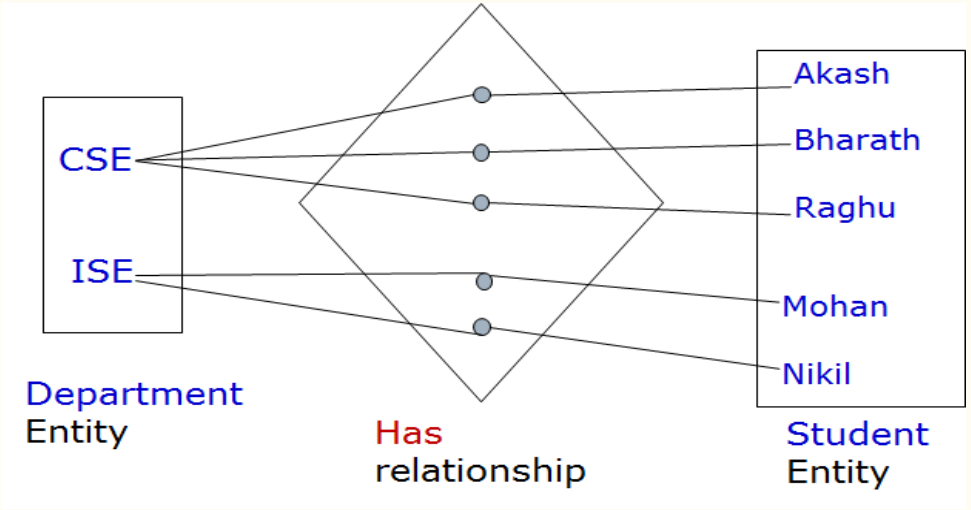
One entity from entity set A can be associated with more than one entities of entity set B however an entity from entity set B, can be associated with at most one entity.





CARDINALITY: ONE TO MANY

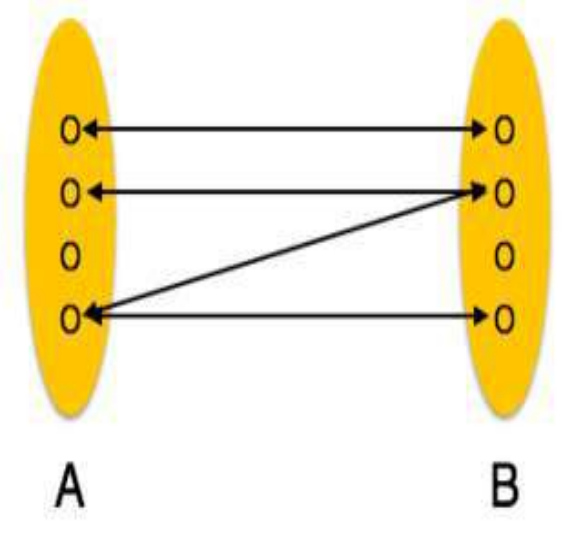
Example:

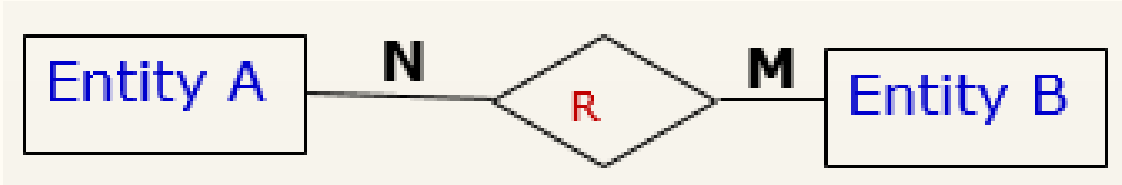


CARDINALITY: MANY TO MANY

Many to Many:

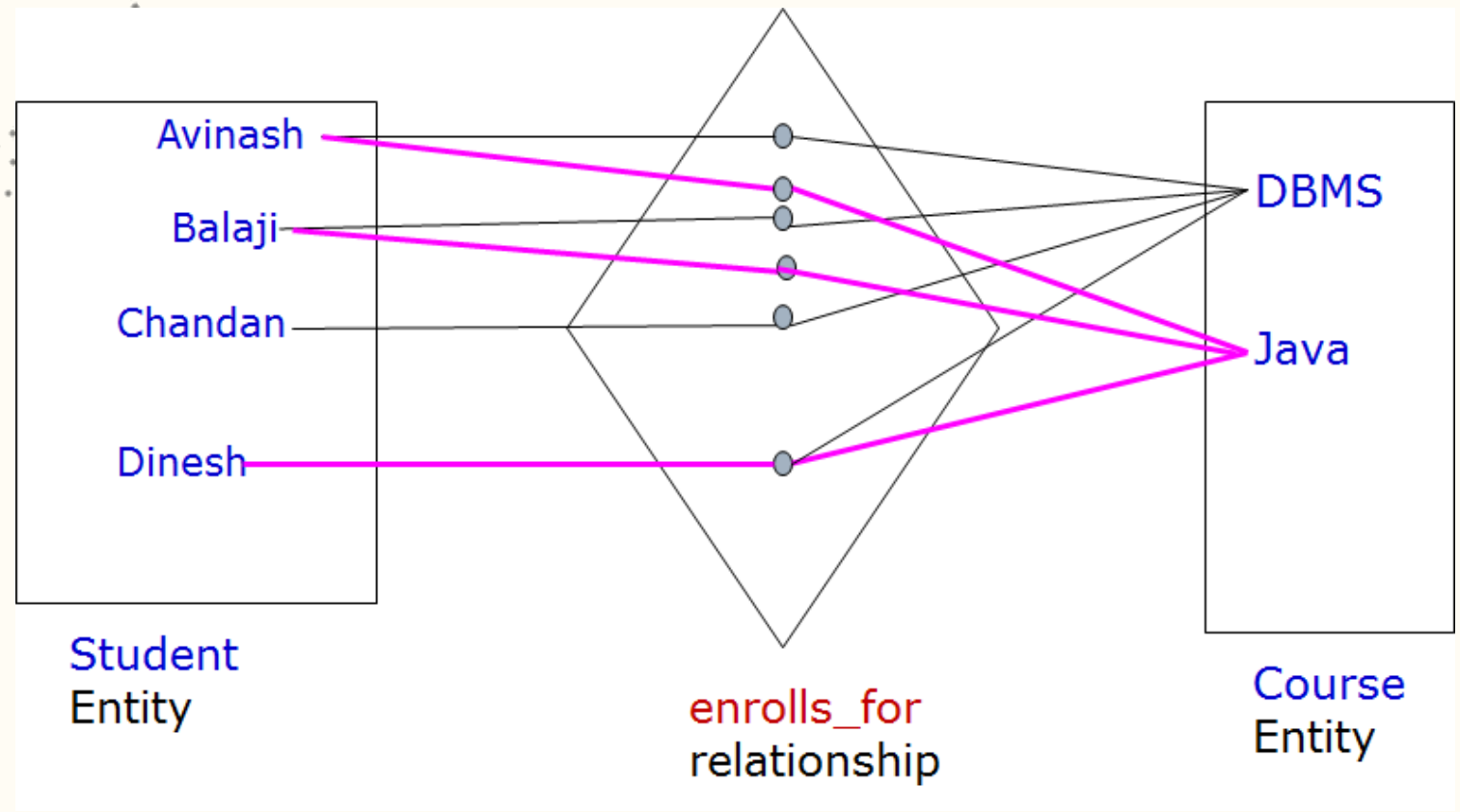
One entity from A can be associated with more than one entity from B and vice versa.





CADINALITY: MANY TO MANY

Example:

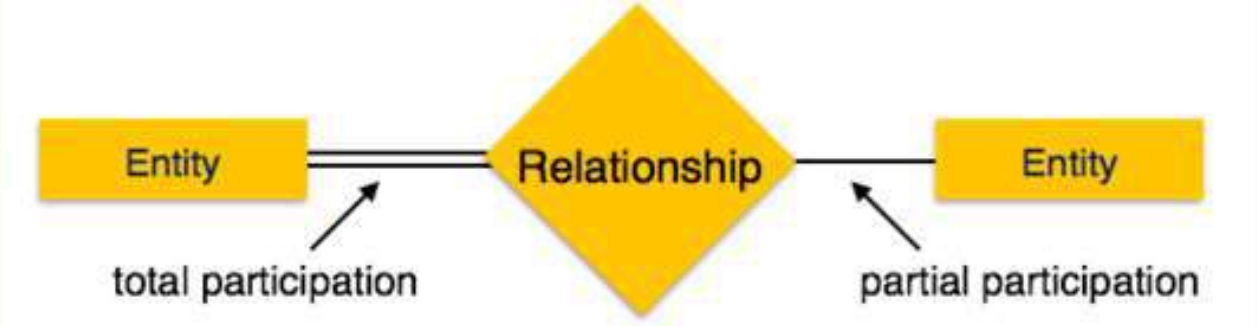


PARTICIPATION CONSTRAINT

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

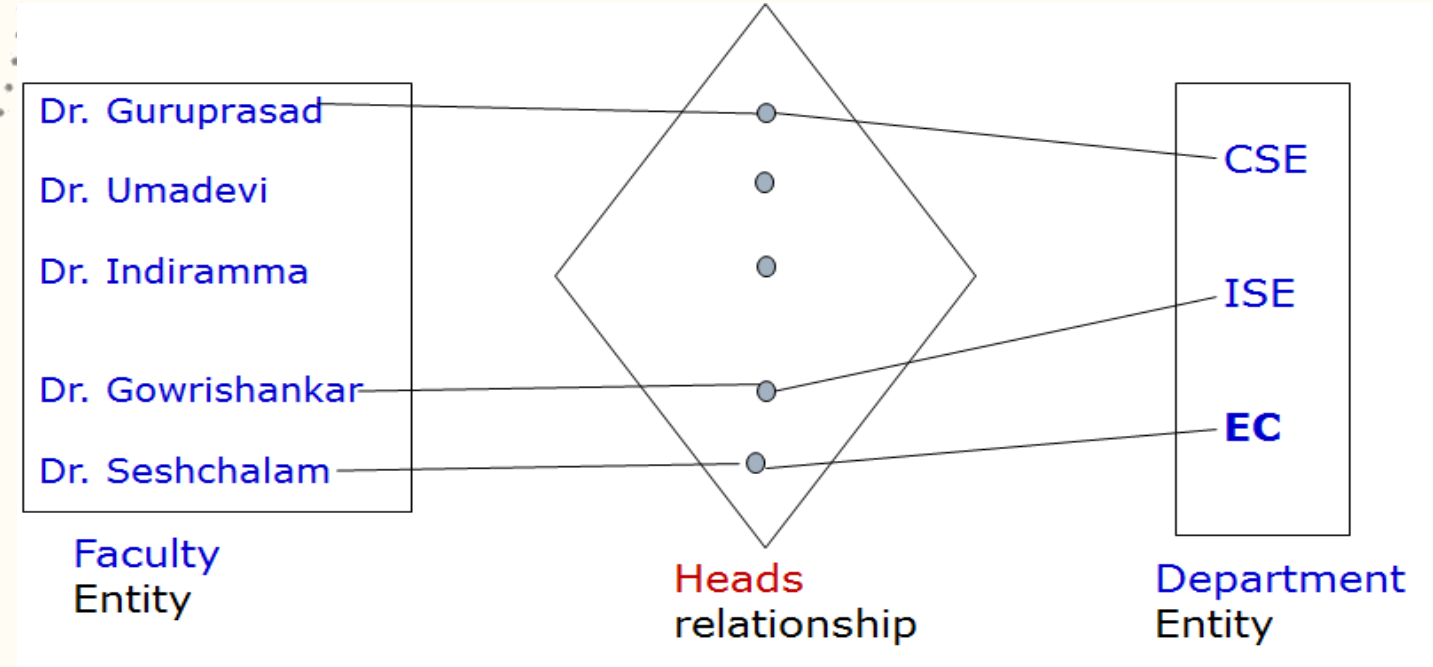
- **Total Participation** – Each entity is involved in the relationship. Total participation is represented by double lines.

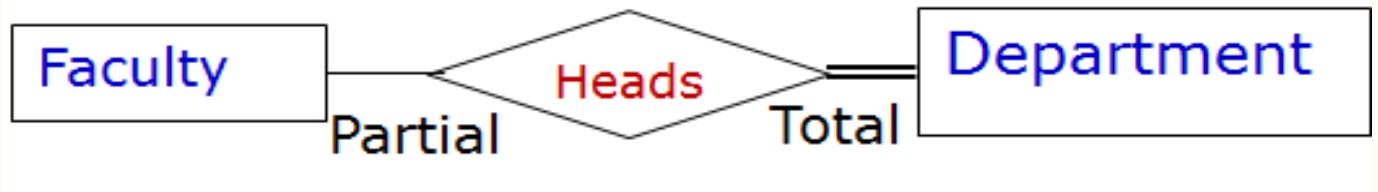
- **Partial participation** – Not all entities are involved in the relationship. Partial participation is represented by single lines.



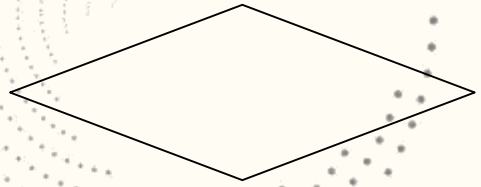
PARTICIPATION CONSTRAINT

Example:

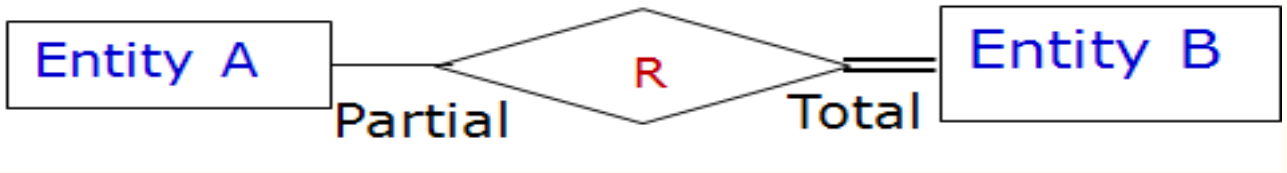




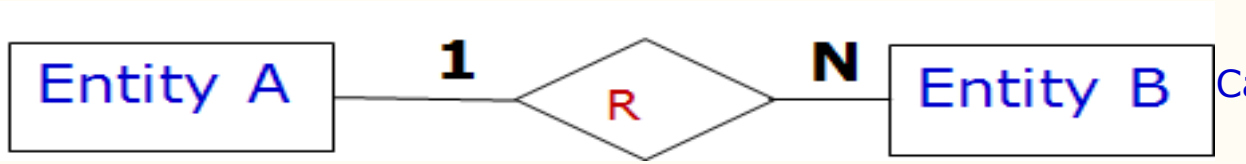
ER DIAGRAM SYMBOLS



Relationship



Total Participation of Entity A in R

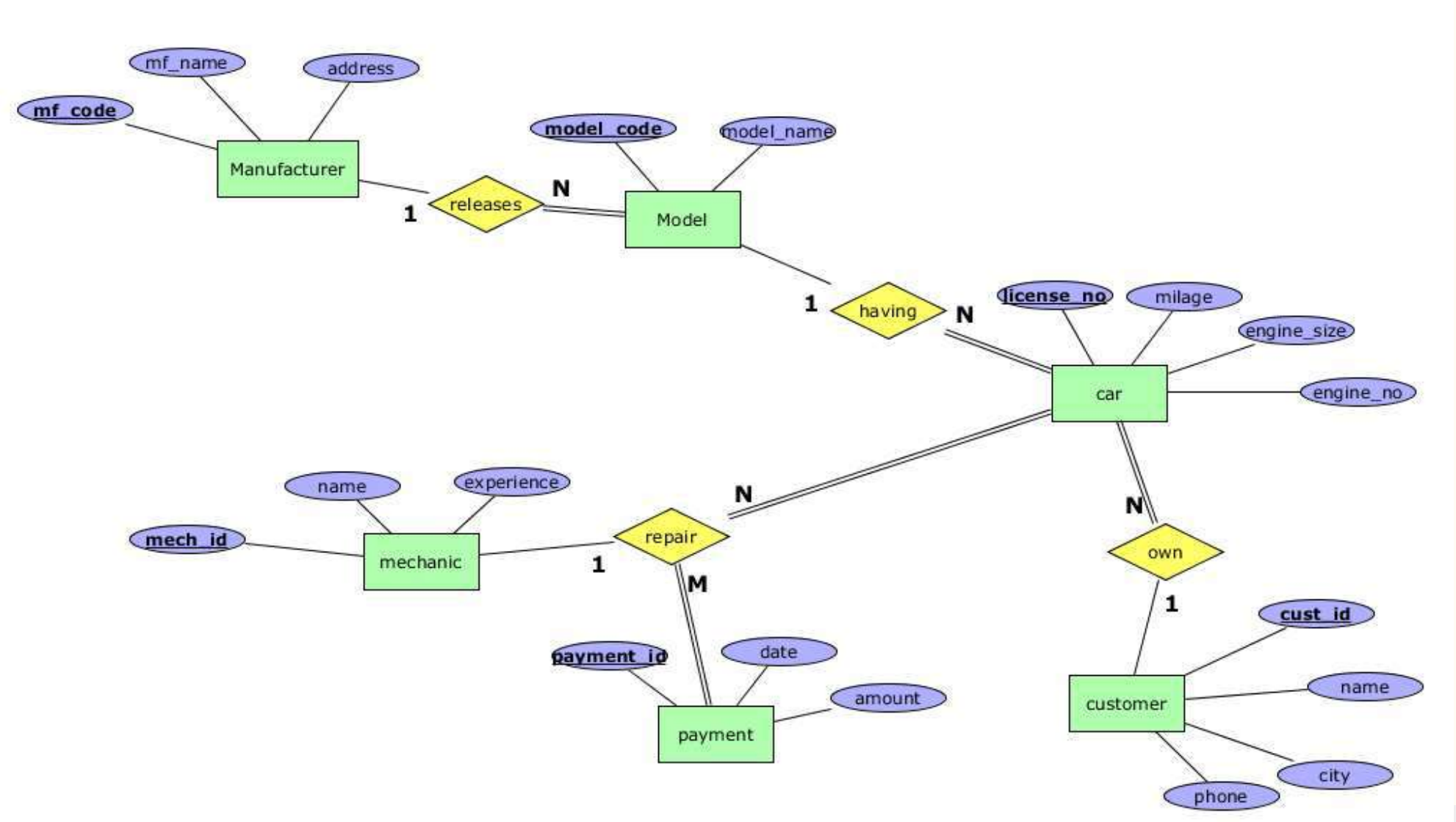


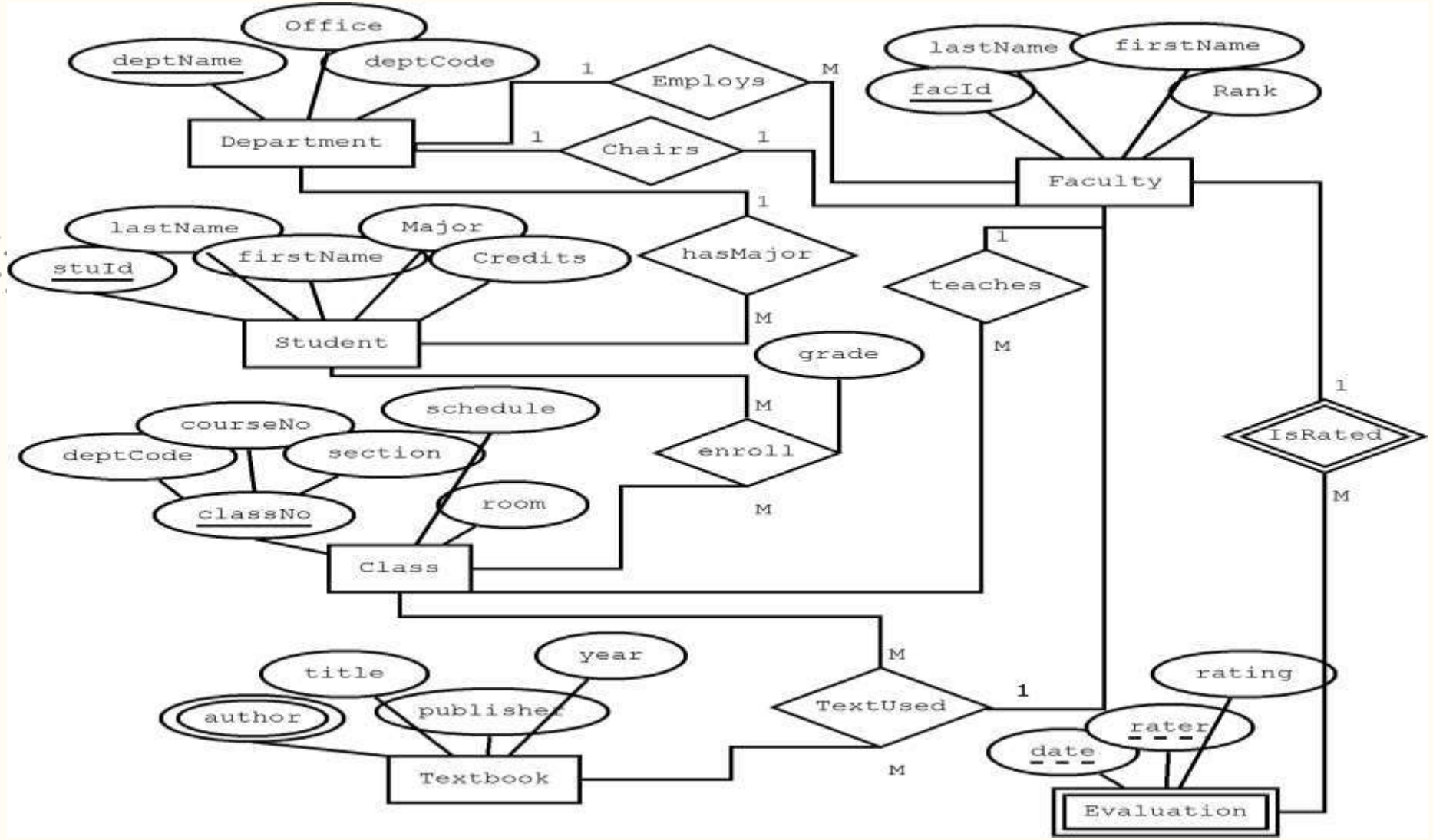
Cardinality Ratio 1:N for Entity A : B in R

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.

ER diagram- Answer




Office
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SUMMARY

- In an Entity-Relationship (ER) model, constraints and relationships are both used to define the rules and connections between entities in a database.
- The main constraint types in an ER model include entity integrity, referential integrity, domain, check, and business rules constraints.
- Entity integrity and referential integrity constraints ensure that each row or instance in a table represents a unique entity and that the relationships between entities are valid, respectively.
- Domain constraints specify the allowable values for a column, while check constraints specify a condition that must be true for each row in a table.
- Business rules constraints define the rules that govern the behavior of the organization or business.

SUMMARY (Contd..)

- ER modeling is used to ensure that data is stored in a consistent and structured manner, which makes it easier to maintain and query the database.
- The process of ER modeling involves identifying entities and their attributes, determining relationships between entities, and creating the ERD.
- ER modeling helps to identify potential data redundancies, inconsistencies, and other data-related issues.
- ER modeling is a widely used technique in database design and is essential for developing complex database systems.
- ER modeling is an iterative process, meaning that the ERD can be refined and updated as the requirements of the database change.

SUMMARY (Contd…)

- The main relationship types in an ER model include one-to-one, one-to-many, and many-to-many relationships. In a one-to-one relationship, each entity in the first set is related to only one entity in the second set, and vice versa.
- In a one-to-many relationship, each entity in the first set can be related to many entities in the second set, but each entity in the second set can only be related to one entity in the first set.
- In a many-to-many relationship, each entity in the first set can be related to many entities in the second set, and each entity in the second set can be related to many entities in the first set. To represent a many-to-many relationship, a bridge or junction entity is required to link the two sets of entities.
- Overall, constraints and relationships in an ER model work together to ensure that the data in a database is accurate, consistent, and effective.

SELF-ASSESSMENT QUESTIONS

1. Which of the following constraint types ensures that each row or instance in a table represents a unique entity?

(a) Referential integrity constraint

(b) Check constraint

(c) Entity integrity constraint Answer : C

(d) Business rule constraint

2. In an ER model, which of the following relationship types requires a bridge or junction entity to link the two sets of entities?

(a) One-to-one relationship

(b) One-to-many relationship

(c) Many-to-many relationship Answer : C

(d) None of the above.

TERMINAL QUESTIONS

1. **Explain the difference between entity integrity and referential integrity constraints in an ER model. Provide an example of each type of constraint.**

2. **Discuss the importance of domain constraints in an ER model. How do domain constraints help to ensure the accuracy and consistency of data in a database? Provide an example of a domain constraint.**

3. **Describe the different types of relationships in an ER model, including one-to-one, one-to-many, and many-to-many relationships. When would you use each type of relationship, and how do they affect the structure and organization of the database?**

4. **Explain the role of check constraints in an ER model. How can check constraints help to ensure that data in a database is accurate and consistent? Provide an example of a check constraint.**

5. **Discuss the importance of business rules constraints in an ER model. How do business rules constraints help to ensure that the database supports the needs and goals of the organization or business? Provide an example of a business rule constraint.**

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

Team - DBMS