CAB
Modern Approach of Database

Prepared by:
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Learning Objectives

- How to design a database using the modern approach.
- Meaning of Entity Relationship (ER) Model.
- Elements of ER-Model in detail.
- Types of Relationships in DBMS with examples.
- Degree of Relationship in DBMS with examples.
- Meaning of Specialization.

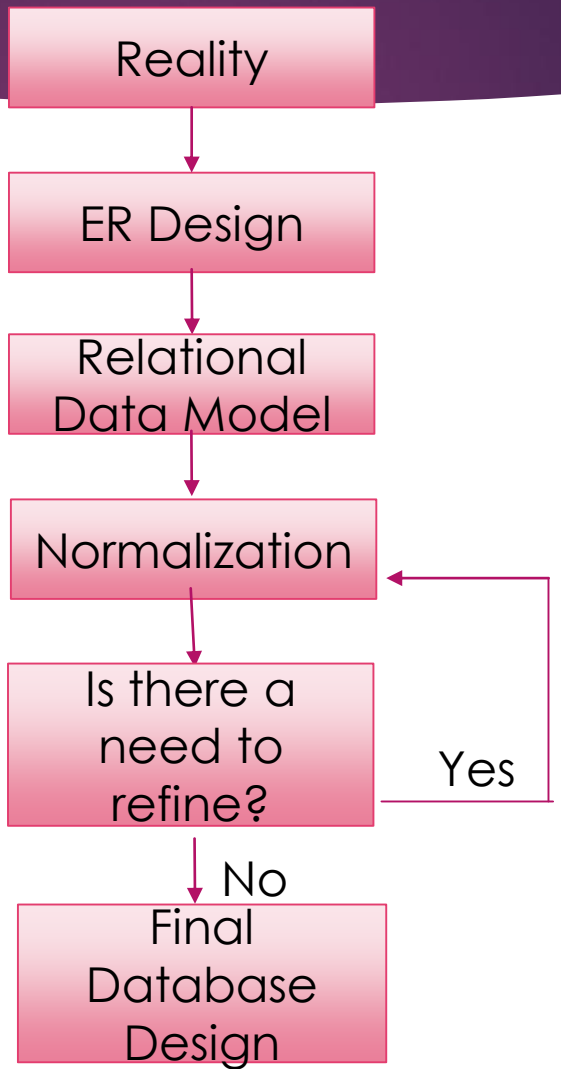
Learning Objectives (Contd.)

- Understanding the concept of Relational Data Model
- Components of RDBMS.
- Properties of Relational Tables.
- Creating Relationship between Tables with examples.

Designing a database

- Database design is a process of producing detailed data model of a database.
- A database design is a **logical design** of base data structure developed for the purpose of storing data.
- The designer determines what data must be stored and how the data elements interrelate.
- Database design involves classifying data and identifying interrelationships. This theoretical representation of the data is called an **ontology**.

Database designing process



Entity Relationship (ER) Model

- An ER Model is a data model that is used to design relational databases.
- It's main component is ER-diagram which creates graphical representation of the entities and the relationship between them.
- It is easy to transform ER-diagrams to relational data models.

Elements of ER-Model

- An ER diagram has three main components:

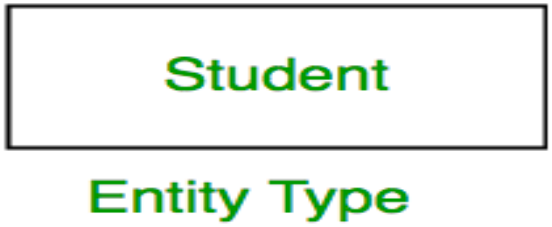
1. Entity
2. Attribute
3. Relationship

Entity

- An entity is a person, place, object, event or concept in the user environment.
- It is equivalent to a database table.
- It is represented in a rectangular shape which may have a number of attributes.
- Weak Entity is an entity that cannot be uniquely identified by its own attributes and relies on the relationship with other entity.
- The weak entity is represented by a double rectangle.

Entity

Example: In a database there can be an entity (table) named student.



Attribute

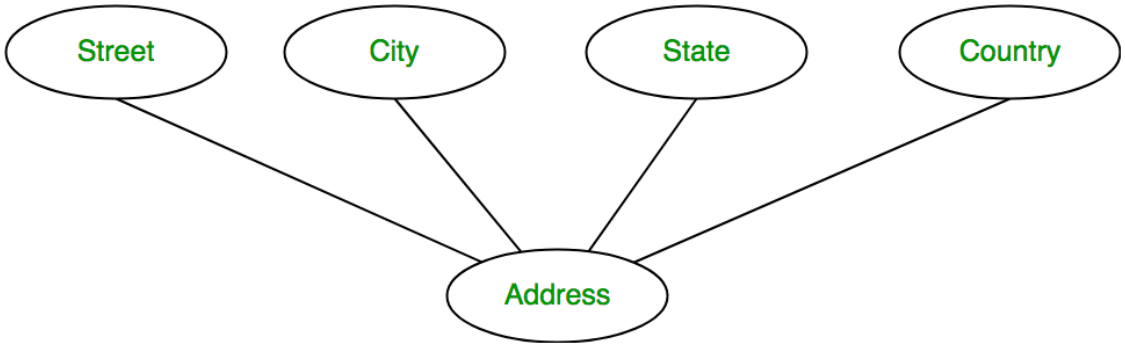
- Attributes are the properties which define the entity type.
- For example, Roll_No, Name, DOB, Age, Address, Mobile_No are the attributes which defines entity type Student.
- In ER diagram, attribute is represented by an oval as shown below.

Key Attribute

- The attribute which uniquely identifies each entity in the entity set is called key attribute.
- For example, Roll_No will be unique for each student.
- In ER diagram, key attribute is represented by an oval with underlying line as shown below.

Composite Attribute

- An attribute composed of many other attribute is called as composite attribute.
- For example, Address attribute of student Entity type consists of Street, City, State, and Country as shown below.



Multivalued Attribute

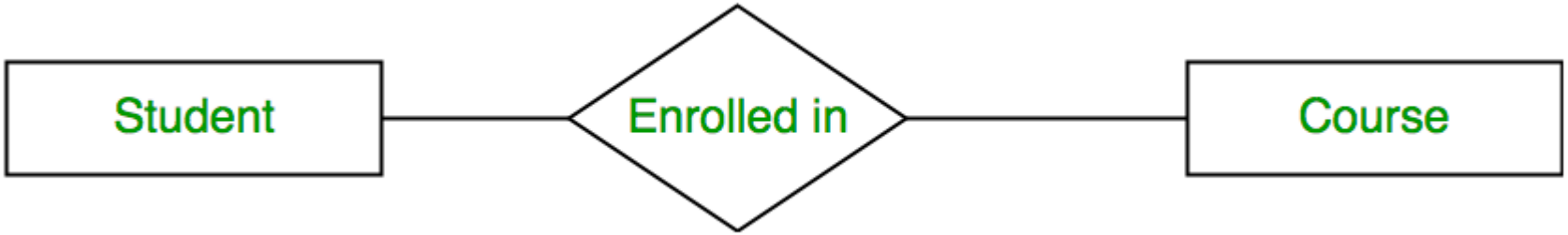
- An attribute consisting more than one value for a given entity.
- For example, Phone_No (can be more than one for a given student).
- In ER diagram, multivalued attribute is represented by double oval as shown below.

Derived Attribute

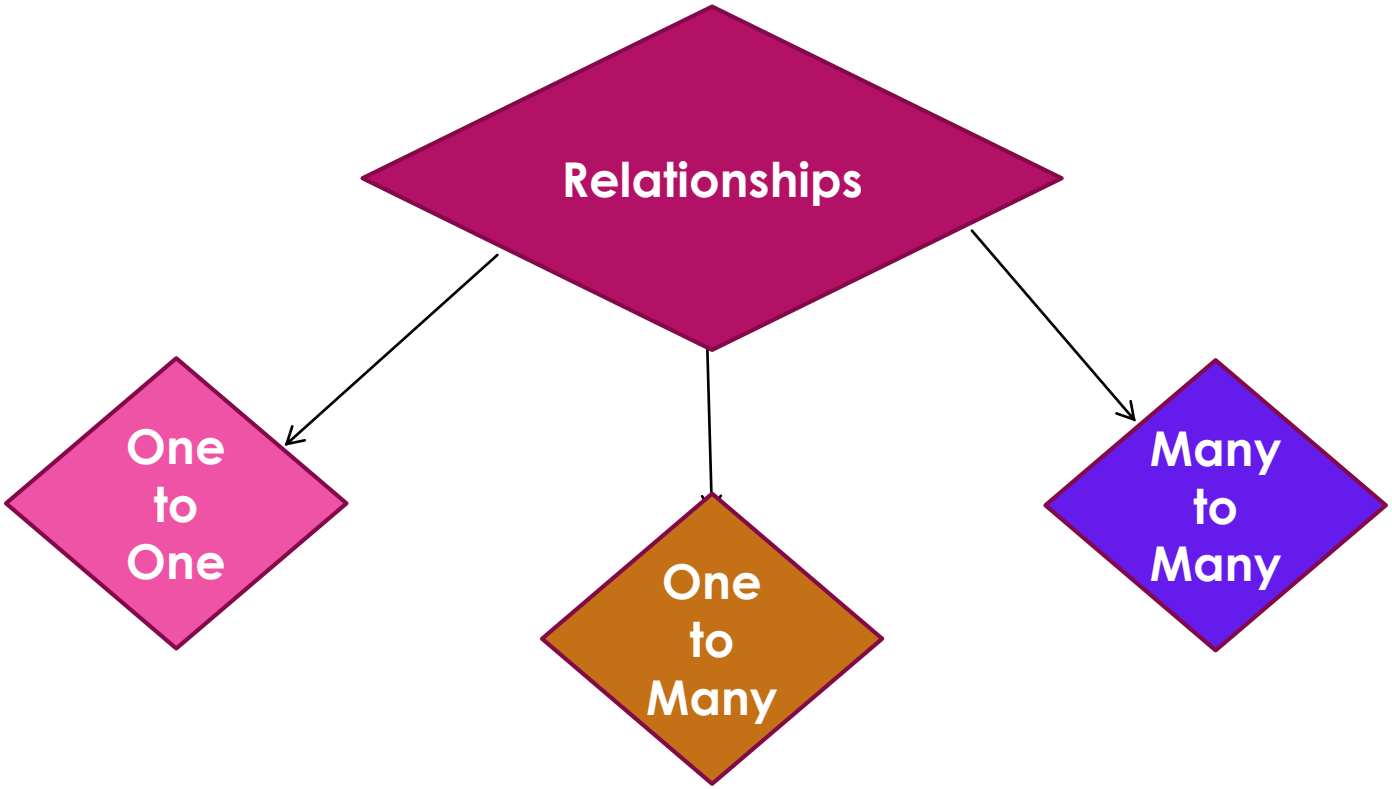
- An attribute which can be derived from other attributes of the entity type is known as derived attribute.
- E.g.; HRA and DA are derived attributes for calculation of salary of an employee or Age can be derived from DOB.
- In ER diagram, derived attribute is represented by dashed oval as shown below.

Relationship

- A relationship represents the association between entity types.
- For example, 'Enrolled in' is a relationship type that exists between entity type Student and Course.
- In ER diagram, relationship type is represented by a diamond and connects the entities with lines as shown below.



Types of relationships



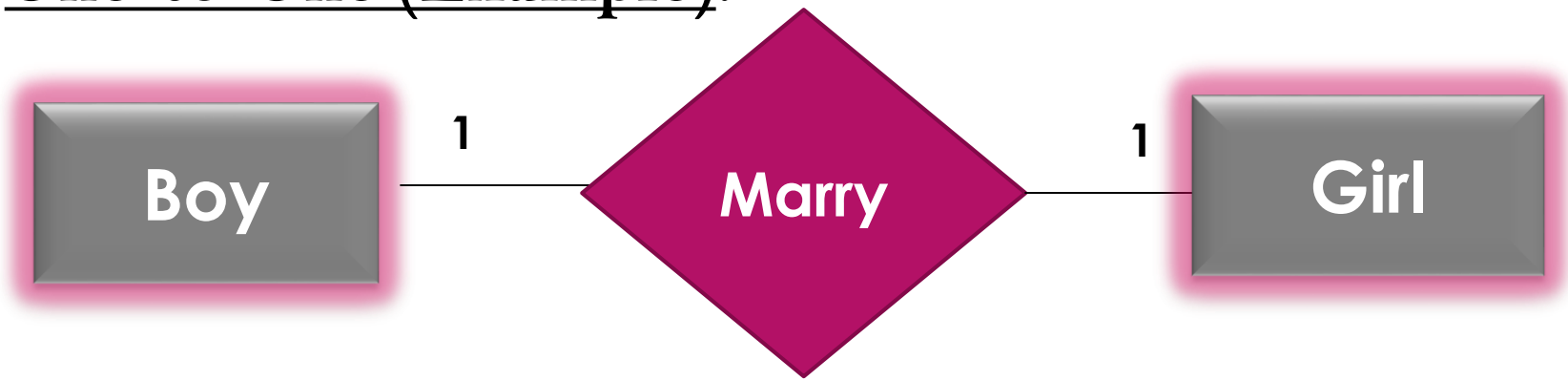
Types of relationships

- **One-to-One:**

- For every row of entity 1 there is only one corresponding row of entity 2.
- It is represented as (1:1).
- Eg. Two entities – boy and girl. Assuming that one boy will marry only one girl and vice versa then the relationship can be represented as in the next slide.

Types of relationships

- **One-to-One (Example):**

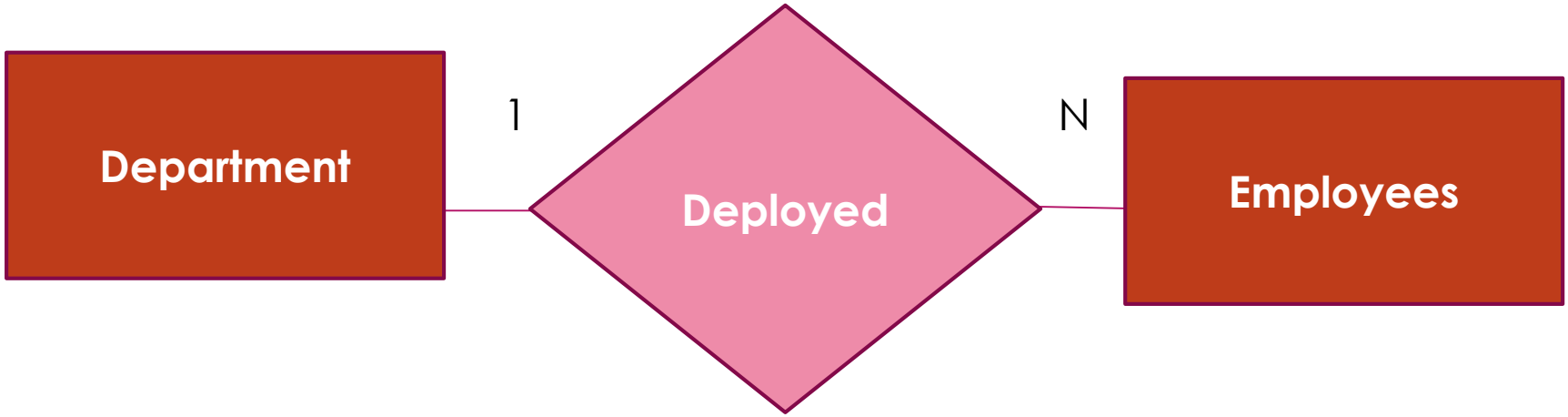


Types of relationships

2. One-to-Many:

- For every row of entity 1 there exists zero, one or many rows of entity 2.
- It is represented as (1: N).
- Eg. A single department consists of a large number of employees. This can be represented as shown in next slide.

One-to-Many (Example) :



Types of relationships

3. <u>Many-to-Many</u>:

- For every row of entity 1 there exists many rows of entity 2 and vice versa.
- It is represented by (M:N)
- They cannot be modelled directly and have to be broken into multiple one-to-many relationships.
- Eg. The relationship between the students of a college and the subjects.

Many-to-Many (Example):

Degrees of Relationship

Unary relationship

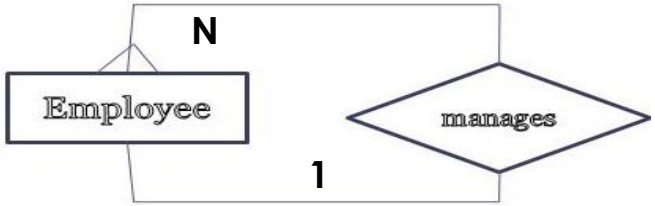
Binary relationship

Ternary relationship

Unary Relationship

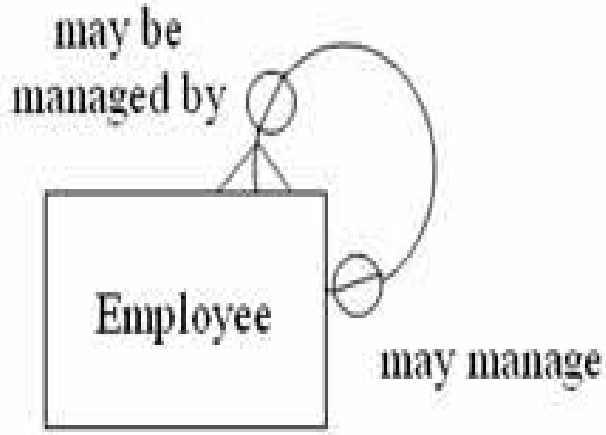
A relationship between the instances of a single entity type.

For example-If we take an entity 'employees' and wish to represent the relationship between employee and its manager, there exists a unary relationship as one employee cannot work under many managers but a manager can manage many other employees.



Unary Relationship (Contd.)

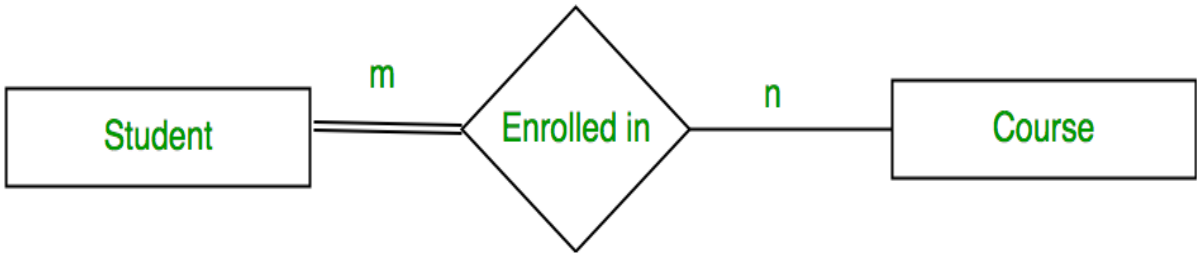
- In such relationships, only single entity participates.
- It is also called recursive relationship as shown below.



Binary Relationship

Binary relationship is a relationship between two entities.

For example- many students being enrolled in a single course. Here, “students” and ''course'' are two separate entities.

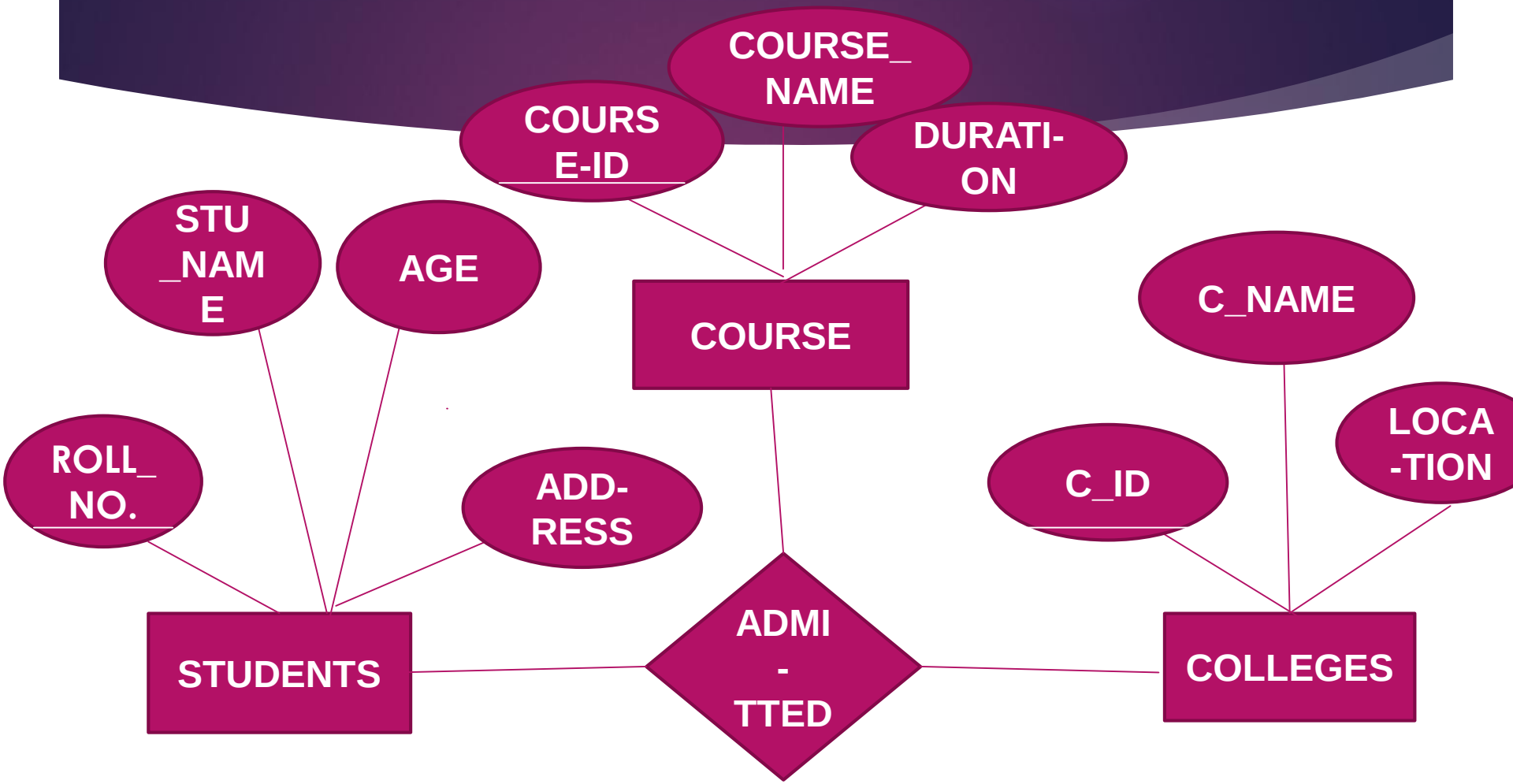


Ternary Relationship

- When three entities participate in a relationship, there exists ternary relationship.
- **Example:**

▶ In a university students (roll no, name, age, address) are admitted to different colleges (id, name, location) for different courses (id, name ,duration). Present an ER diagram.

Ternary Relationship

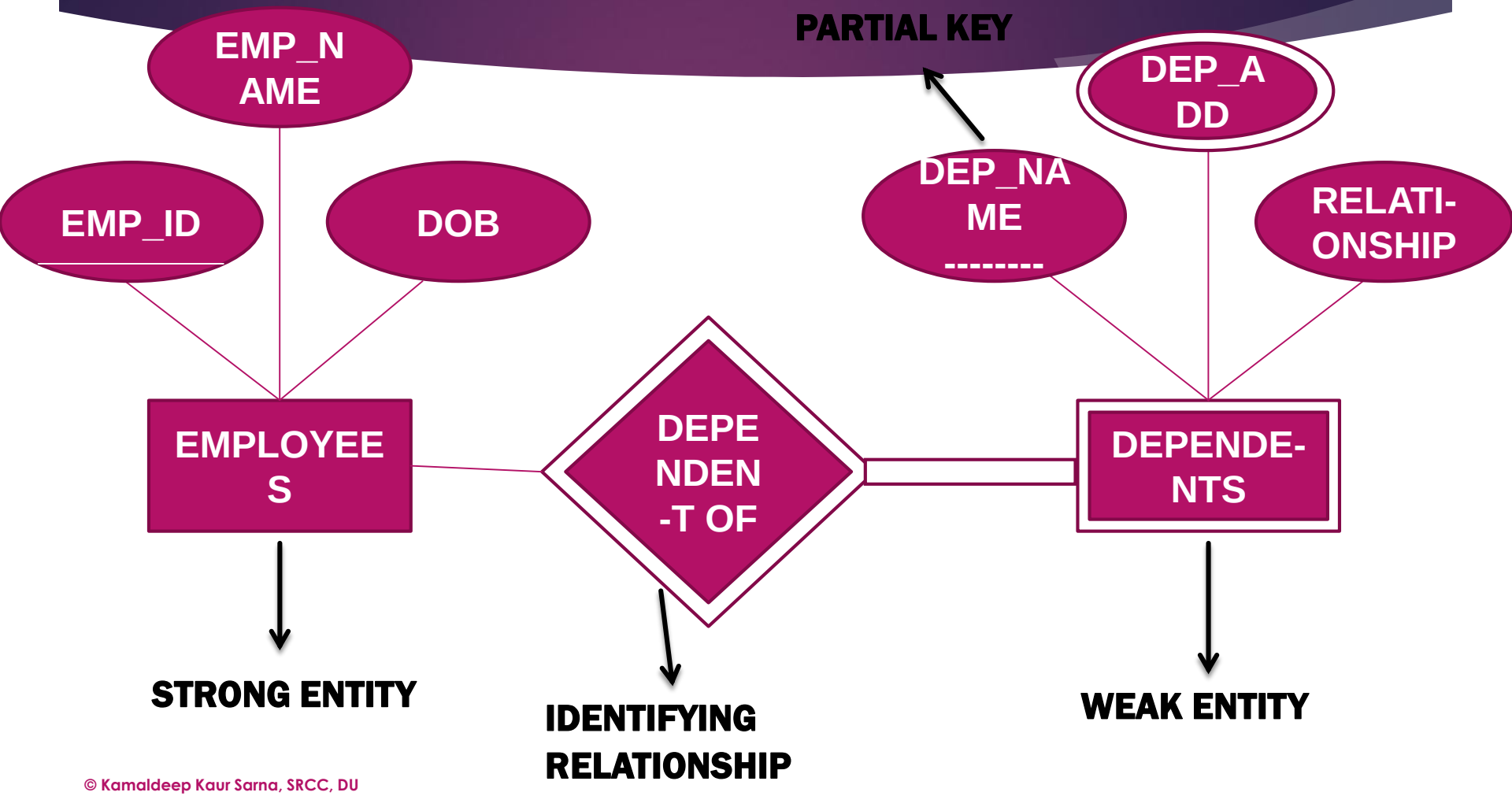


Example: ER diagram for a weak Entity

- In an organisation the employees have to declare the names of their dependents. Considering employees and dependents as two different entities and make an ER diagram.

Entity	Attributes
Employees	Emp_Id, Emp_ Name, Emp_DOB
Dependents	Name, Address ,Relationship

Solution

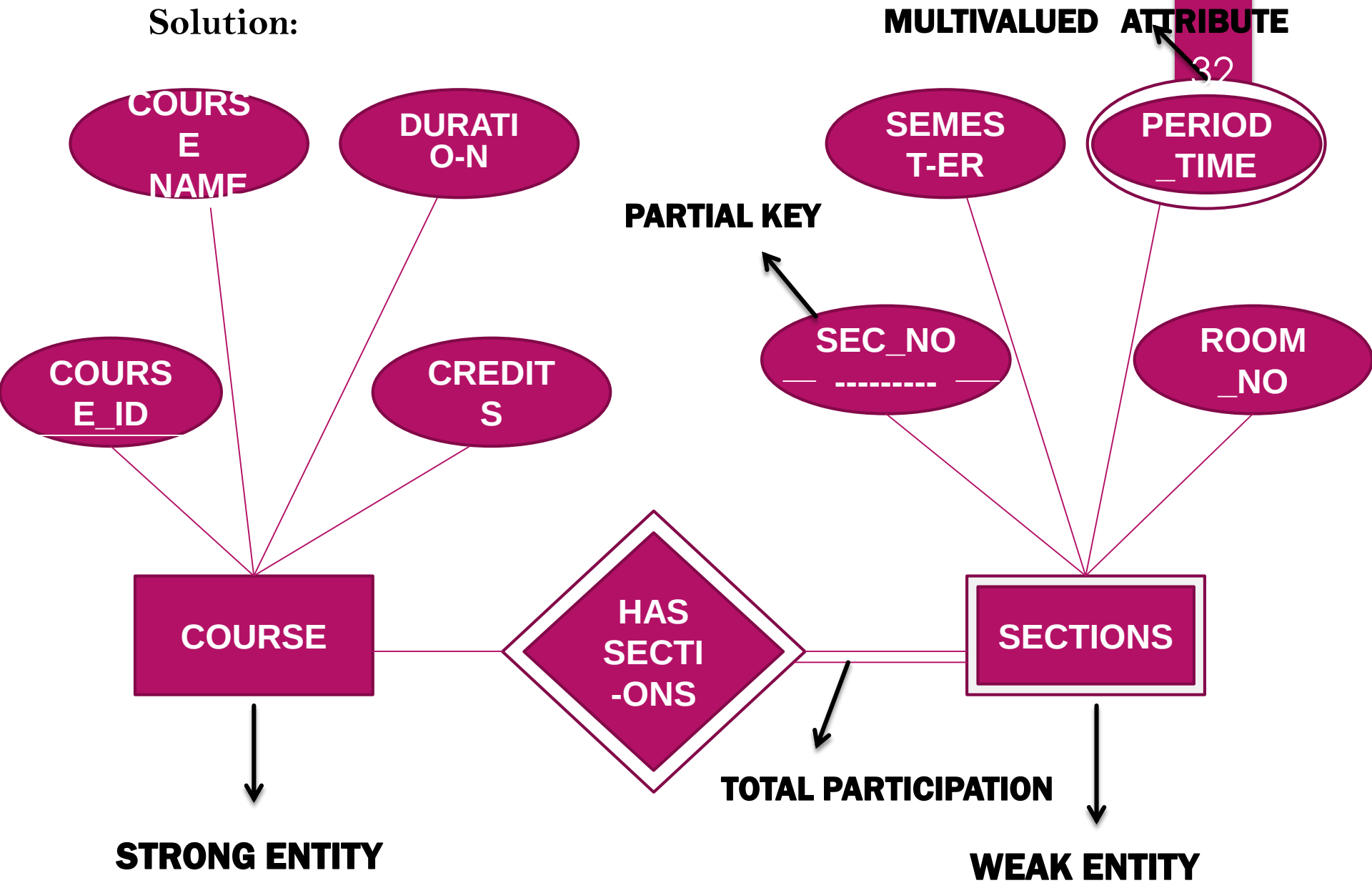


Example: Weak entity, total participation and multivalued attributes

In a college there are several courses in which there are more than 1 section in each course. Prepare an ER diagram based on the following details:

Entity	Attributes
Course	**Course_Id, Course Name, Duration, Credits.**
Section	Section_No., Semester, Room_No., Period_time, Professor

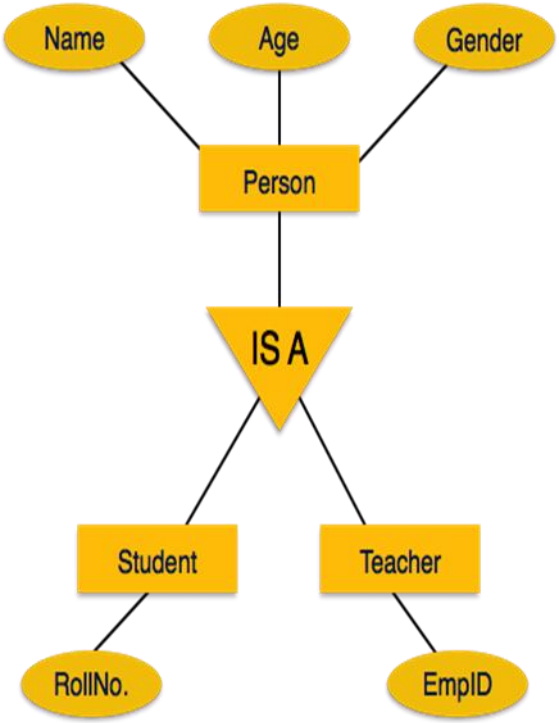
Solution:



Specialization

- Specialization is a case in which a lower level entity set inherits all the attributes of a higher level entity set with which it is linked.
- The lower level entities may have additional attributes and they may participate in additional relationships.
- It is represented by a triangle in which 'ISA' is written.

Specialization Example:

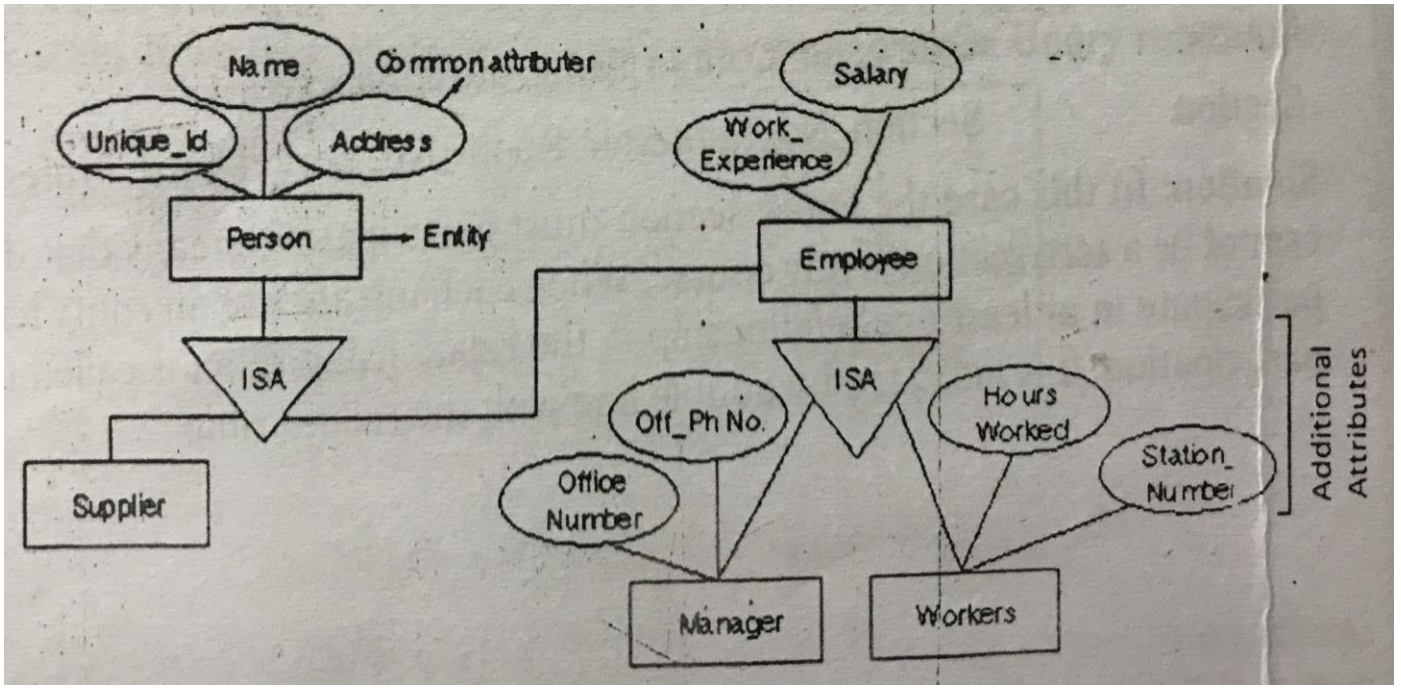


Real World Cases

Case 1: Construct an ER Diagram for a real world situation in which:

- Persons can be employees or suppliers of an organization
- The employees may be managers or the workers
- Each of them may have accordingly

Solution

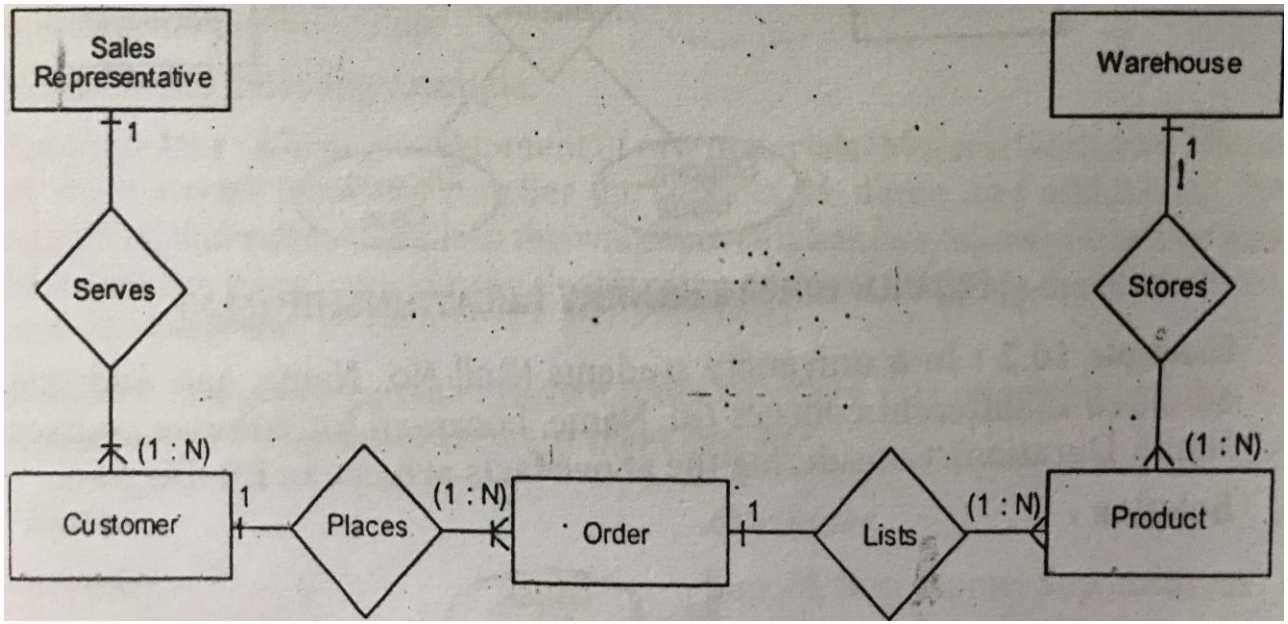


Case 2:

Construct an ER Diagram for a real world situation in which:

- A sales representative serves a customer
- A customer places an order
- An order contains a product
- A warehouse stores a product

Solution

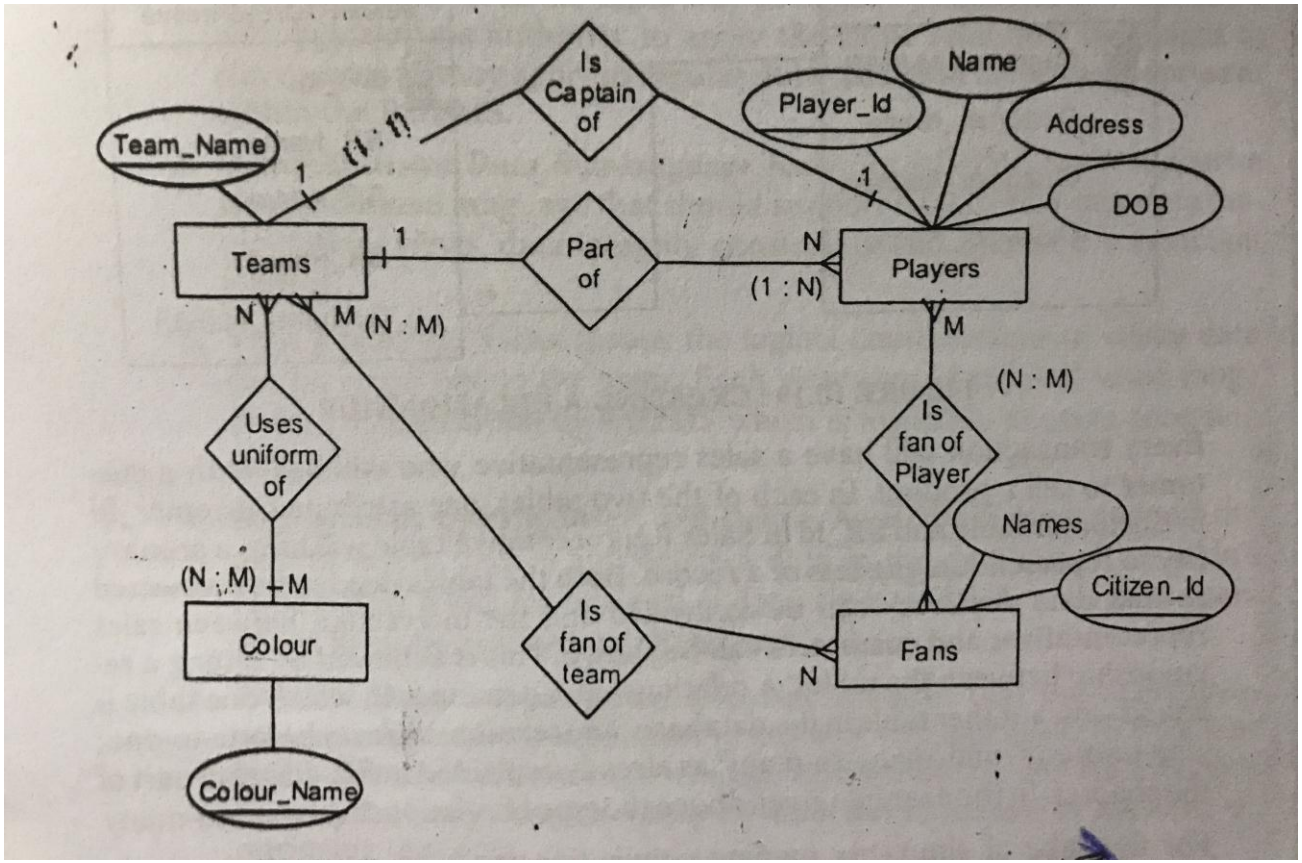


Case 3:

Construct an ER Diagram for a real world situation in which:

- For each sports team, there will be a captain and a coloured uniform (multi or single coloured), other players and name of the team
- Name, address and date of birth of each player
- Favourite player and team for each fan

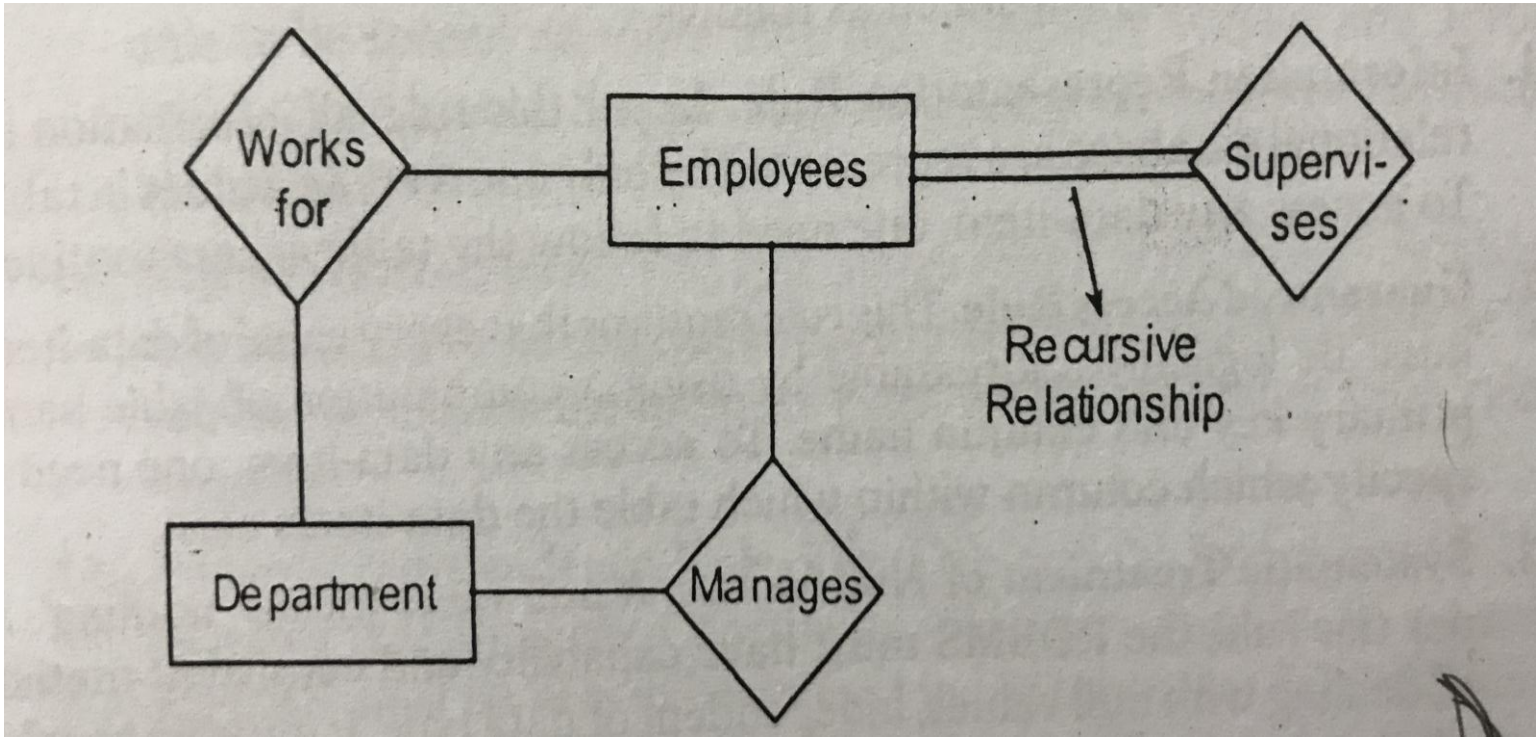
Solution



Case 4:

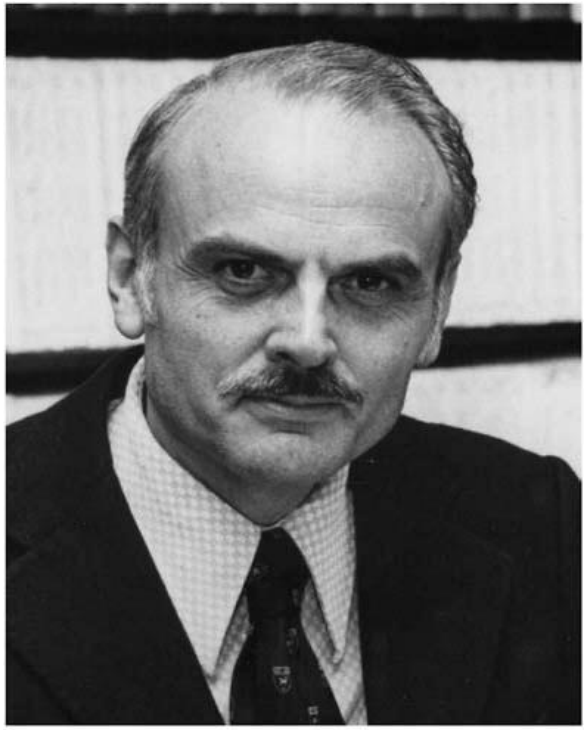
- In an organization, there are employees who manage and work for different departments and also supervise the other employees.
- Present it using ER-diagram ignoring attributes.

Solution



RELATIONAL DATA MODEL

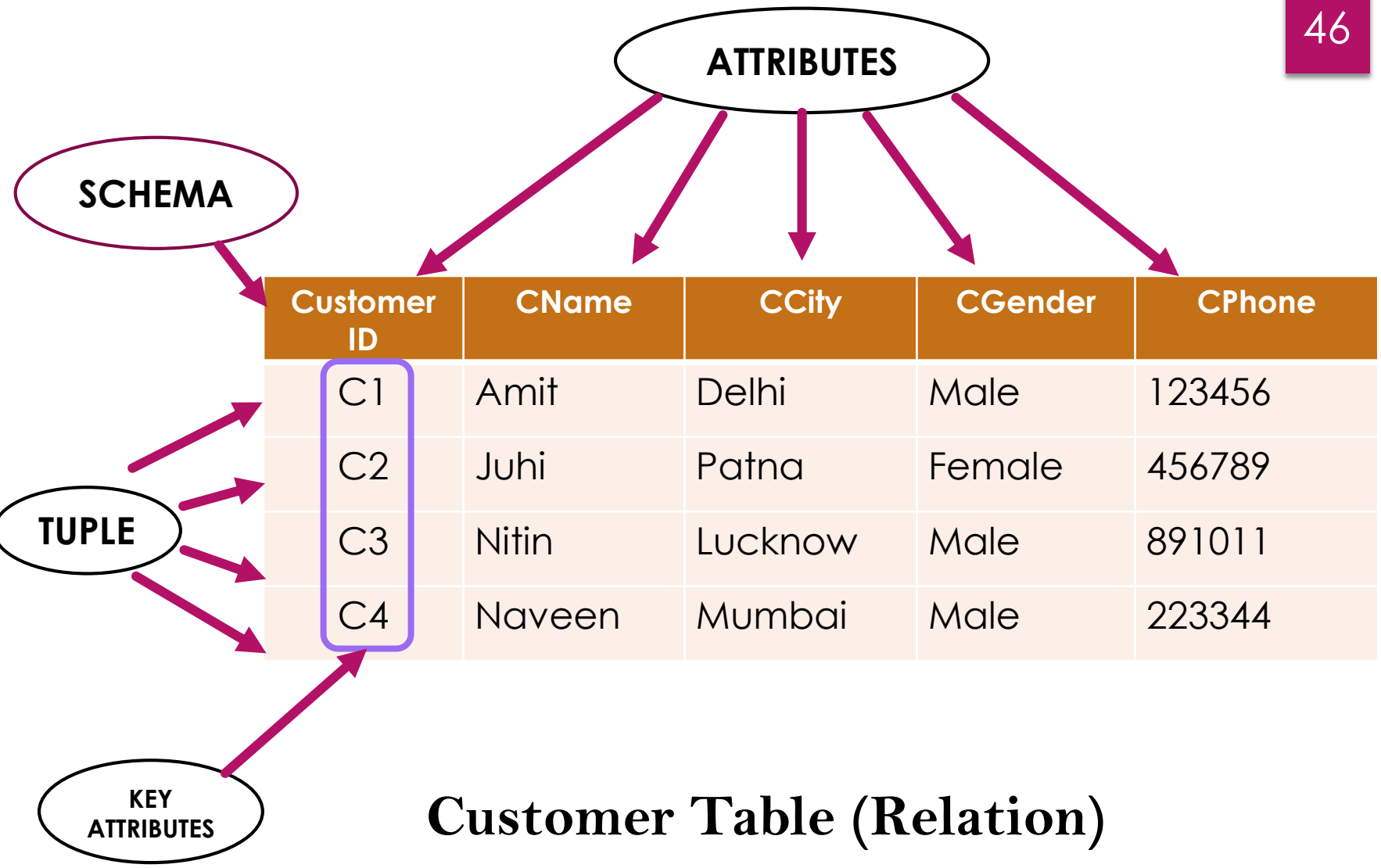
Relational Data Model



- EDGAR F. CODD , a researcher in IBM, conceived the Relational Data Model in 1970.
- Father of RDBMS.

Relational Database Management System

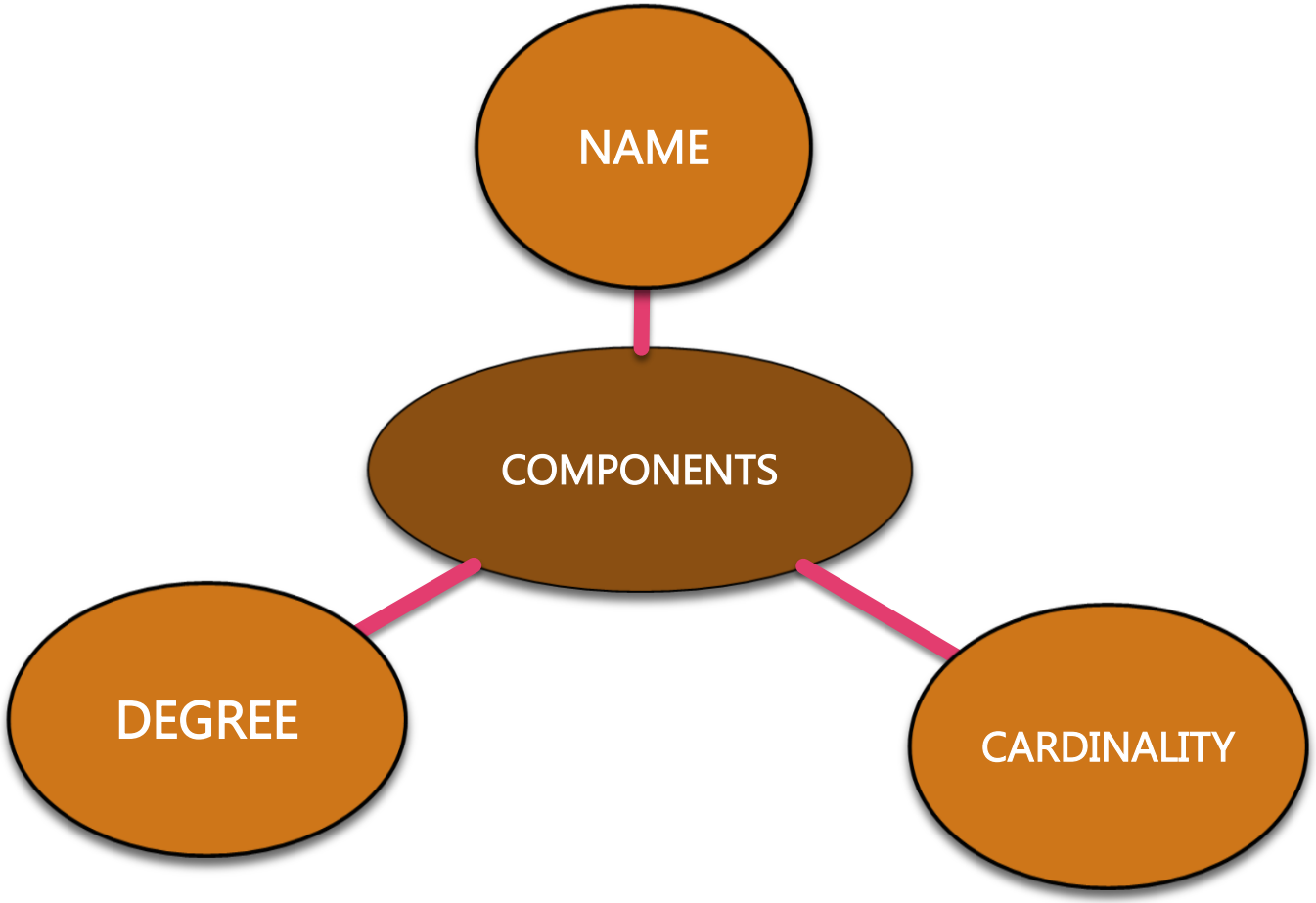
- A database management system that stores data in the form of **related tables** is called Relational Database Management System (RDBMS).
- Based on set theory.
- It consists of a series of un-ordered two-dimensional tables. These tables are known as **relations**.
- The tables are used to represent data.



Customer ID	CName	CCity	CGender	CPhone
C1	Amit	Delhi	Male	123456
C2	Juhi	Patna	Female	456789
C3	Nitin	Lucknow	Male	891011
C4	Naveen	Mumbai	Male	223344

Customer Table (Relation)

Three components of RDBMS



Properties of relational tables

1. The values in a relational table are atomic. Any attribute, if in a group, is required to be converted into an atomic form.

   E.g. Name will be further divided into First Name, Middle Name and Last Name.

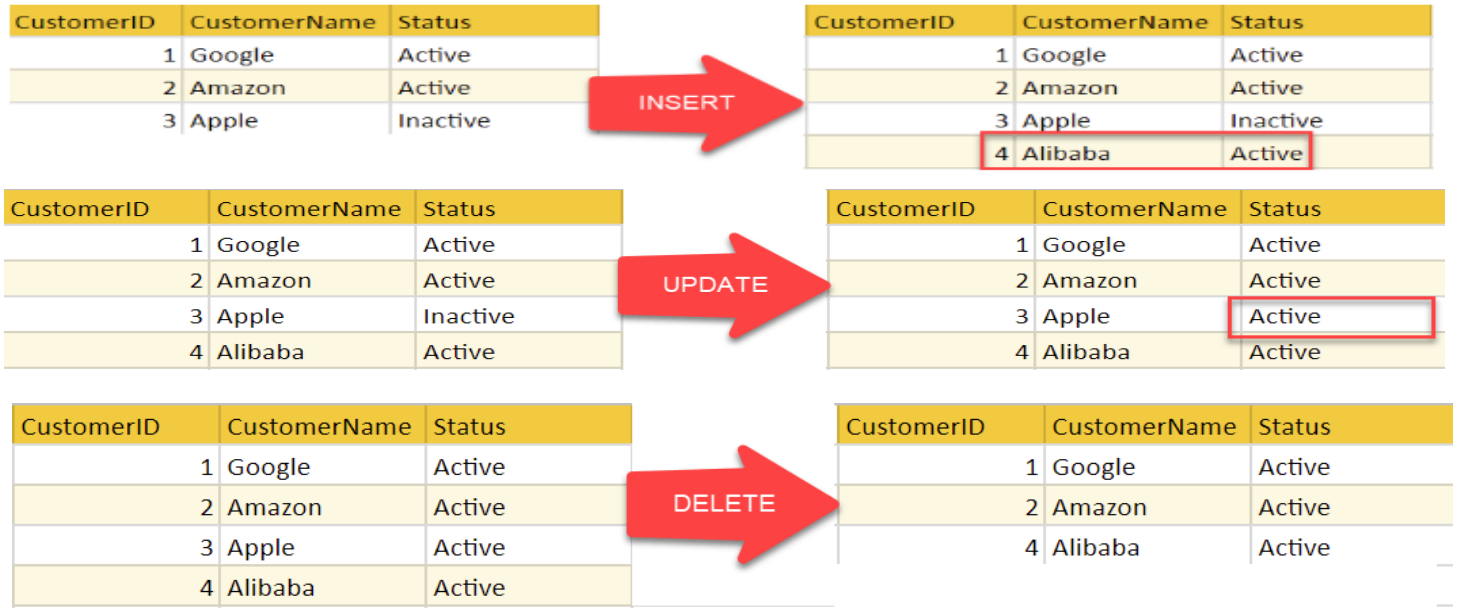
Cust_No	Last_Name	First_Name
560779	Smith	Juan
207228	Smith	George
173996	Smith	Ben
477610	Smith	Conrad

Properties of relational tables

2. Each row of relational table is unique and is identified by its primary key.
3.Each column attribute has a unique name within a relational table.
4.The order of columns in relational table is insignificant.
5.The order of rows in relational table is insignificant.
6. The column values are of same kind.

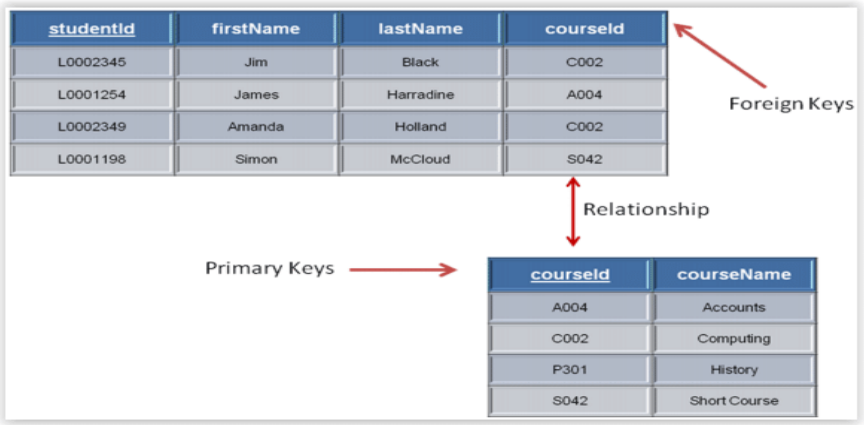
Creating Relationship between Tables

- In RDBMS, the data is stored in form of tables and all the operations, .e.g., insert, delete, edit, update etc are carried out using these tables only as shown below.



Creating Relationship between Tables

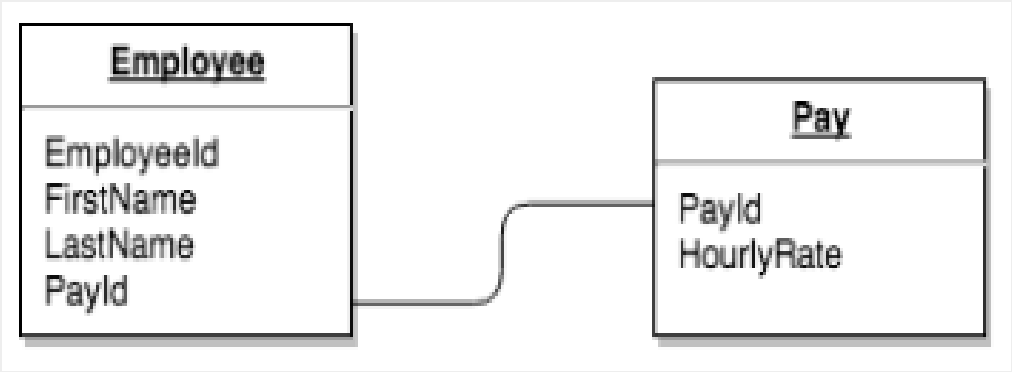
- Each table represents only one type of object and to show the interaction between the tables Foreign Key is used.



- In the above tables, student Id and course Id are primary key to represent uniqueness of the tables. Course Id is foreign key establishing the relationship between the tables.

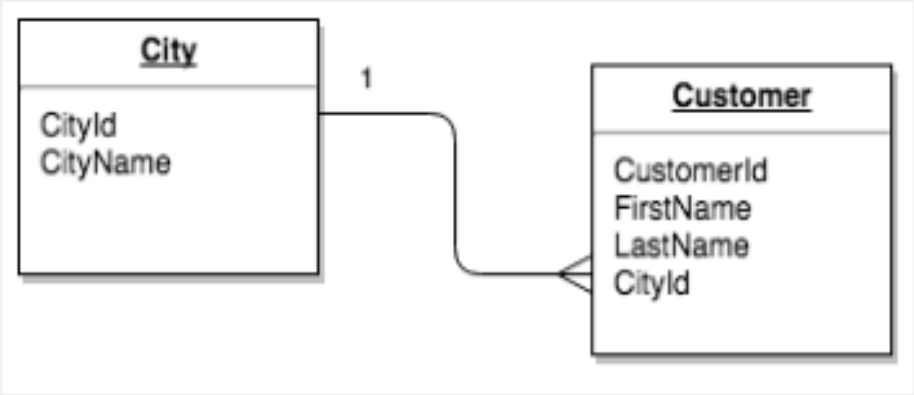
Creating Relationship between Tables

- The relationship may be one to one , one to many or many to many.
- One to One - A row in table A can have only one matching row in table B, and vice versa as shown below.



Creating Relationship between Tables

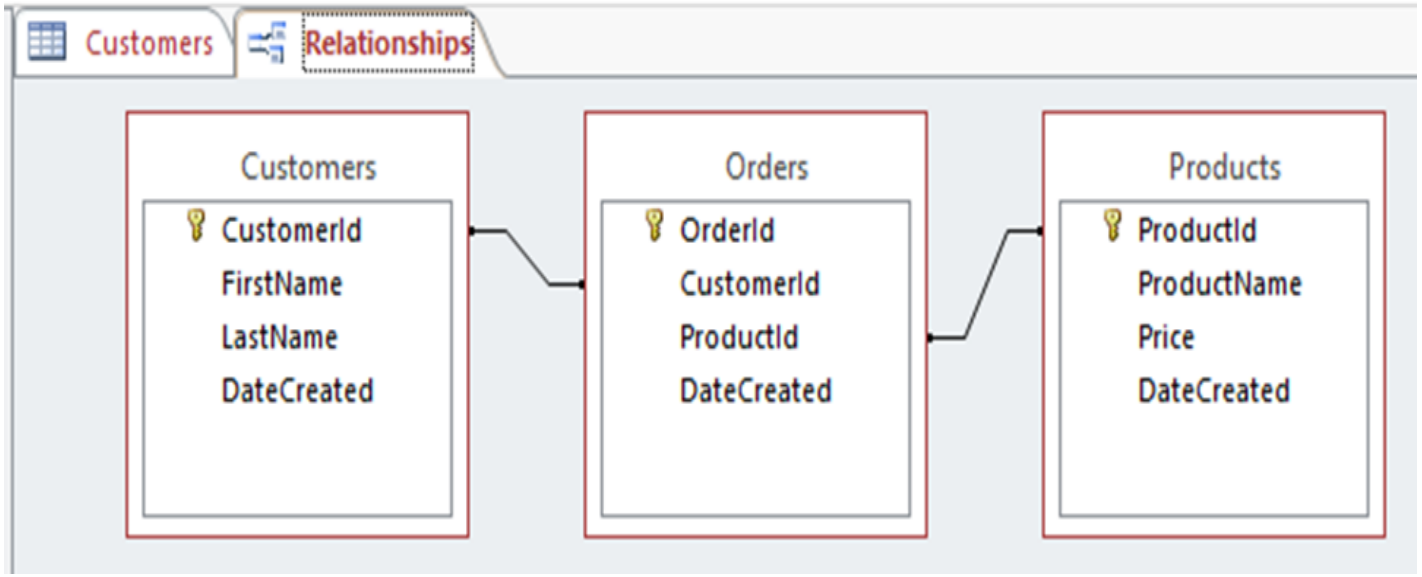
- One to Many- This is the most common relationship type. In this type of relationship, a row in table A can have many matching rows in table B, but a row in table B can have only one matching row in table A as shown below.



Creating Relationship between Tables

- Many to Many- In a many-to-many relationship, a row in table A can have many matching rows in table B, and vice versa.
- A many-to-many relationship could be thought of as two one-to-many relationships, linked by an intermediary table.
- The intermediary table is typically referred to as a "junction table" (also as a "cross-reference table").
- This table is used to link the other two tables together.
- It does this by having two fields that reference the primary key of each of the other two tables.

Creating Relationship between Tables



Instructions

- Students are required to thoroughly read the slides (along with the reference books).
- An Online session will be held for this topic on **Zoom platform** on Friday, 27 March, 2020 at 2:15 pm.
- Further details regarding the conduct of the session will be communicated through the CRs of the class.
- For any queries, feel free to contact through email, phone or WhatsApp during the CAB scheduled lecture timings.

Assignment

1. Briefly explain ER-Model.
2. What are the different types of attributes in a relation?
3. Explain the following types of relationships with example:
   - One to One
   - One to Many
   - Many to Many

All are required to e-mail their assignments (in pdf format) on email ID (kamaldeepkaur.sarna@srcc.du.ac.in) before 6 pm, 31st March, 2020.