



# Data Management and Relational Modelling



**Course:** Data Engineering - I


**Lecture On:** Data Management and  
Relational Modelling

**Instructor:** Vishwa Mohan

# Session 3 | Relational Model

## Session Overview

Segment  Understanding the concept of a relational model and the characteristics of a table in the model

Segment  Discussing Database Keys

Segment  Discussing the implementation of relations in a relational model

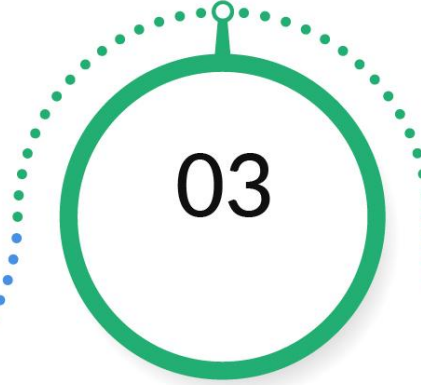
# Segment 2 | Relational Model

## In This Segment

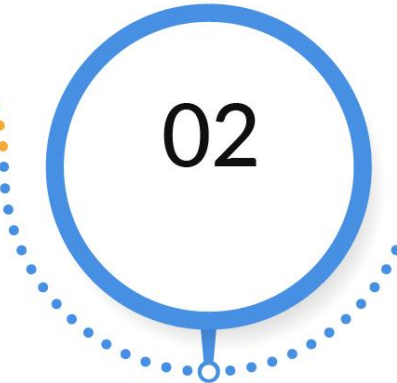
Understanding a relational model



Discussing the characteristics of relational tables



Understanding the need for relational models



An E-R model defines these three concepts:

An **entity**: Is a real-world object

An **attribute**: Is a property of a real-world object

A **relation**: Defines how entities are related

Relational models can be mapped from E-R models. Relational models describe database implementation in much more detail.

## A Relational Model



For a relational model, every entity and relation of an E-R model is a table. These tables are relations in a relational model because all the tables are interconnected through common attributes.

A relational model stores data in the form of a table or a relation. These relations are connected to each other to form a complete picture of the data.

# A Relation in a Relational Model

Values that are permitted are also described for a relation.

Name -> String Data Type

Customer ID -> String Data Type

Phone Number -> INT

Attributes

Customer ID	Name	Age	Phone Number	Address
101	Virat	20	9087690871	Mumbai
102	Shikhar	20	9089879082	Mumbai
103	Rahul	21	9678567854	Punjab
105	Rohit	21	9234560987	Punjab

A row or a tuple

tuple t1 <101, Virat, 20, 9087690871,  
Mumbai >

Values

# Characteristics of a Table in a Relational Model



In a relational model database, the name of every table must be unique.



The name of every attribute of a table must be unique to that table.



Every table must have a key attribute. The value of this key attribute cannot be the same for any two rows of that table.



The data type for each attribute must be defined.



The order of the rows does not matter.



The order of the attributes does not matter.

# Summary



The Relational Model can be build upon the E-R model. Every Table is a relation in a relational model. Every data value is stored in the form of tables.



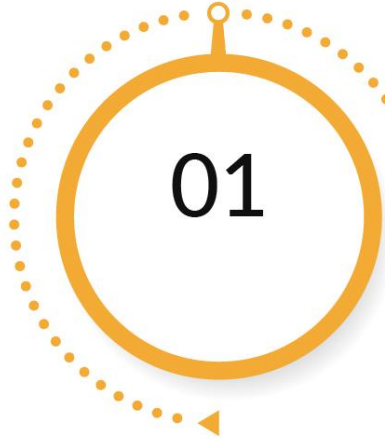
Every table must contain a key attribute to identify each row.



# Segment 3 | Database Keys

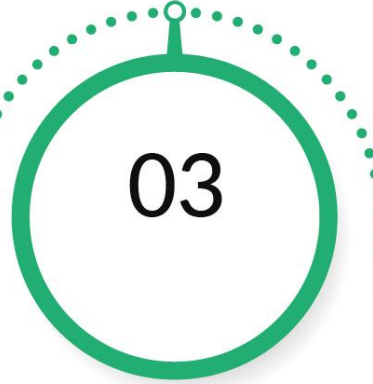
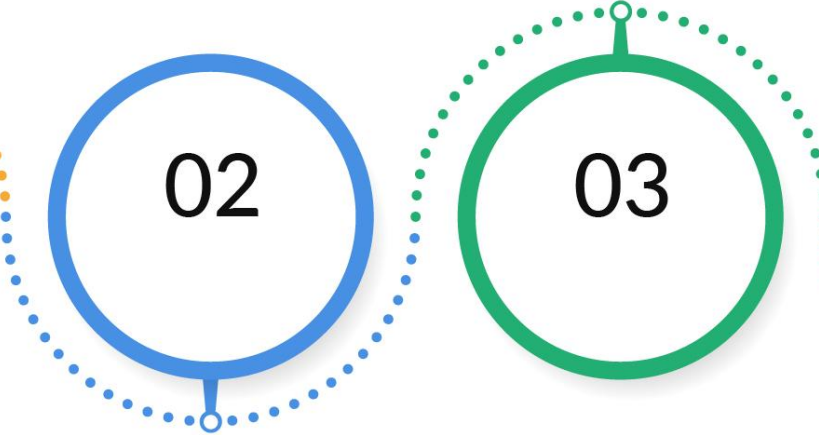
## In This Segment

Understanding key attributes



Understanding Foreign Keys.

What are different types of keys.



# Super Keys

Super keys are attributes or combinations of attributes that can uniquely identify each row of a table.

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

<Transaction ID, Student ID, Name, Phone Number, Course ID>

<Transaction ID, Student ID, Phone Number, Course ID>

<Transaction ID, Student ID, Name, Course ID>

<Transaction ID, Student ID, Course ID>

<Transaction ID, Name, Phone Number, Course ID>

<Transaction ID, Phone Number, Course ID>

<Transaction ID, Phone Number>

<Transaction ID, Course ID>

<Transaction ID, Student ID>

<Transaction ID, Name>

<Transaction ID, Student ID, Name>

<Transaction ID, Name, Course ID>

<Transaction ID, Name, Phone Number>

<Transaction ID, Student ID, Phone Number>

<Student, Course ID, Name, Phone Number>

<Student ID, Course ID, Name>

<Student ID, Course ID, Phone Number>

<Phone Number, Course ID, Name>

<Student ID, Course ID>

<Phone Number, Course ID>

<Transaction ID>

# Candidate Keys

Candidate keys are attributes or combinations of attributes that can uniquely identify each row of a table. Such a combination includes only useful attributes. It is a subset of super keys.

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

<Transaction ID>

<Student ID, Course ID>

<Phone Number, Course ID>

# Primary Keys

Primary keys are attributes or combinations of attributes that can uniquely identify each row of a table. Such a combination includes one of the candidate keys.

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

<Transaction ID>

# Composite Keys

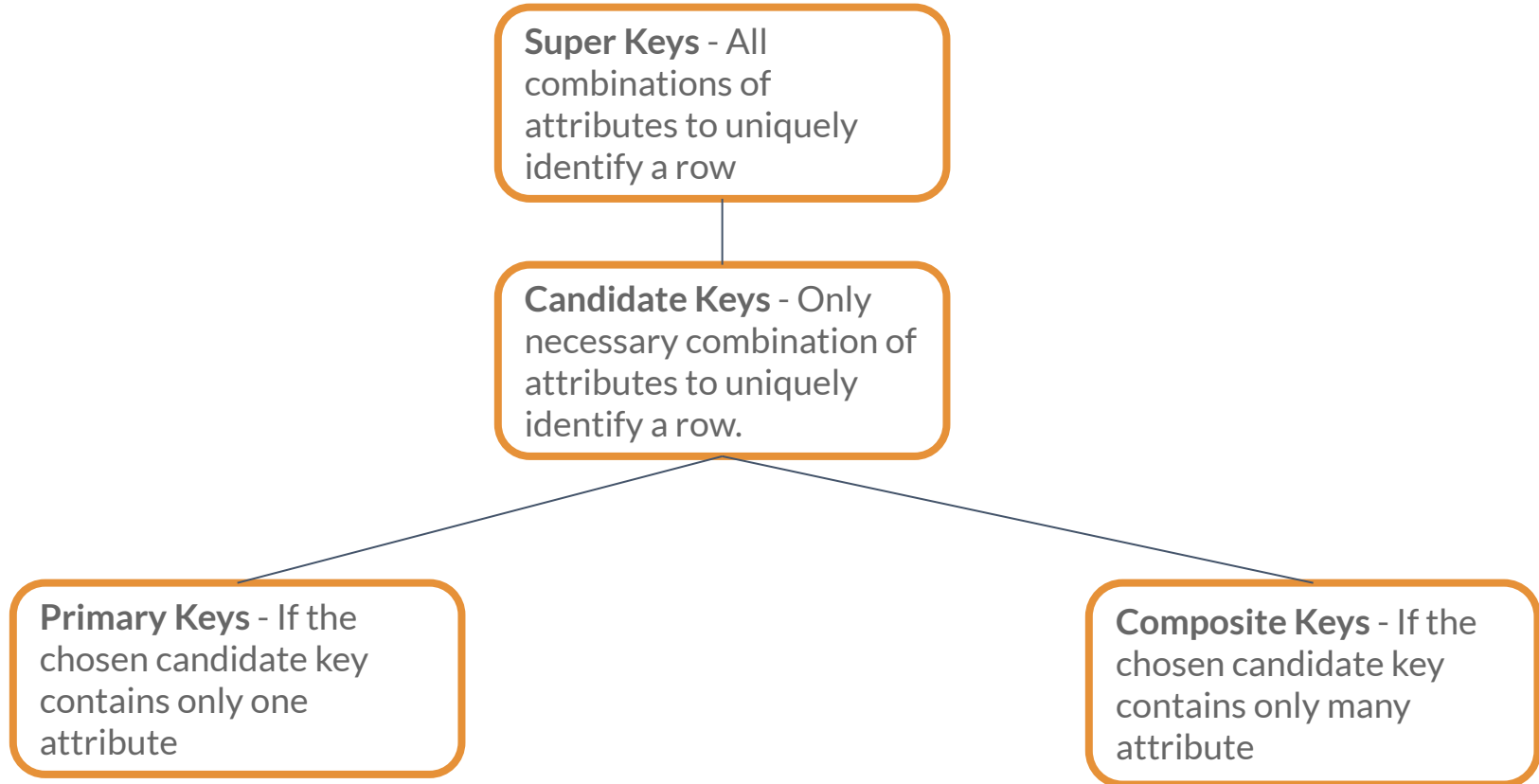
Composite keys are a combination of attributes that can uniquely identify each row of a table.

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

<Student ID, Course ID>

<Phone Number, Course ID>

# Composite Keys



# Foreign Keys

Transaction ID	Student ID	Name	Phone Number	Course ID
1001	101	Virat	9087690871	C123
1002	101	Virat	9087690871	C124
1003	102	Rahul	9678567854	C123
1004	103	Virat	9234560987	C250
1005	102	Rahul	9678567854	C250

Course ID	Course Name
C123	Marketing
C124	Data Science
C250	Product management



# Summary | DataBase Keys



A key in a relational model is a column whose value cannot be same for any two rows in a table.



Super Keys are combination of all columns that can uniquely identify each row.



Candidate Key is subset of super keys containing only those combinations that contain useful and necessary attributes.

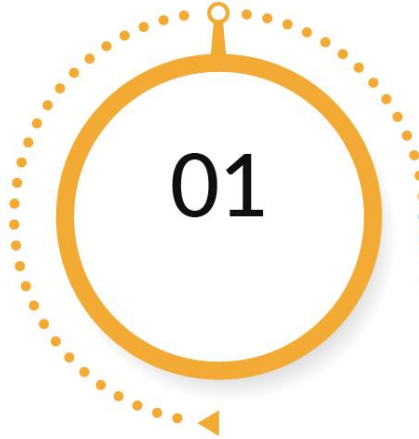


One of the candidate keys is chosen to identify each row. If it is a single attribute, it is a primary key. If it contains more than one attribute, it is a composite key. Foreign keys are used to relate two tables.

# Segment 4 | Building a Relational Model

## In This Segment

Mapping an E-R model  
to relational model.



Understanding the  
Implementation of Many to  
Many Relation



Implementing relation  
between entities using foreign  
keys.

# Mapping an E-R Model to a Relational Model



Every entity is represented as a table.



Every attribute is represented as a column.



One-to-one and one-to-many relations between entities are implemented using foreign keys.



A many-to-many relation is implemented by adding a new entity. This new entity has a one-to-many relation with both the entities.

# Implementing a One-to-One Relation

In a one-to-one relation between entities, check for minimum cardinality of each entity in the relation.

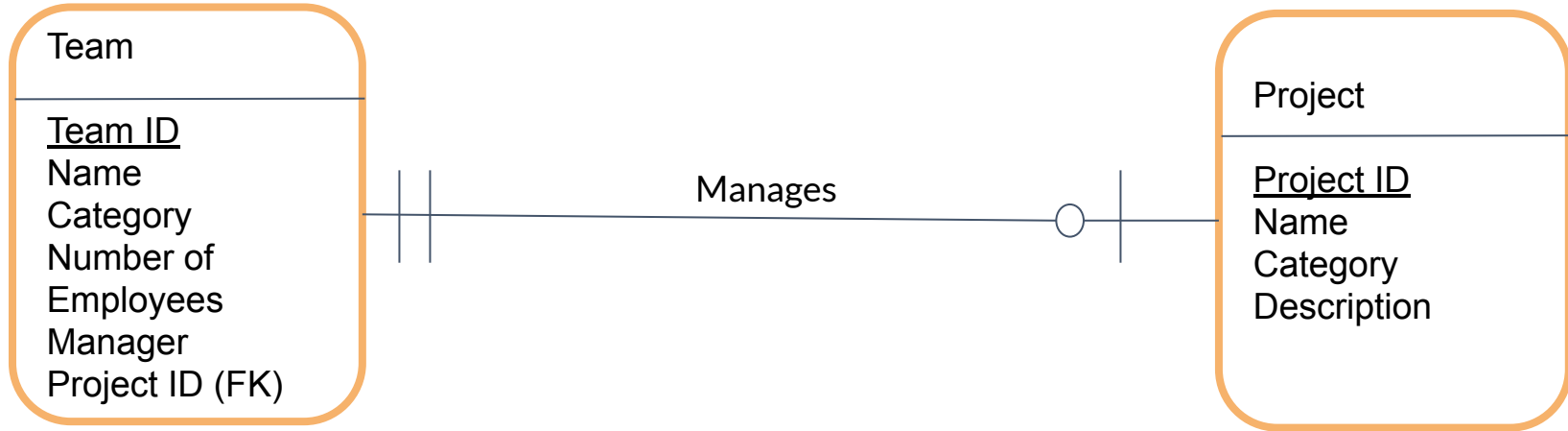


If the participation of both the entities is either mandatory or optional, any one entity can get the foreign key.



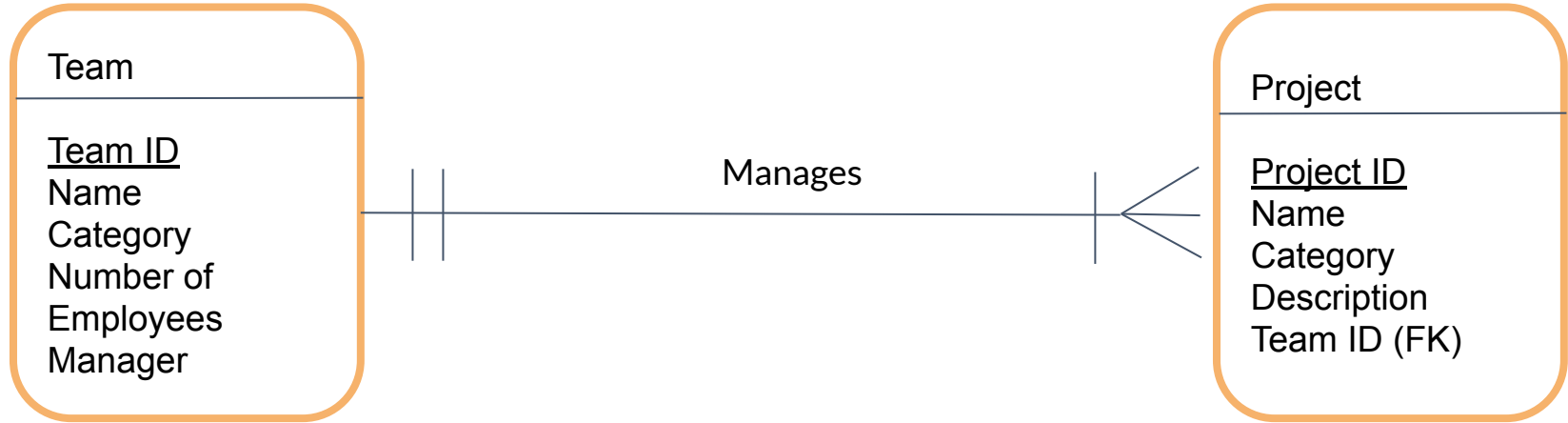
If the participation of one entity is mandatory and that of the other entity is optional, the one whose participation is mandatory gets the foreign key.

# Implementing a One-to-One Relation



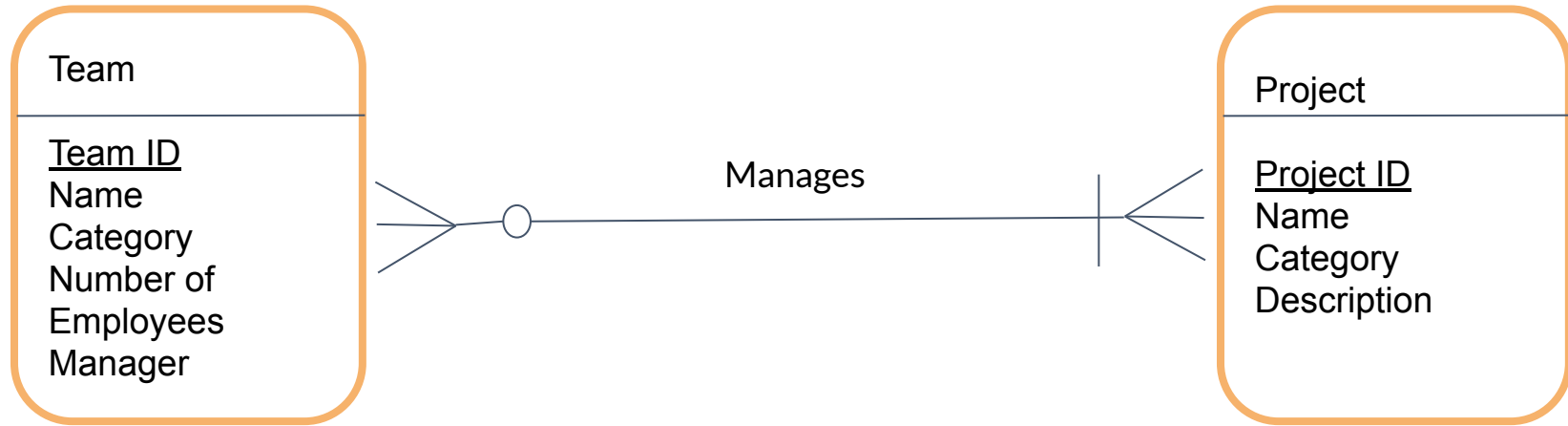
# Implementing a One-to-Many Relation

In a one-to-many relation between entities, the entity on the 'many' side gets the foreign key.

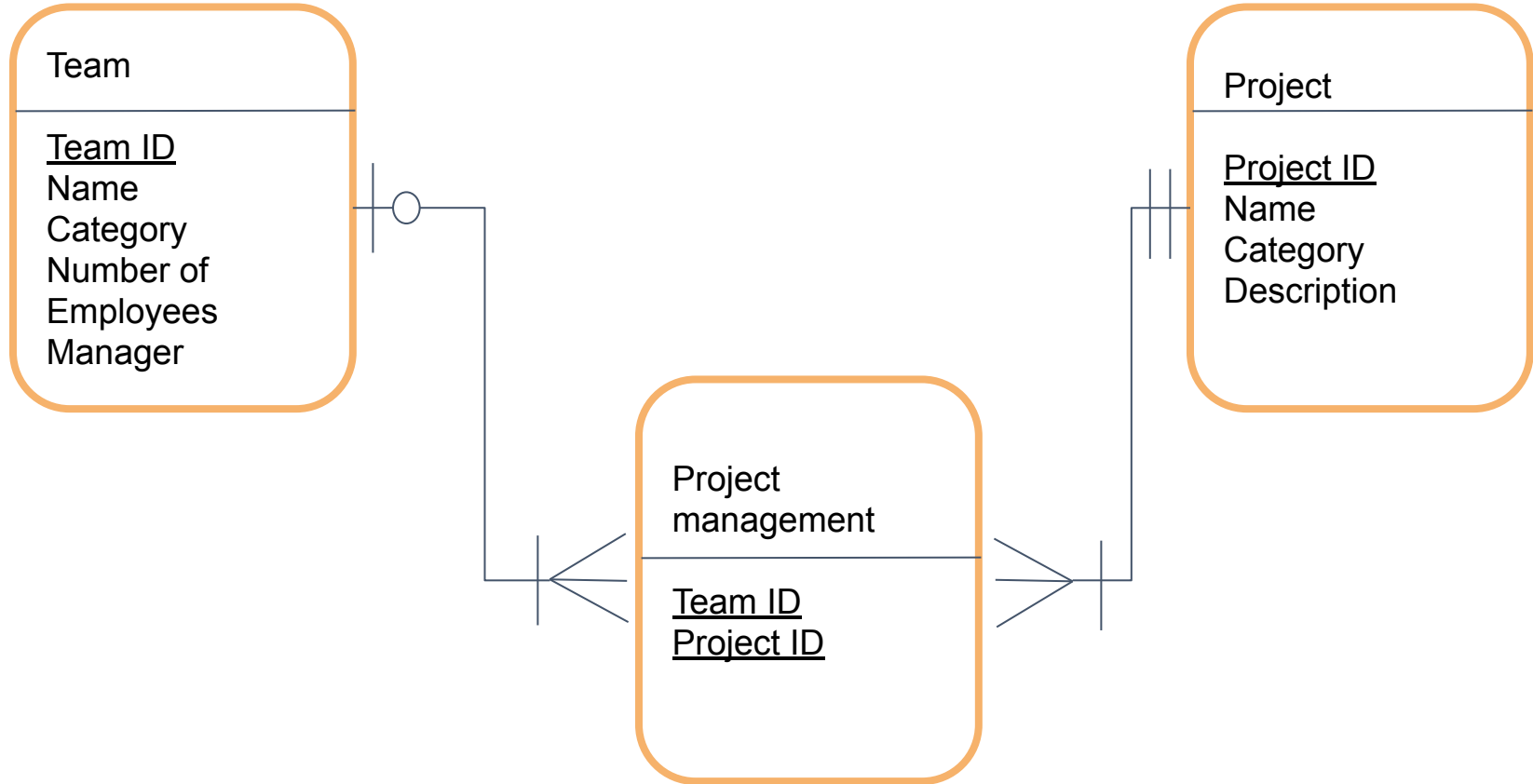


# Implementing a Many-to-Many Relation

In a many-to-many relation between entities, a new entity is made, and foreign keys of both the entities are kept in this new entity. This new entity also has a one-to-many relation with both the entities.



# Implementing Many-to-Many Relation





# Summary | Building a Relational Model



One to One and One to Many Relation between entities are implemented using foreign keys.

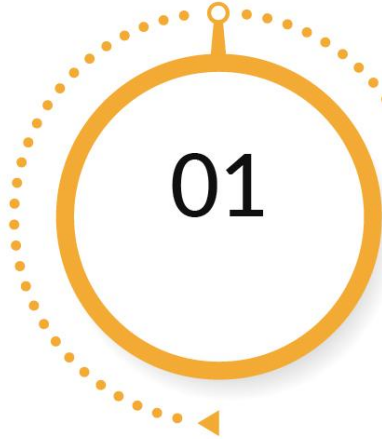


Many to Many relation is implemented by building another entity that has one to many relation with both the entities.

# Segment 5 | ACID property of relational databases

## In This Segment

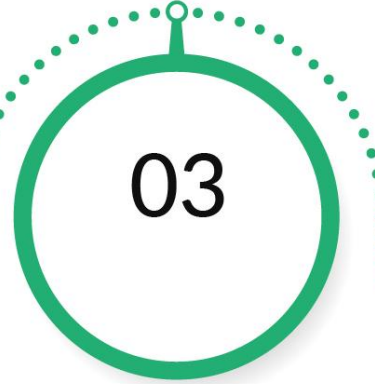
Relational Databases and their use



ACID property of relational databases.



What is a transaction in relational database?



# Transaction in a Relational Databases

01

A database build using relational model is a relational database. A relational database management system manages relational databases.

02

A transaction in a relational database is one activity that cannot be divided into smaller activities.

03

If a user transfers money from one account to another, this activity either does not happen or happens completely.

04

If the money is deducted from one account, the other account must receive the money.

# ACID Property

## Atomicity

Every Transaction is atomic. It either happens completely or not at all.

## Consistent

All the three properties makes the data in a relational database consistent.

## Isolation

Any two transactions cannot take place at the same time.

## Durability

If the transaction is completed, changes made to the database due to that transaction remains.

# Session Summary

01

An **E-R model** is a logical schema that identifies various important entities, the relations between those entities and the attributes of each entity for a business database.

02

A **relational model** is built using an E-R model. An E-R model can be easily mapped to a relational model.

03

In a **relational model**, all the entities and relations are tables, and all the attributes are columns.

04

A table in a relational database must have only one value in a field, and no two rows can have the same data in every field.

05

Keys are used to uniquely identify each row of a table.

06

A **super key** consists of all the attributes that can uniquely identify each row.

07

A **candidate key** contains only those attributes that uniquely identify each row.

08

A **primary key** is one of the candidate keys that uniquely identify each row.

09

A **composite key** is a combination of attributes that uniquely identify each row.

10

A **foreign key** is used to implement the relation between entities.

Thank **you**