upGrad

Data Management and Relational Modelling

Course: Data Engineering - I

Lecture On: Data Management and Relational Modelling

Instructor: Vishwa Mohan

Session 2 | E-R Model

Session Overview

Segment 02 Understanding the three-level architecture of a database system

Segment 03 Discussion on data models and their use

Segment 04 Understanding entities and attributes

Segment 05 Discussion on the relations between entities in an E-R model

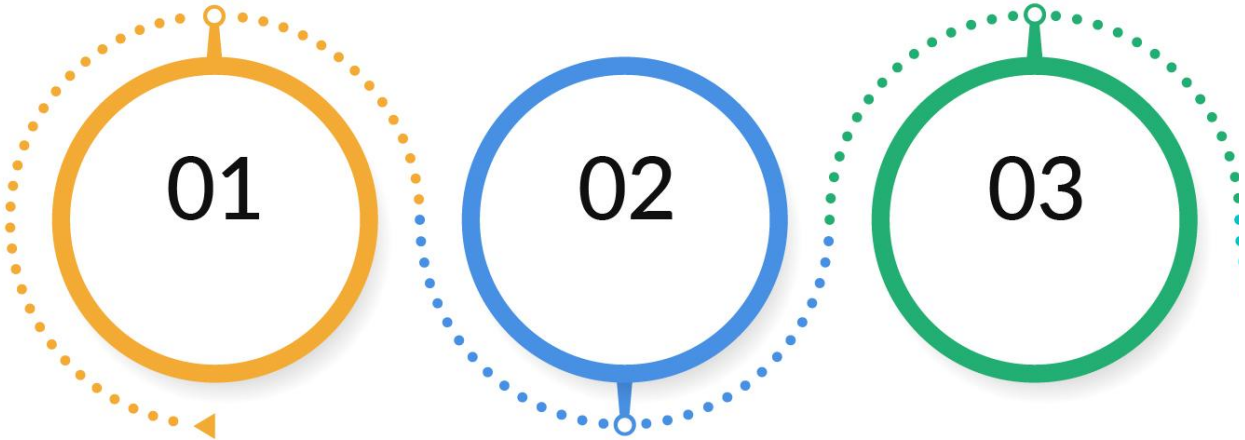
Segment 06 Defining Cardinality and understanding its representation

Segment 2 | Three-Level Architecture

In this Segment

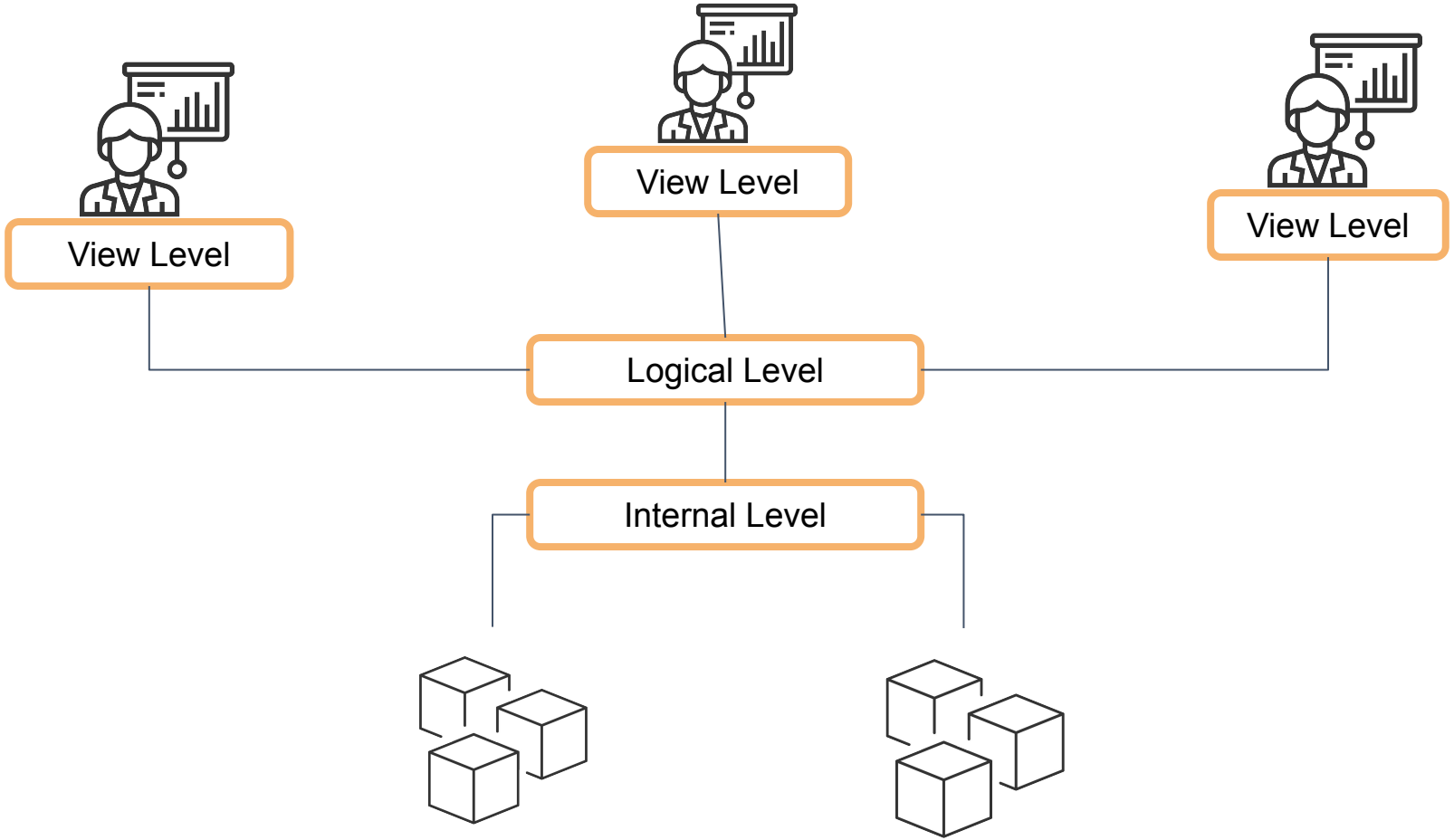
Understanding the three-level architecture

Understanding the View level, the Logical level and the Physical level



Use of each level in the architecture

Three-Level Architecture



Three-Level Architecture

Internal Level

This level defines a schema according to which the data in a database is stored on the storage devices.

This level is the most descriptive level as the entire information and the paths of where the data is stored on the storage devices is known.

Logical Level

This level defines a schema according to which the data is stored in a database.

This level describes various data models that are used to store the data and the relation between various data elements.

The schema designed does not change if the physical storages or the way the data is stored physically changes.

View Level

This level defines which users can access which part of the database schema.

If a part of the database schema changes, then the view levels that contain that part will change.

Summary

A database is used to organise data. To store and secure the data effectively, a three-level architecture is used.

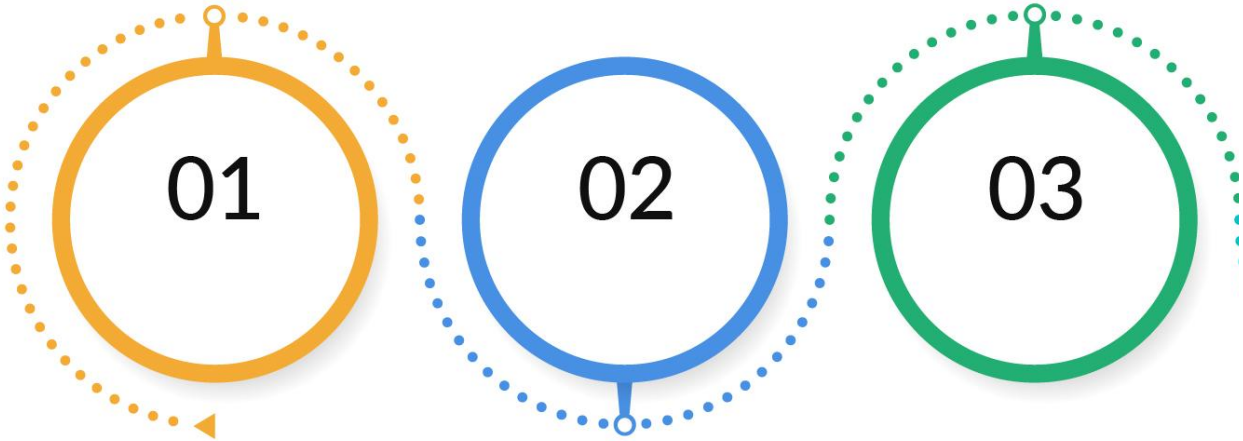
The logical schema designed does not change if the physical storages or the way the data is stored physically changes.

Segment 3 | Data Models

In this Segment

Understanding a Data model

Different Data models



Understanding the use of Data models

Data Models

To model data is to structure it. To structure data is to define a particular schema according to which the data is stored and also define the relation between various data elements.

Data models are necessary for business users to understand a database. Database designers build data models based on the business requirements defined by business users and business users can review the models.

Data models are logical designs created on paper. These designs are then implemented physically.

The Logical view of the database architecture contains data models. These data models do not define how the data is stored on physical storage devices.

E-R and Relational Data Models

E-R Model

01

An E-R model describes real-world objects as entities and their properties as attributes.

02

An E-R model identifies the relation between these entities. It also identifies the degree of relation and the participation of each entity in these relations.

Relational Model

01

A relational model stores each business concept in a table and describes it as a relation. Each relation or table has keys to uniquely identify the data in every record.

02

Foreign keys are used to describe how two different relations or tables are related. The foreign keys are the implementation of the relations described in the E-R model.

Summary | Data Models

The motive of a model is to describe the database schema.

E-R models and relational models use different ways to describe the database schema.

An E-R model can be easily mapped to a relational model, which describes a physical database in much more detail and structure.

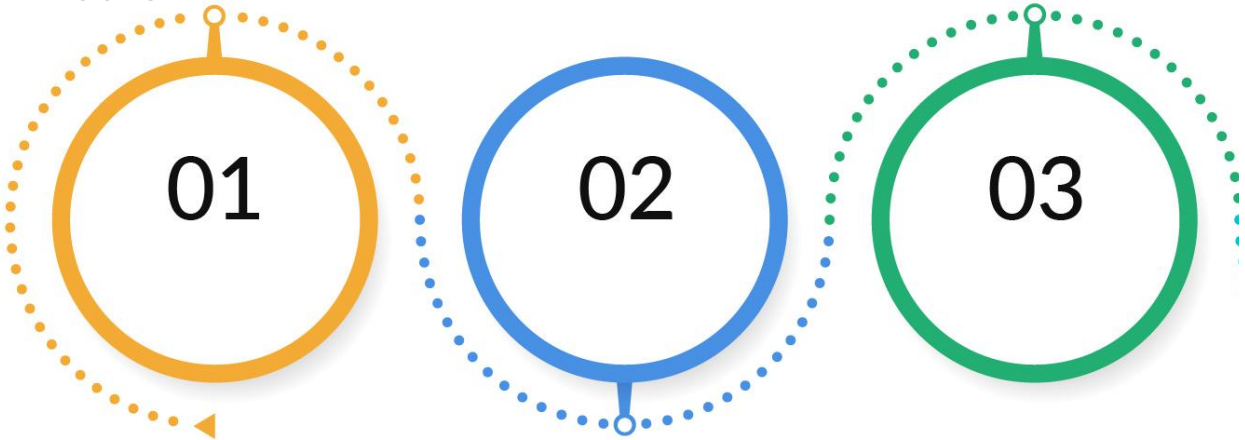
Segment 4 | Building an E-R model

In this Segment

Understanding the concept of entities

Understanding what attributes are

Demonstrating how entities and attributes are represented



What are Entities?

An entity is something about which a business wants to store information.

A clothing product, a student, an employee, a business, an application user, an ingredient, a bank account or a restaurant.

Entities can be understood as real-world objects.

An entity has various properties.

Entity - Properties
Department - Number of Employees, Head Manager
Marketing - 50, Virat
Sales - 100, Rohit

Department - Entity
Marketing and Sales - Unique value for each property

An entity is a table in a relational model.

What are Attributes?

An attribute is some information about an entity that a business wants to store.

Entity - Properties
Department - Manager, Number of Employees
Marketing - Virat, 50
Sales - Rohit, 100

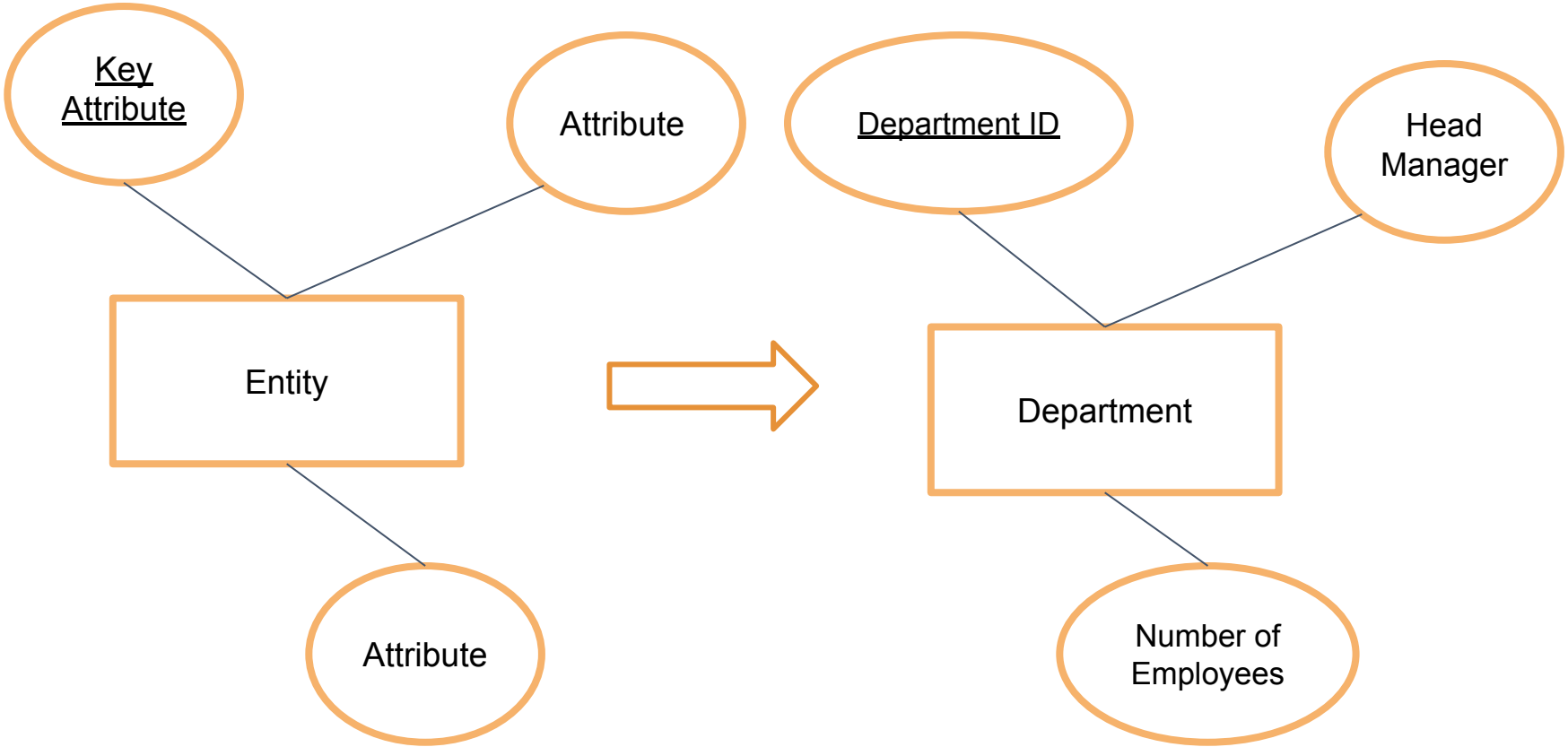
Product size, product weight, product name, customer address, user login ID, course name, number of employees or manager.

Manager and Number of employees are the attributes of the Department entity.

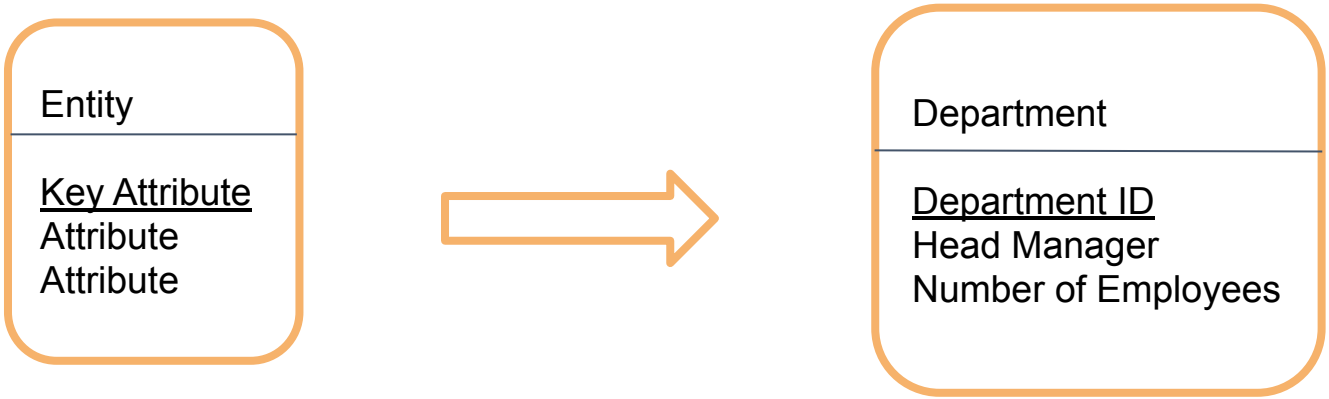
Attributes can be understood as the properties of real-world objects.

An attribute is a column in a relational model.

How are Entities and Attributes Represented?



How are Entities and Attributes Represented?



Different Entities

Student

Student ID
Name
Age
Address
Phone Number

Employee

Employee ID
Name
Age
Address
Phone Number

Product

Product ID
Name
Weight
Size
Brand
Category

Restaurant

Restaurant ID
Name
Category
Address
State
Phone Number

Attributes of a particular entity depend on the business requirements.

The product entity for a clothing business is different from the product entity for a food delivery business.

Bus Ticket Booking Data Model

Customer
Customer ID
Name
Age
Membership Plan
Address

Bus
Bus ID
Name
Number
Number of Seats
Manager

Bus Agency
Agency ID
Name
Manager
Phone Number
Address

Summary

01

Entities are those business concepts about which a company collects data.

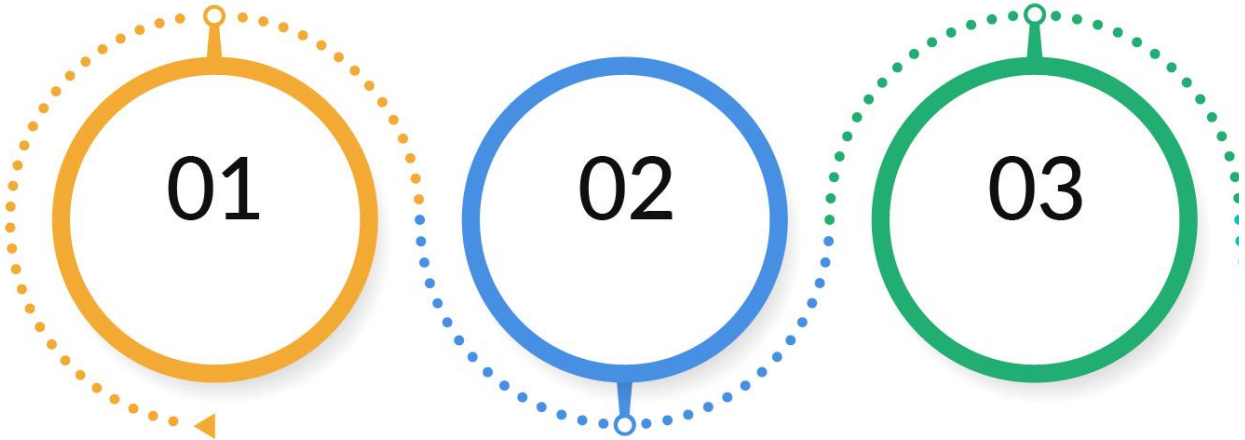
02

Attributes are the properties of entities. They define what data must be known for each entity.

Segment 5 | Relations in an E-R Model

In this Segment

Understanding the concept of relations between entities



Understanding one-to-one, one-to-many and many-to-many relations between entities

Demonstrating how E-R diagrams are represented

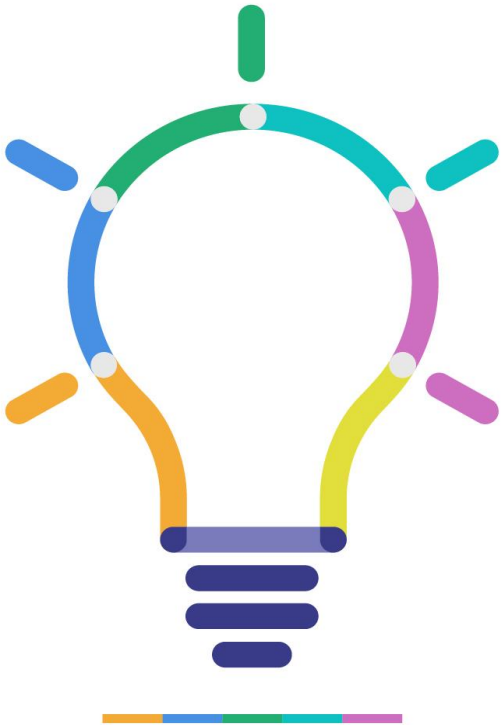
Relations in an E-R Model

- A Unary relation or recursive relation relates one row of an entity to another.
- One employee may ‘report’ to another employee.

It is generally a verb that connects entities:

- An employee ‘works’ in a company.
- A department ‘has’ many employees.
- A team ‘manages’ a project.

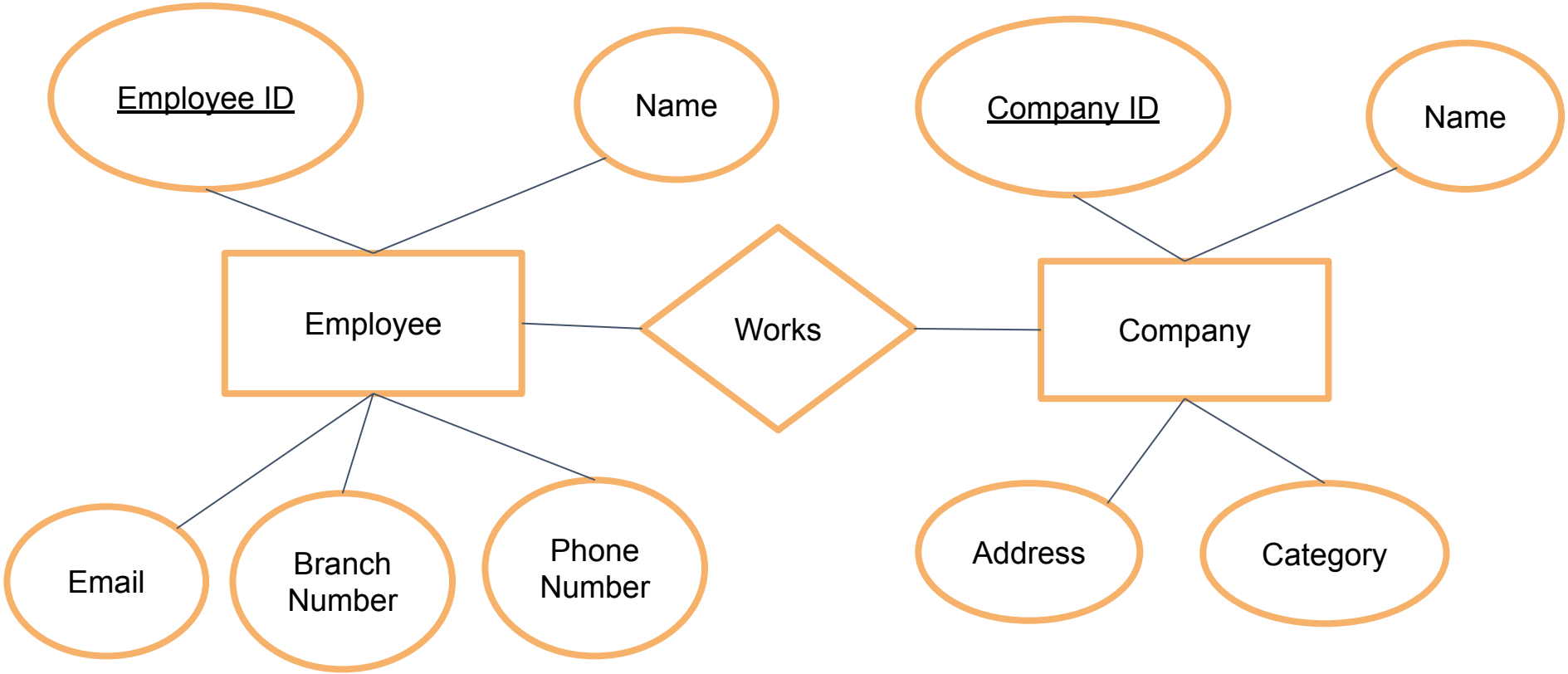
A relation defines how the entities in an E-R model are related to each other



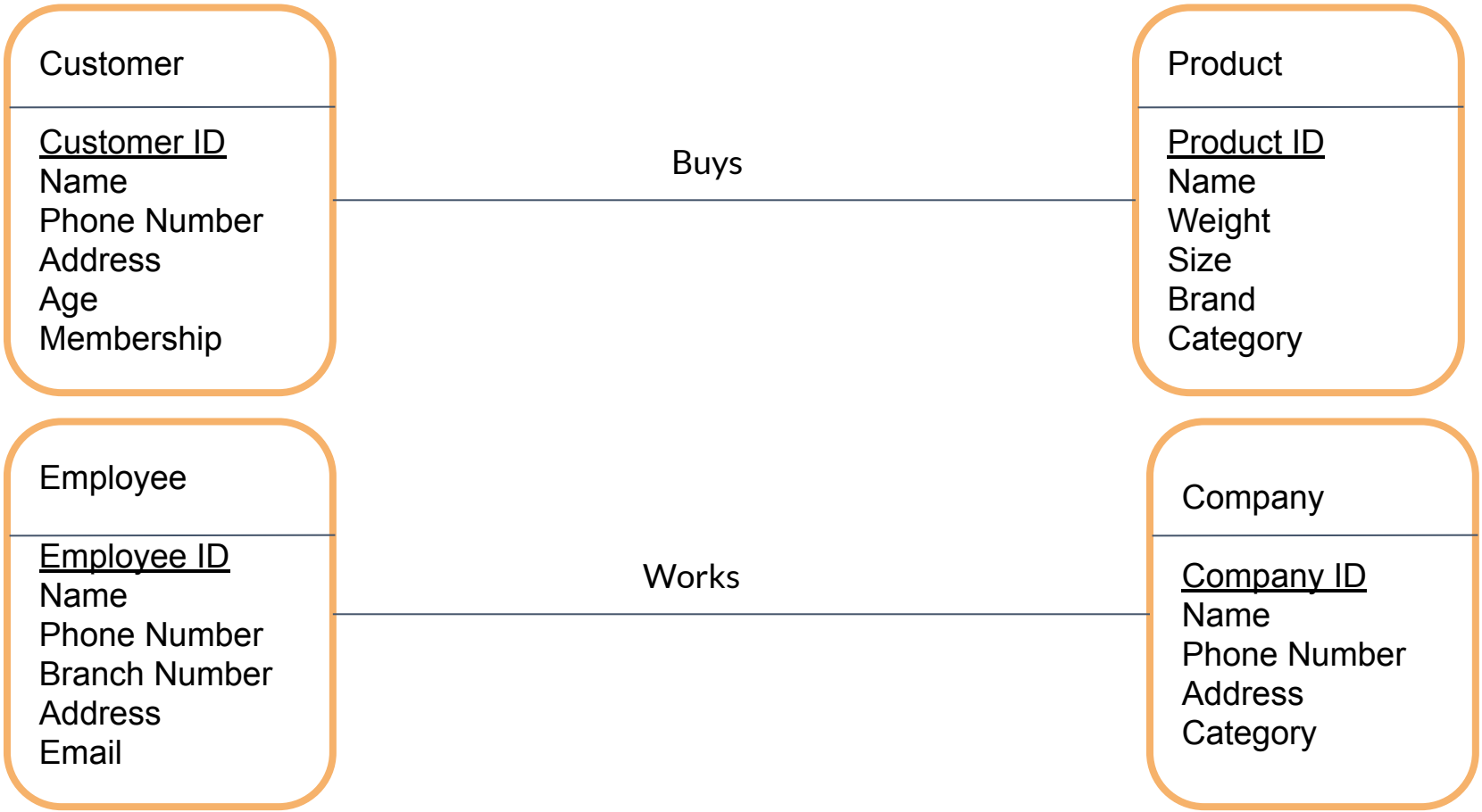
- A Binary relation connects two different entities. For example, a customer ‘buys’ products.
- A Ternary relation connects three different entities.

A relation is a table in a relational model.

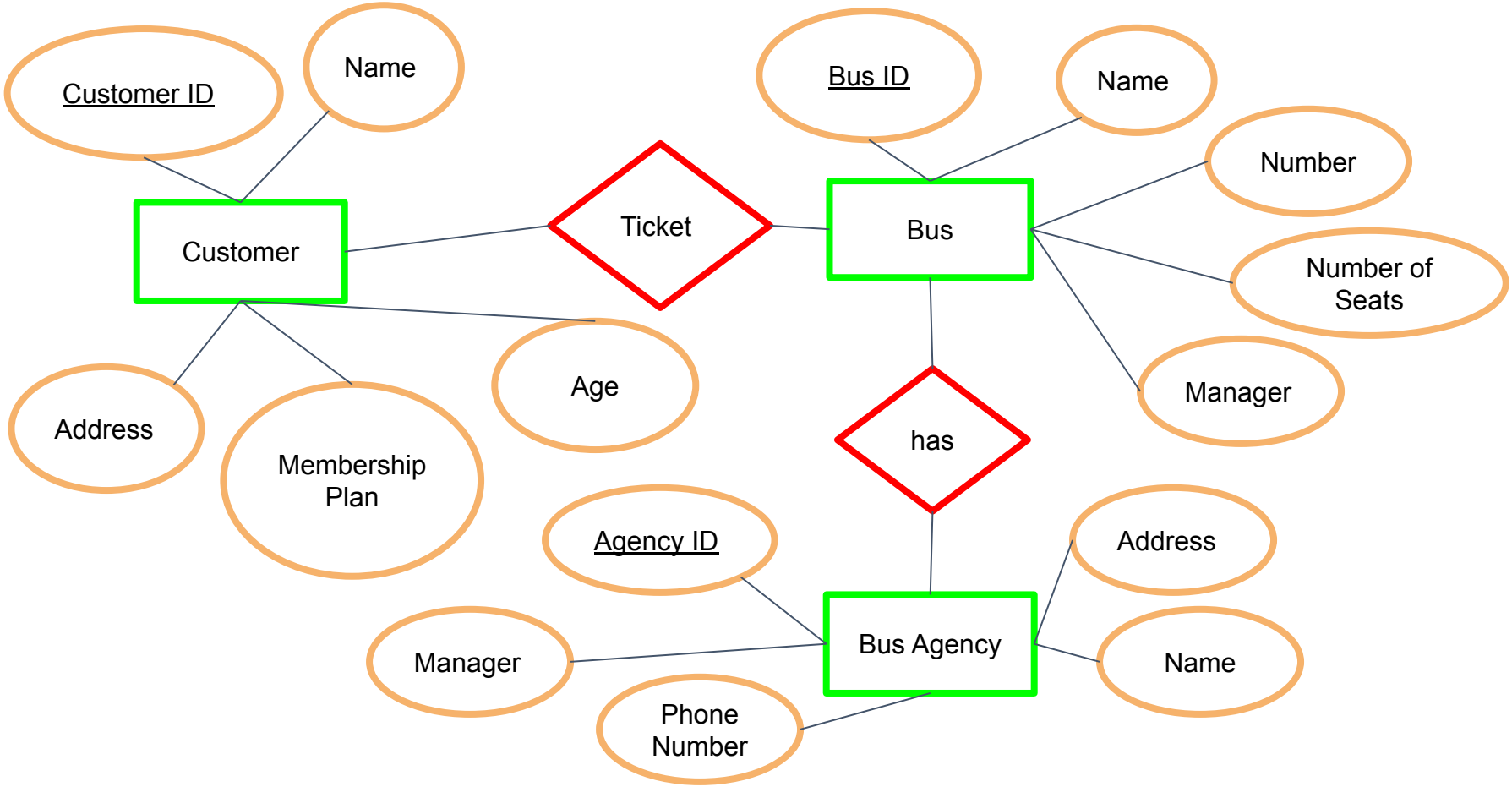
How Relations between Entities are Represented?

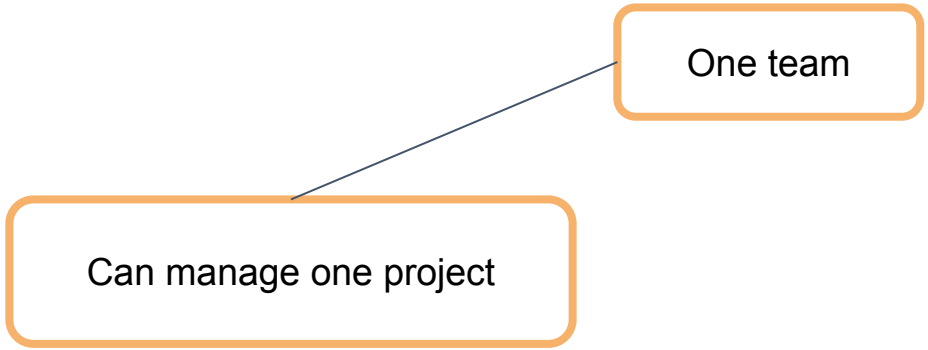


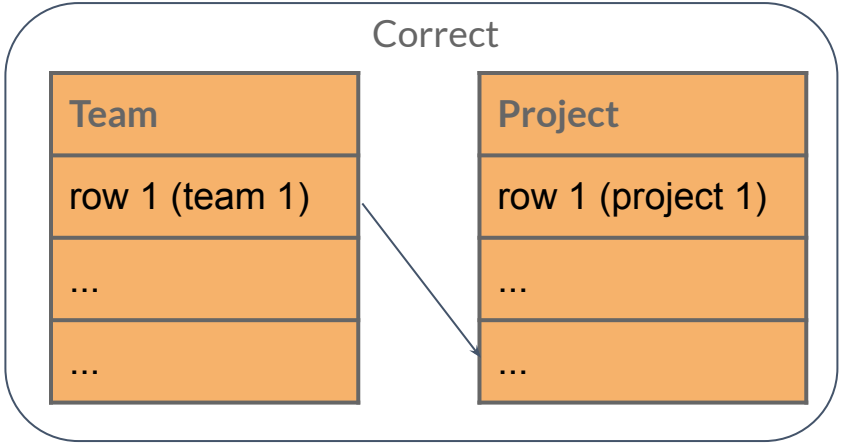
Representation of Relations in an E-R Model



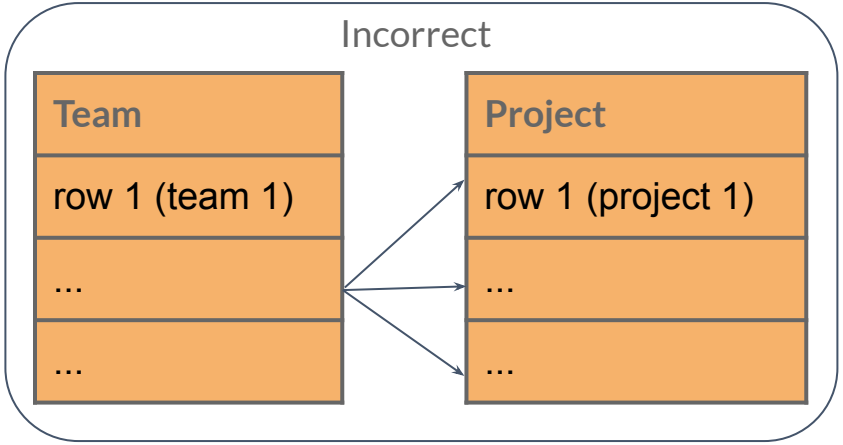
E-R Diagram for a Bus Ticket Booking System



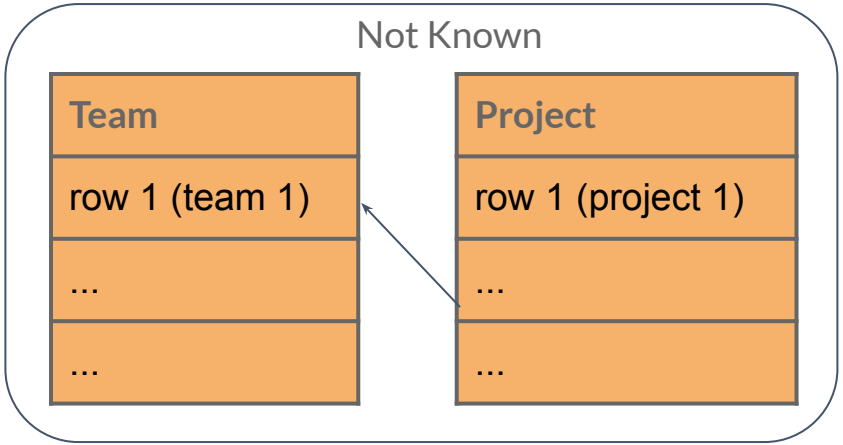

One team
Can manage one project

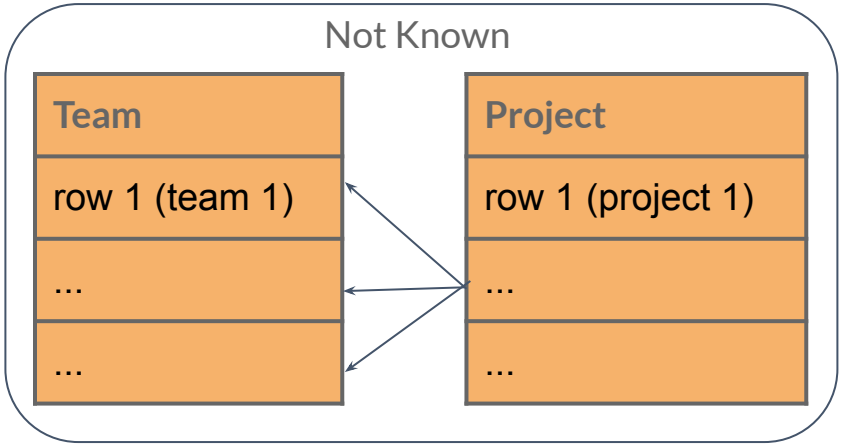


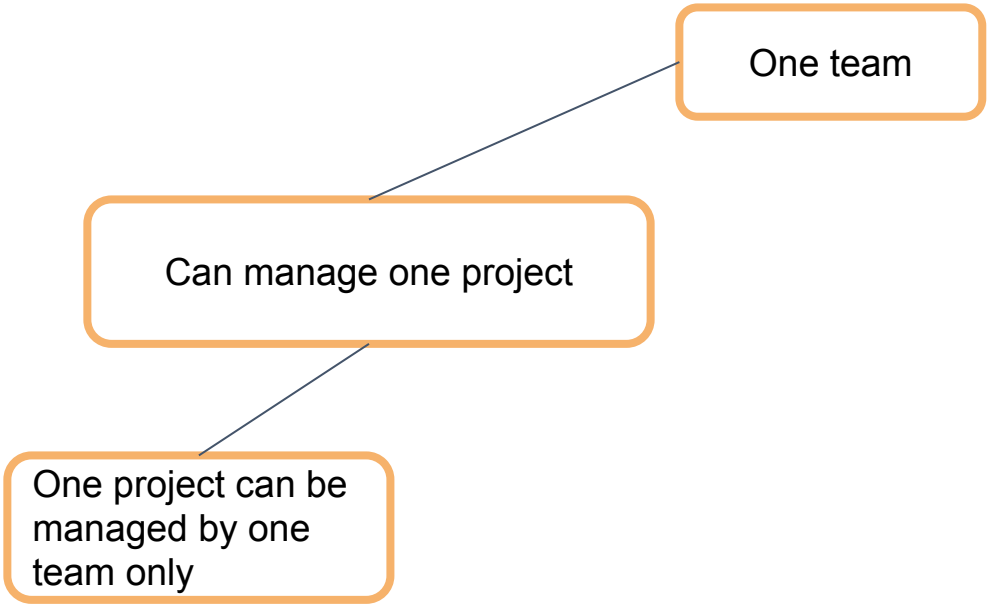
Project-Side Participation is One

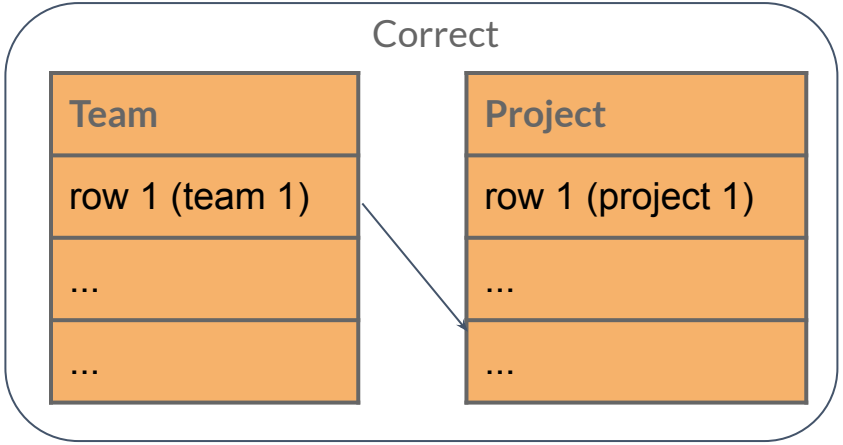


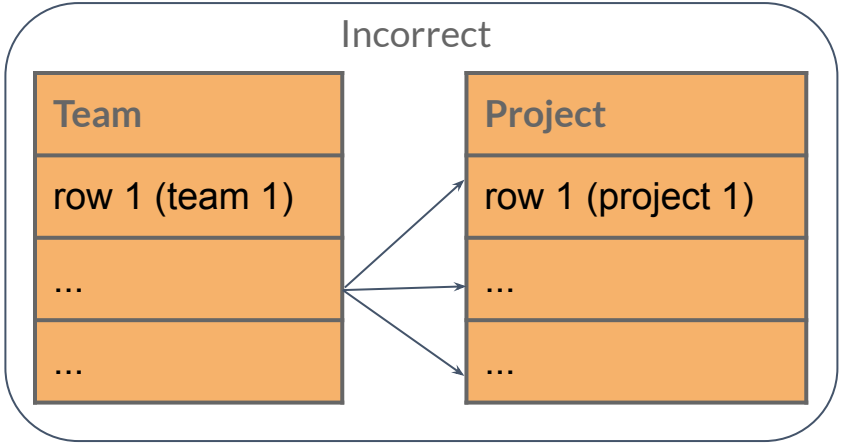
Team-Side Participation is Not Known





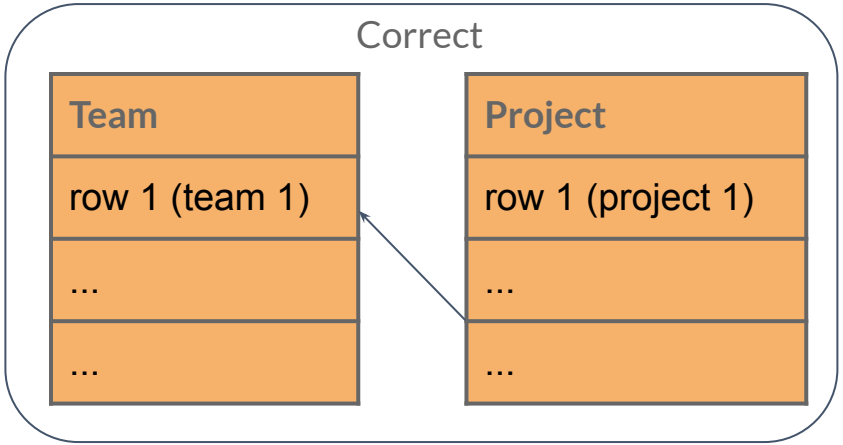

One team
Can manage one project
One project can be managed by one team only

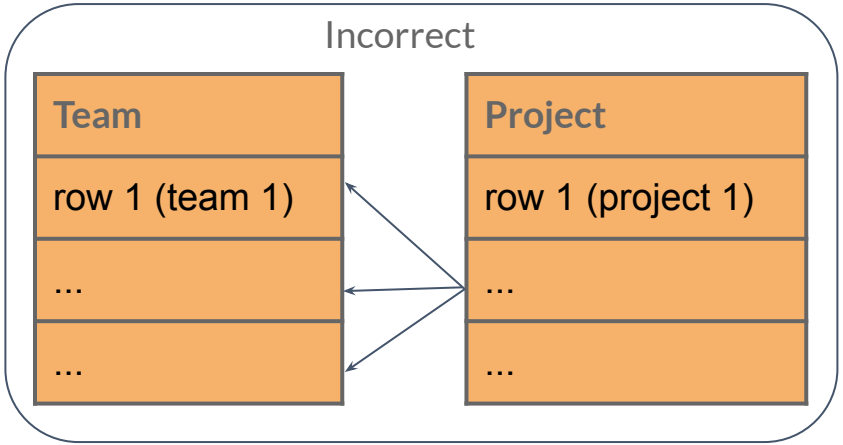


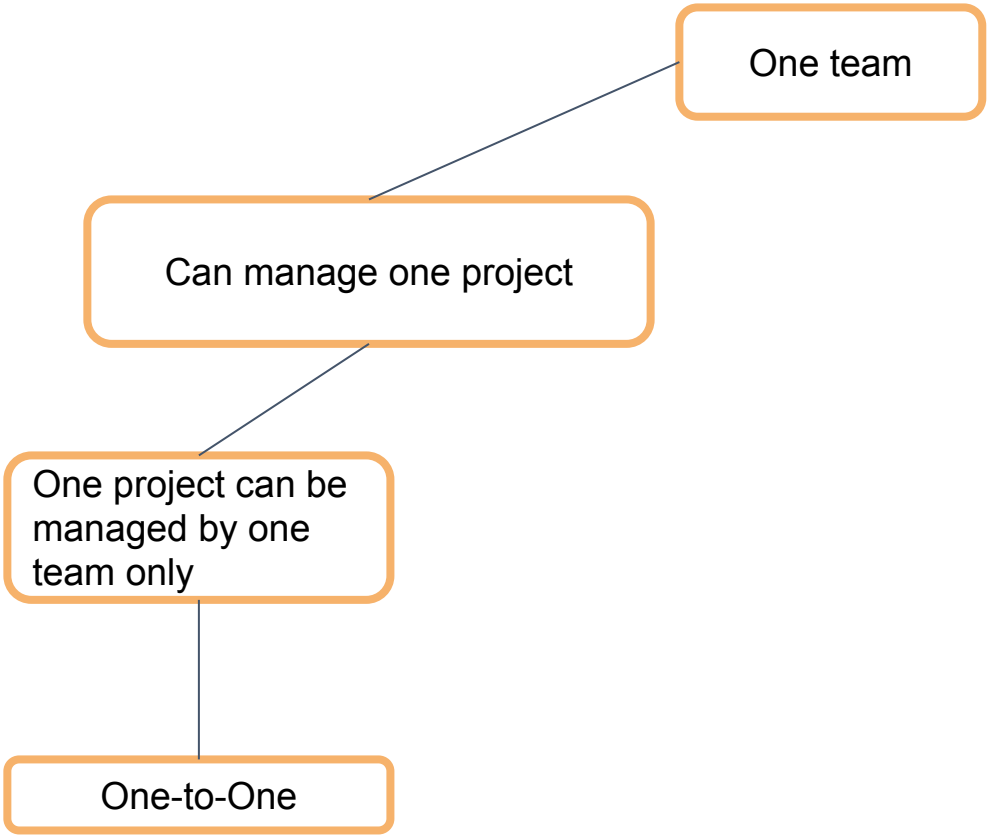


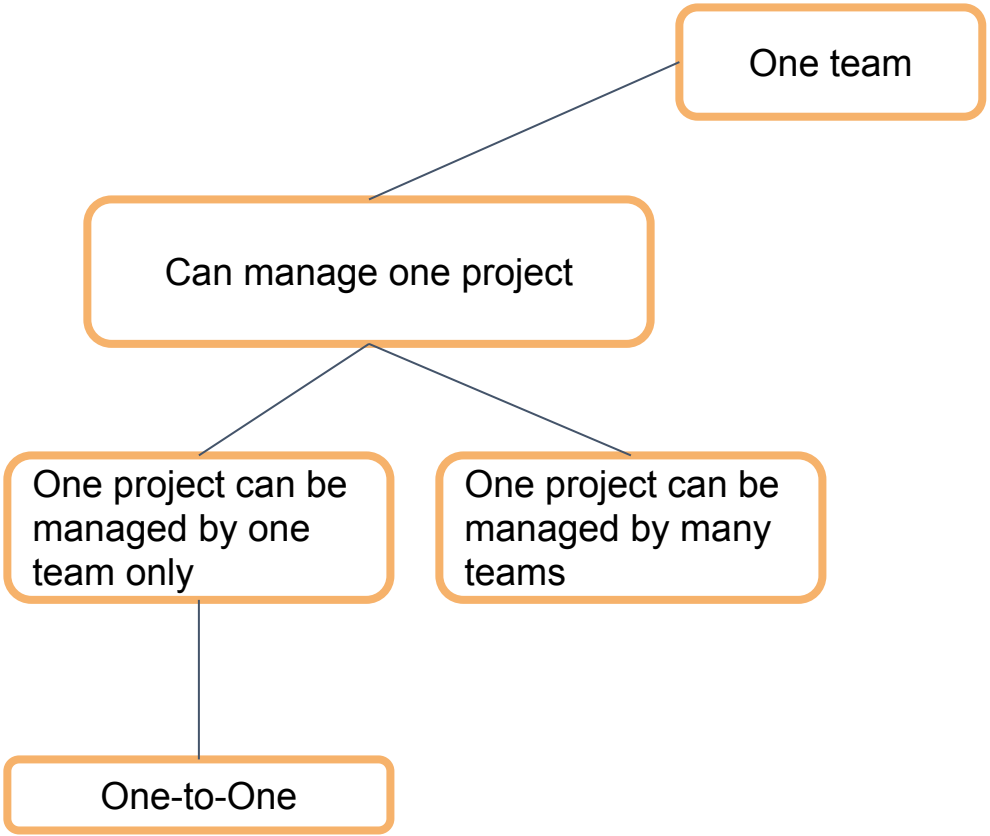
Project-Side Participation is One

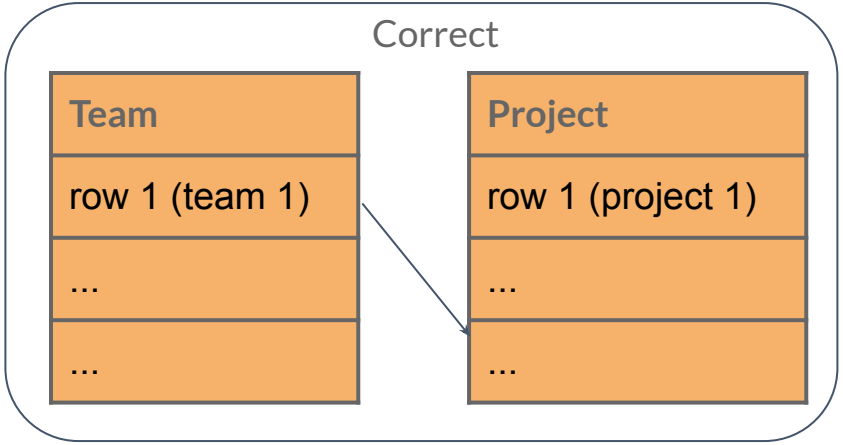
Team-Side Participation is One



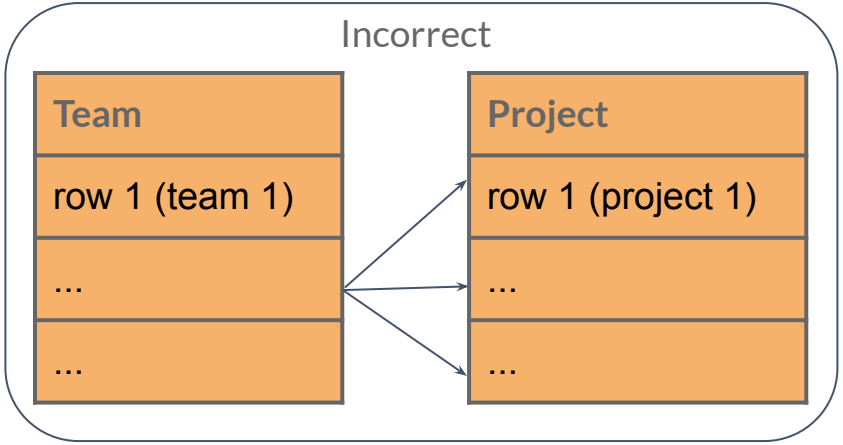



One team
Can manage one project
One project can be managed by one team only
One-to-One

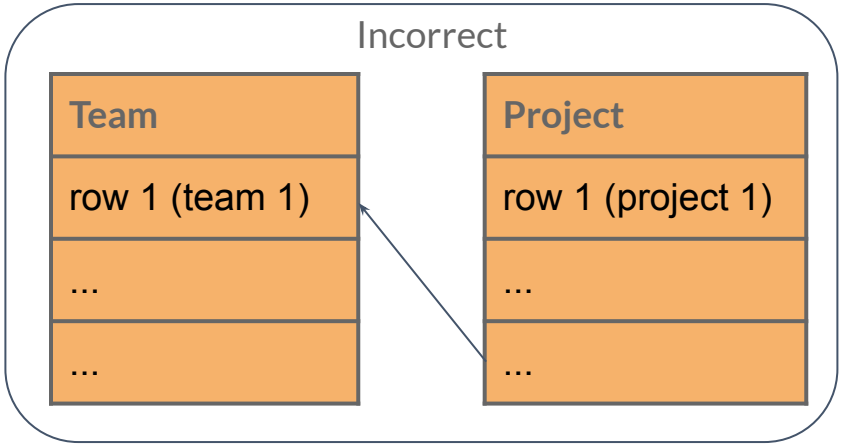

One team
Can manage one project
One project can be managed by one team only
One project can be managed by many teams
One-to-One

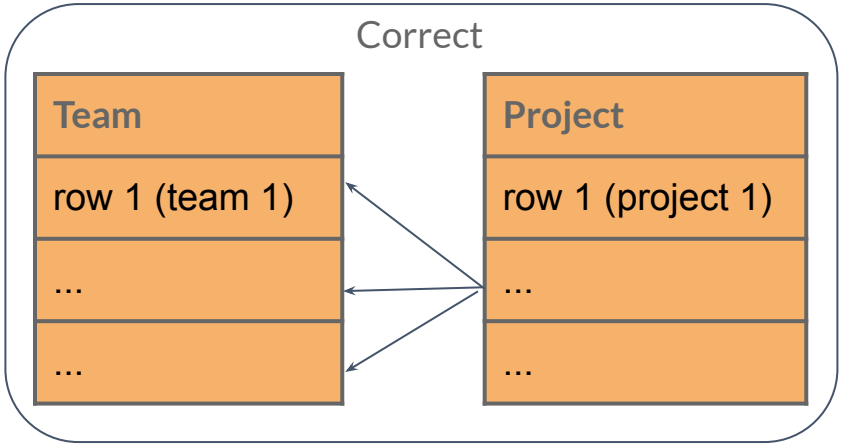


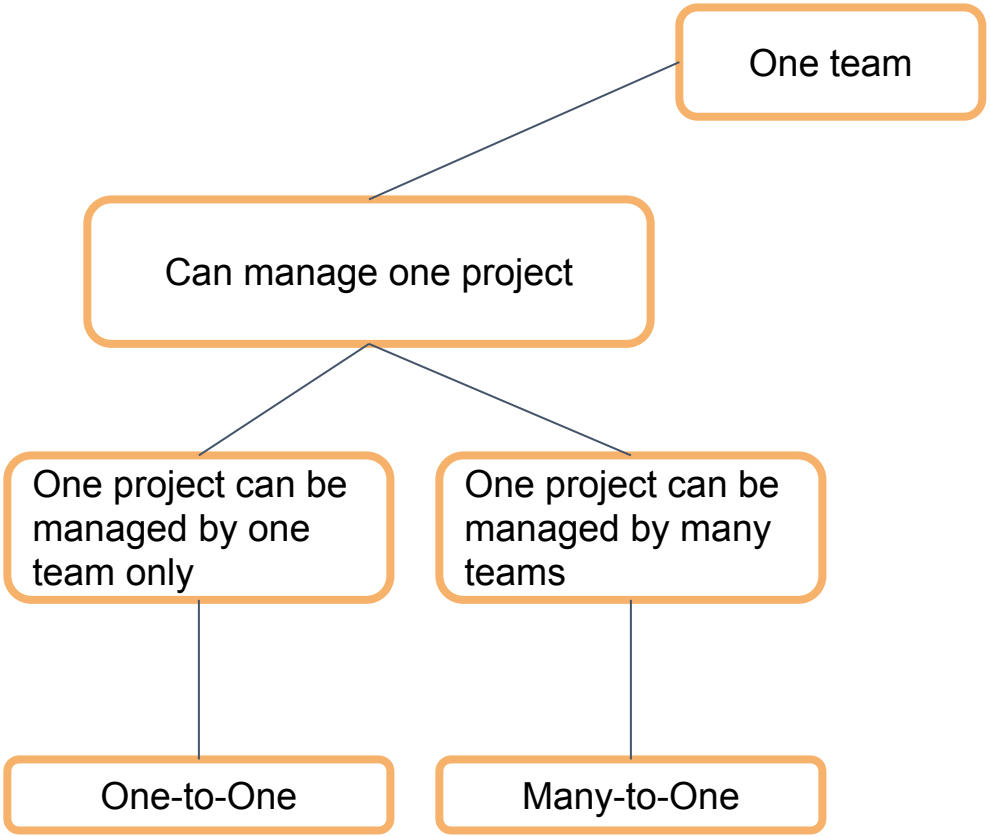
Project-Side Participation is One

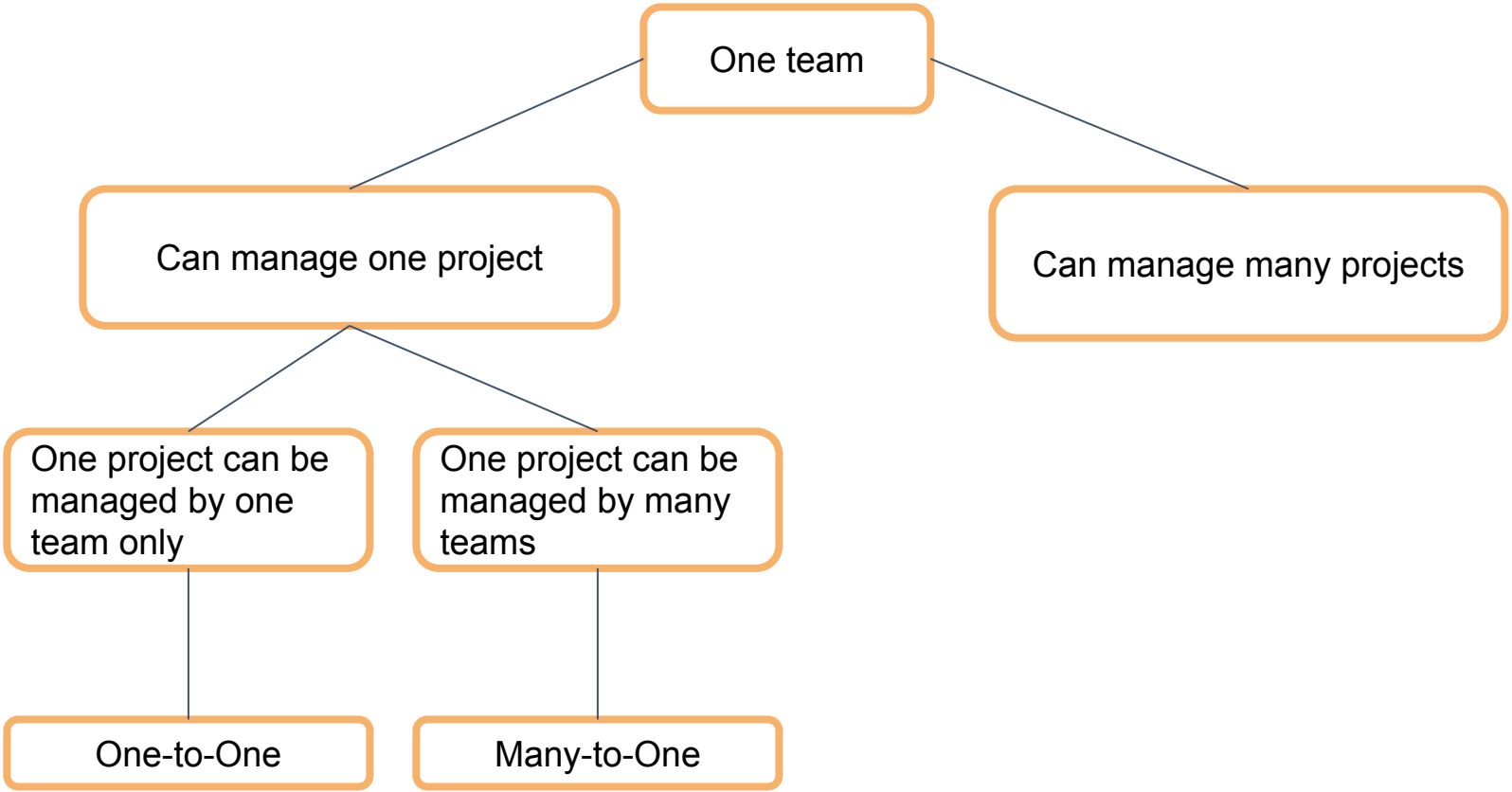


Team-Side Participation is Many






One team
Can manage one project
One project can be managed by one team only
One project can be managed by many teams
One-to-One
Many-to-One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Can manage many projects
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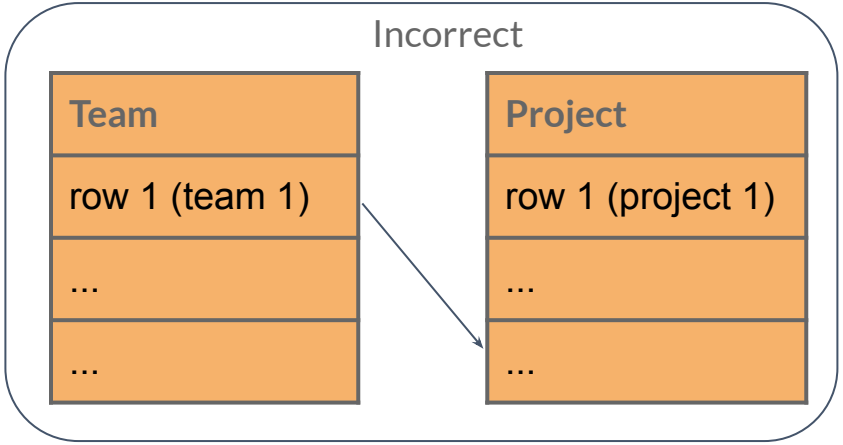
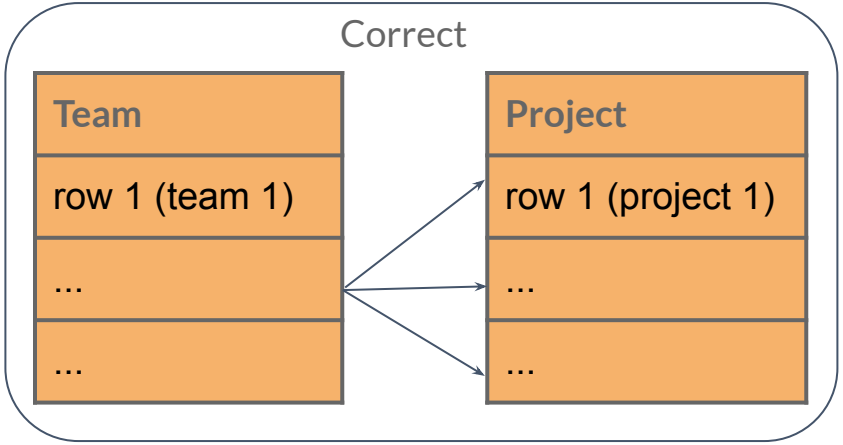
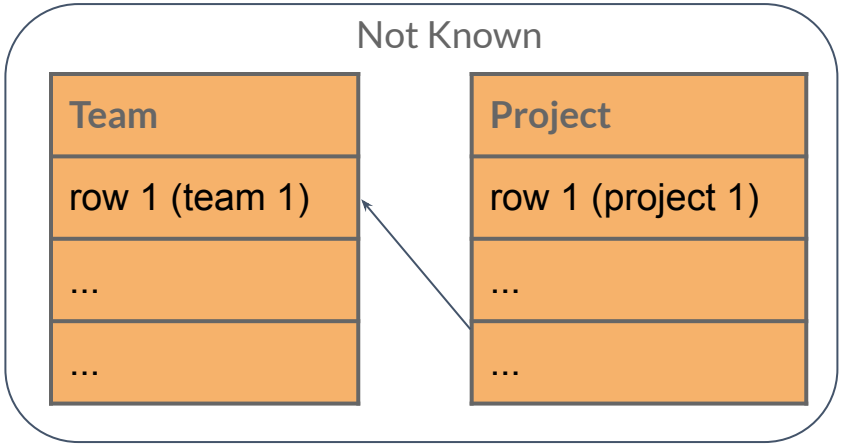
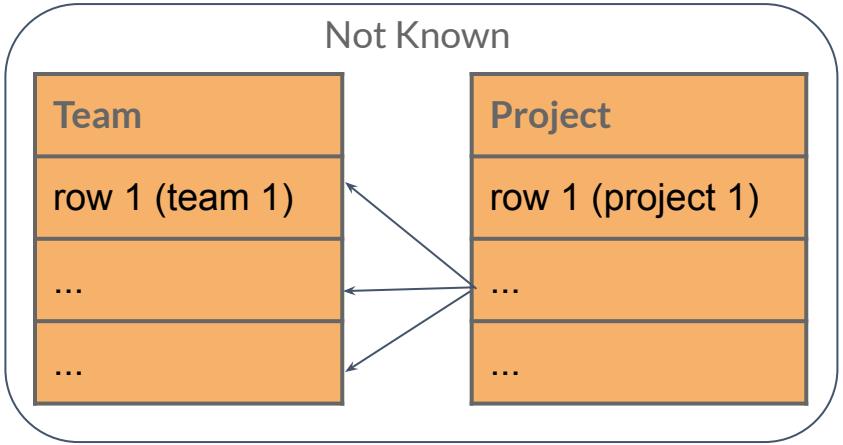


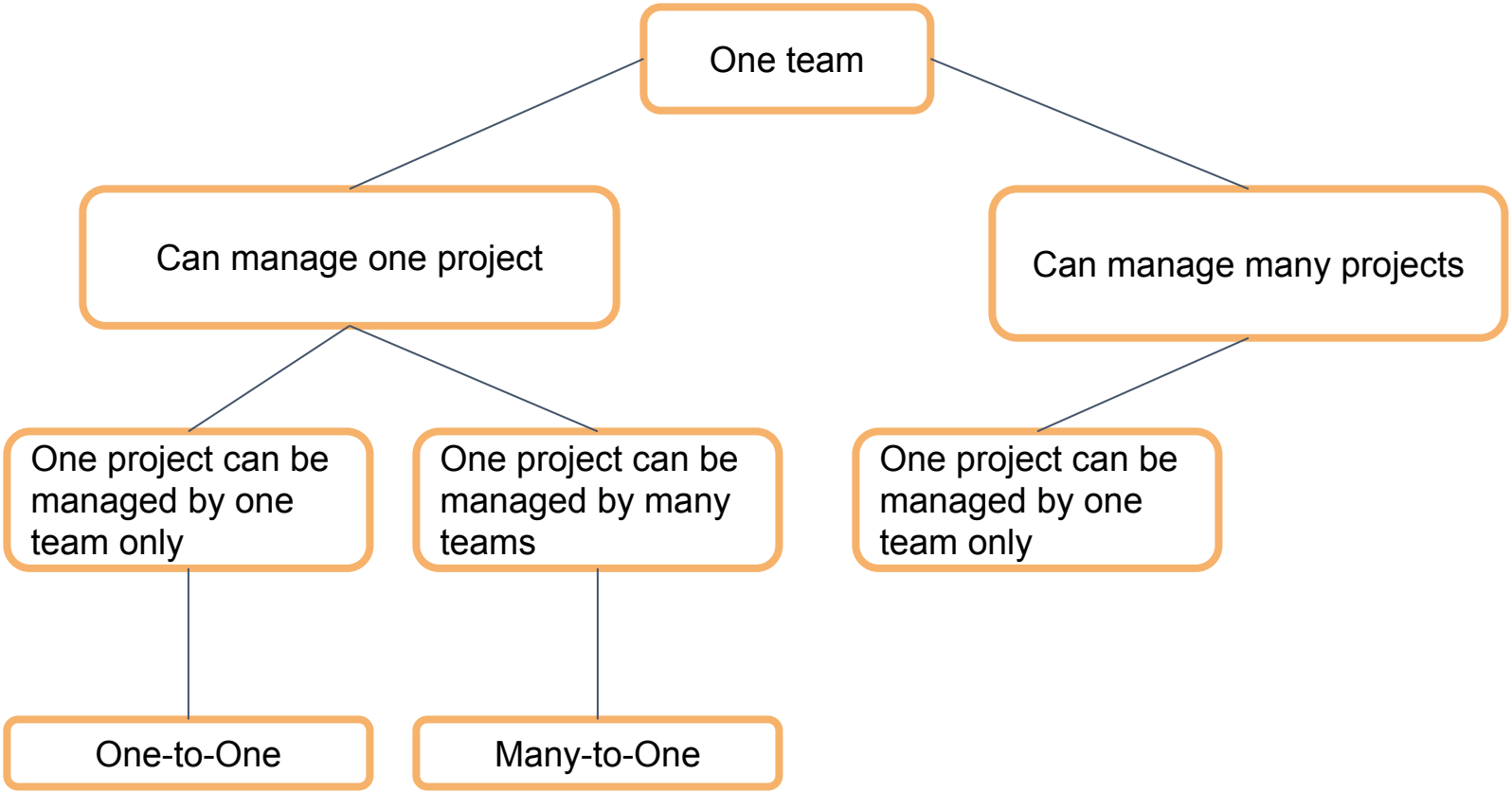


Project-Side Participation is Many

Team-Side Participation is Not Known



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One-to-One
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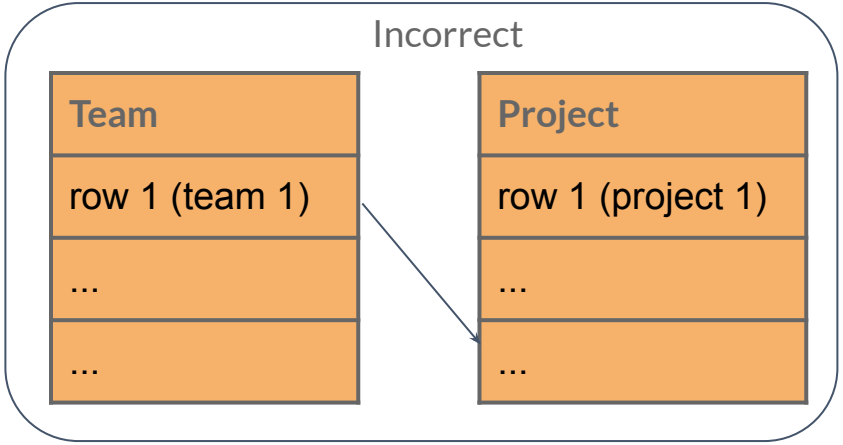
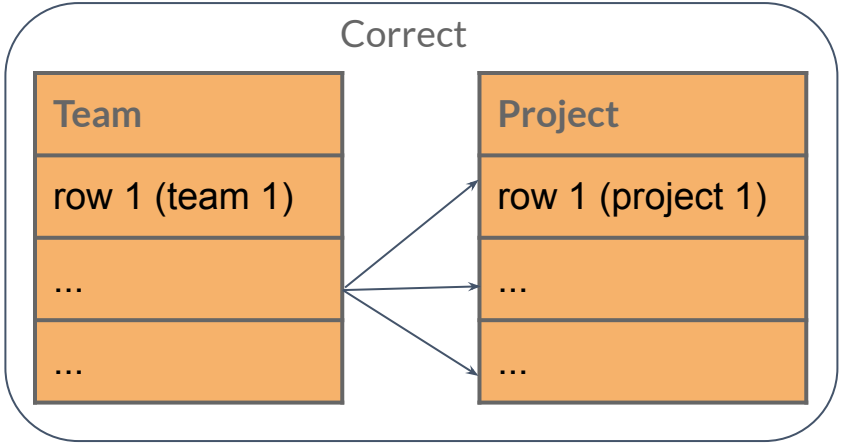
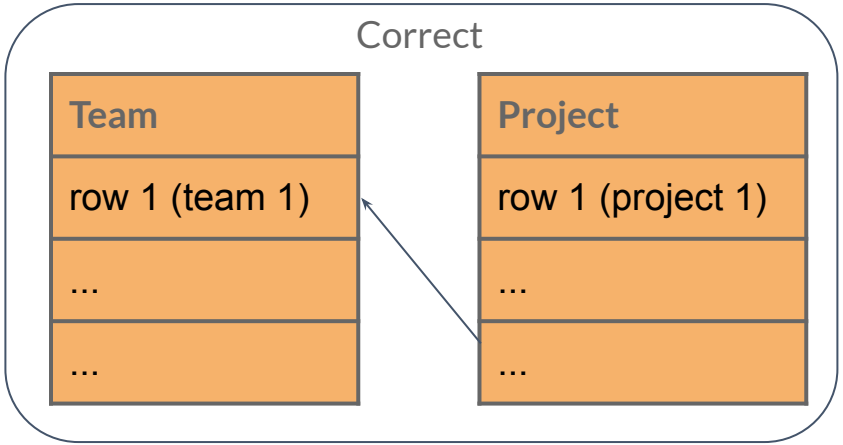
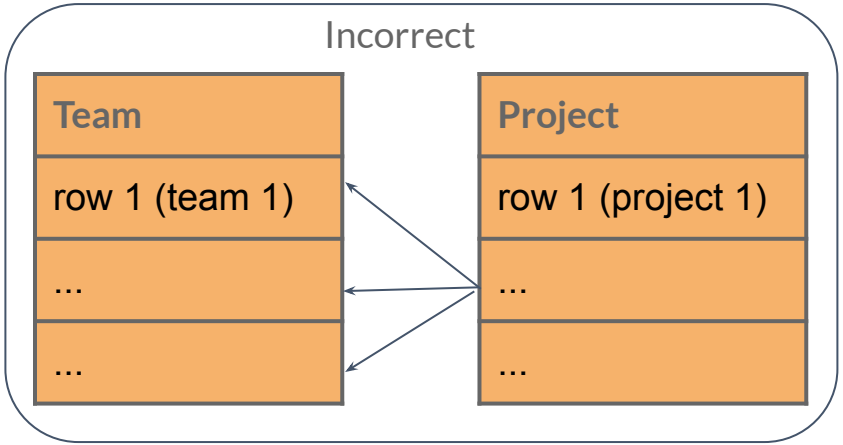


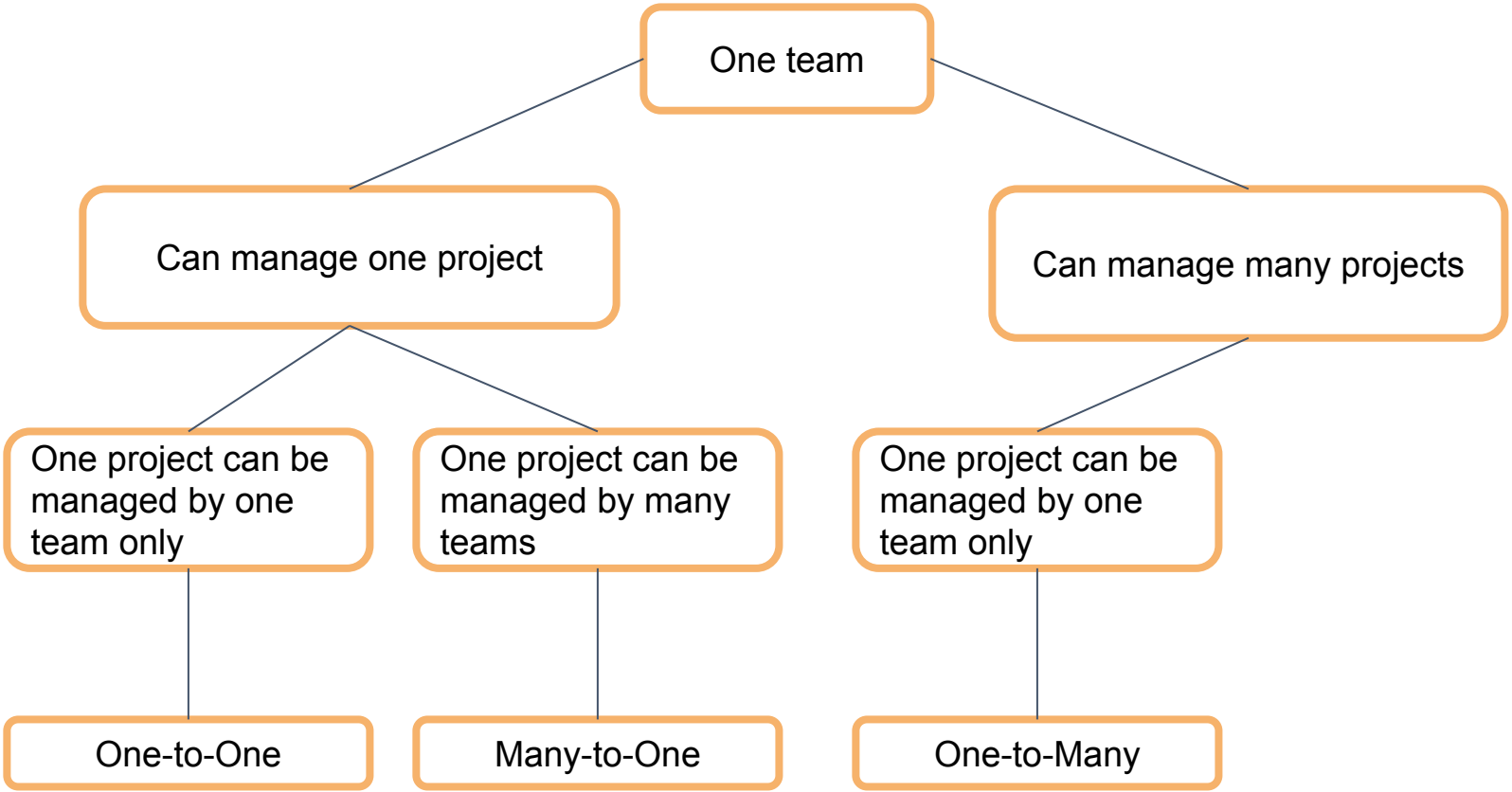


Project-Side Participation is Many

Team-Side Participation is One



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One-to-One
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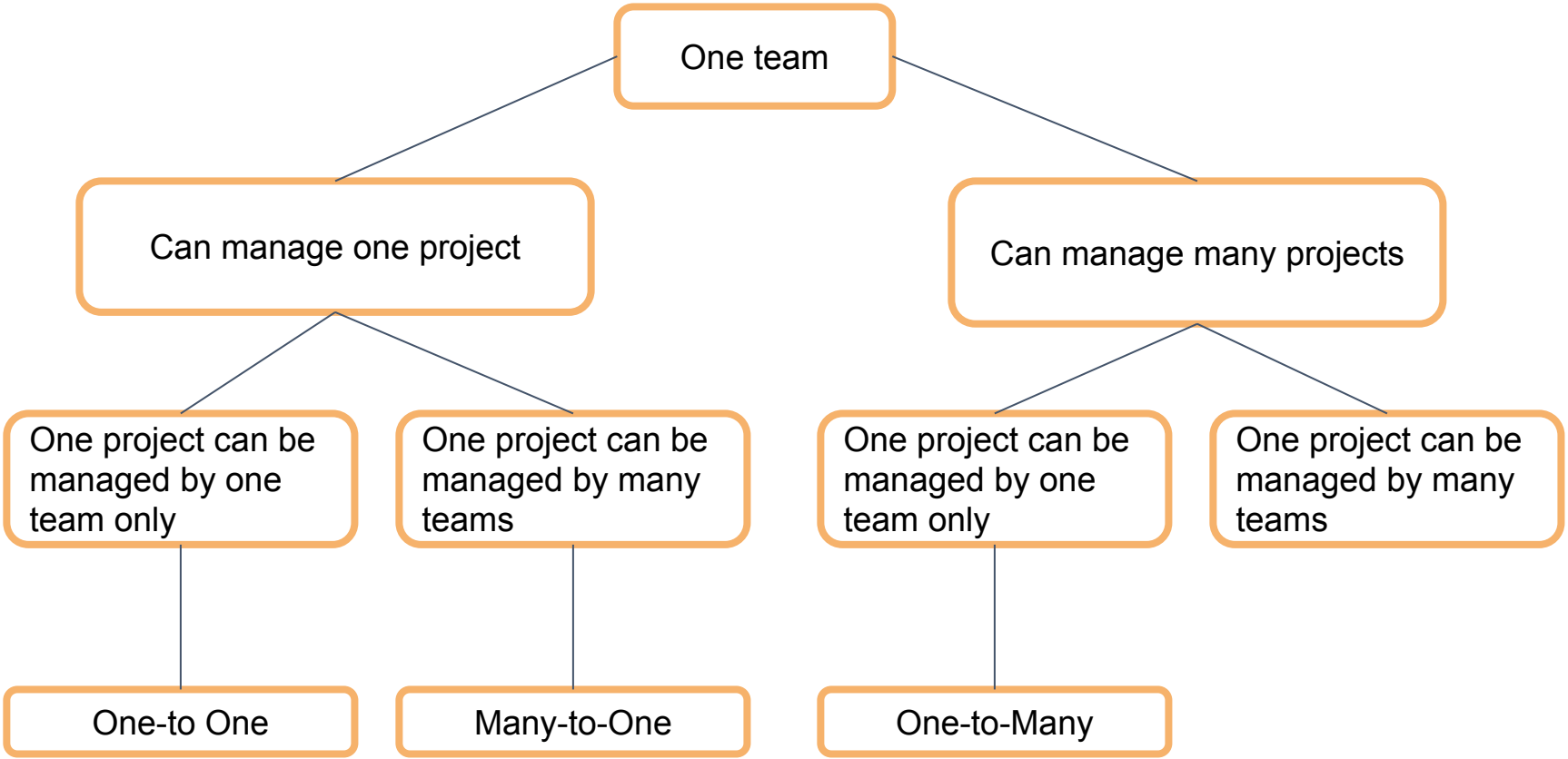
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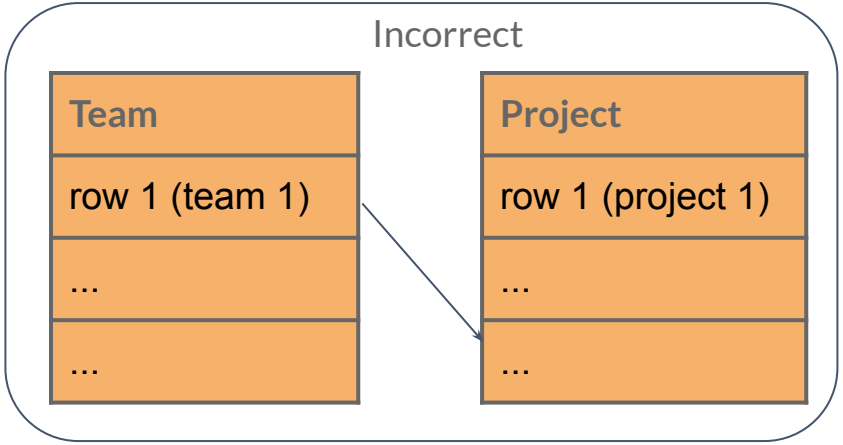
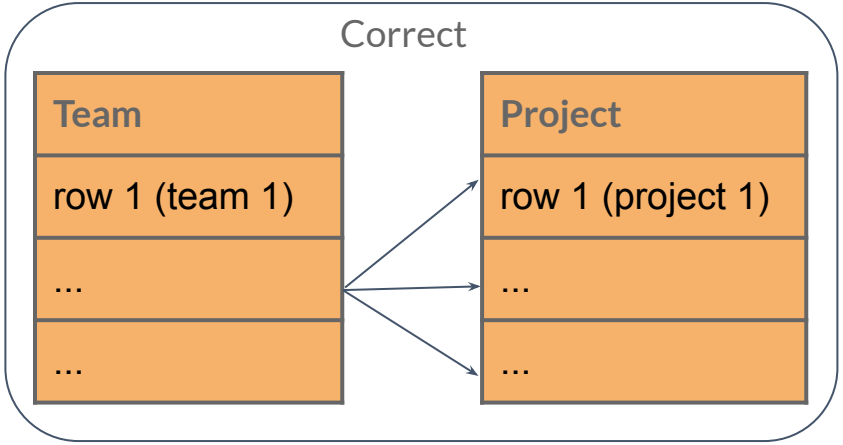
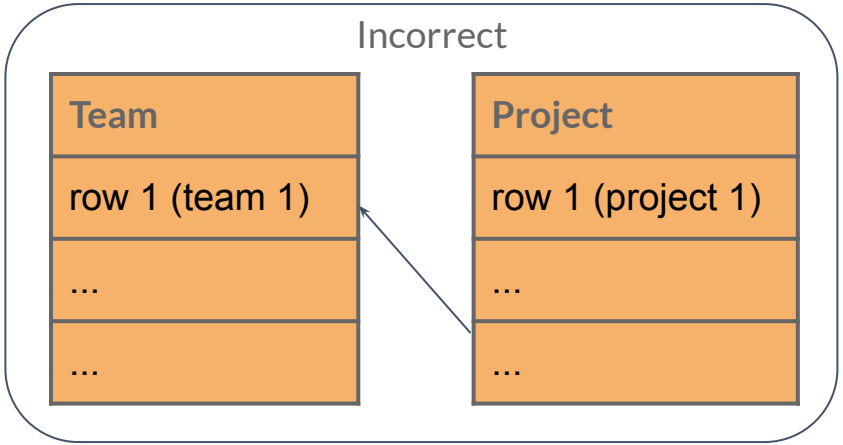
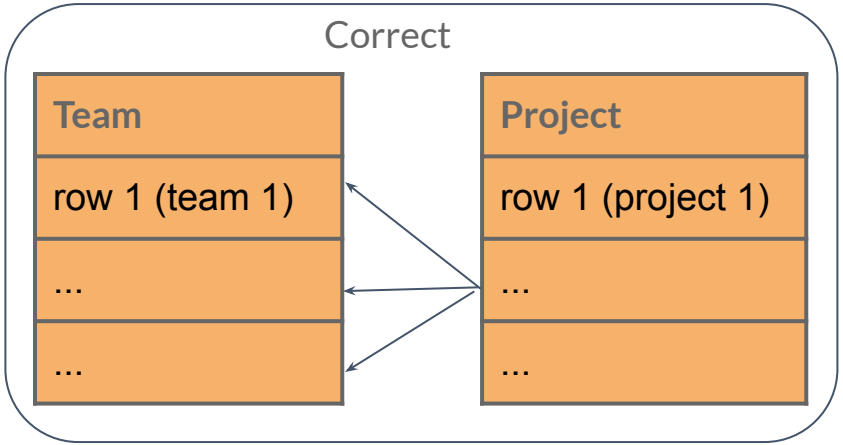


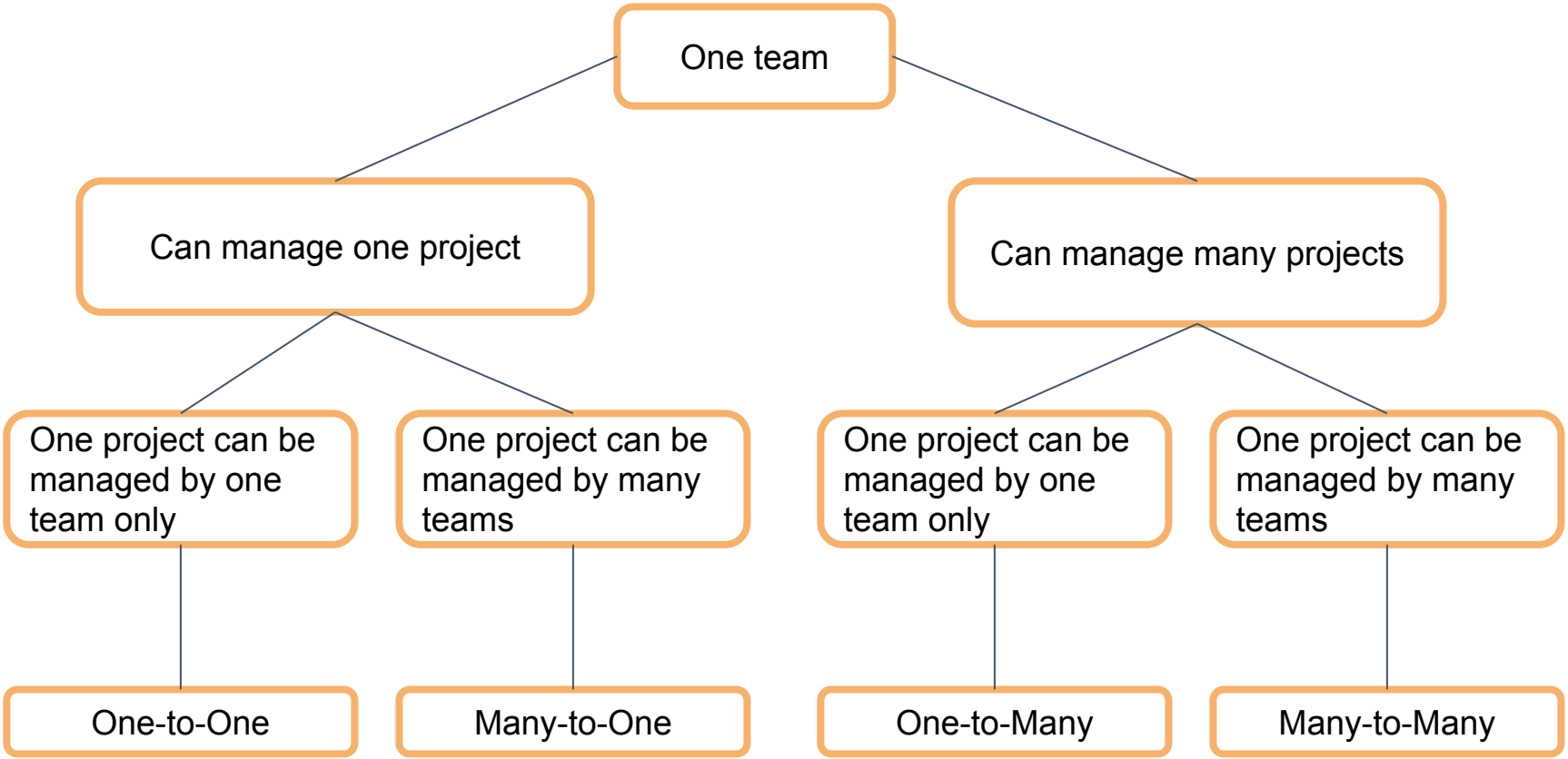


Project Side Participation is many

Team Side Participation is many



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One-to-One
Many-to-One
One-to-Many
Many-to-Many

One to One Relation

2 One to Many Relation

3 Many to Many Relation

Summary

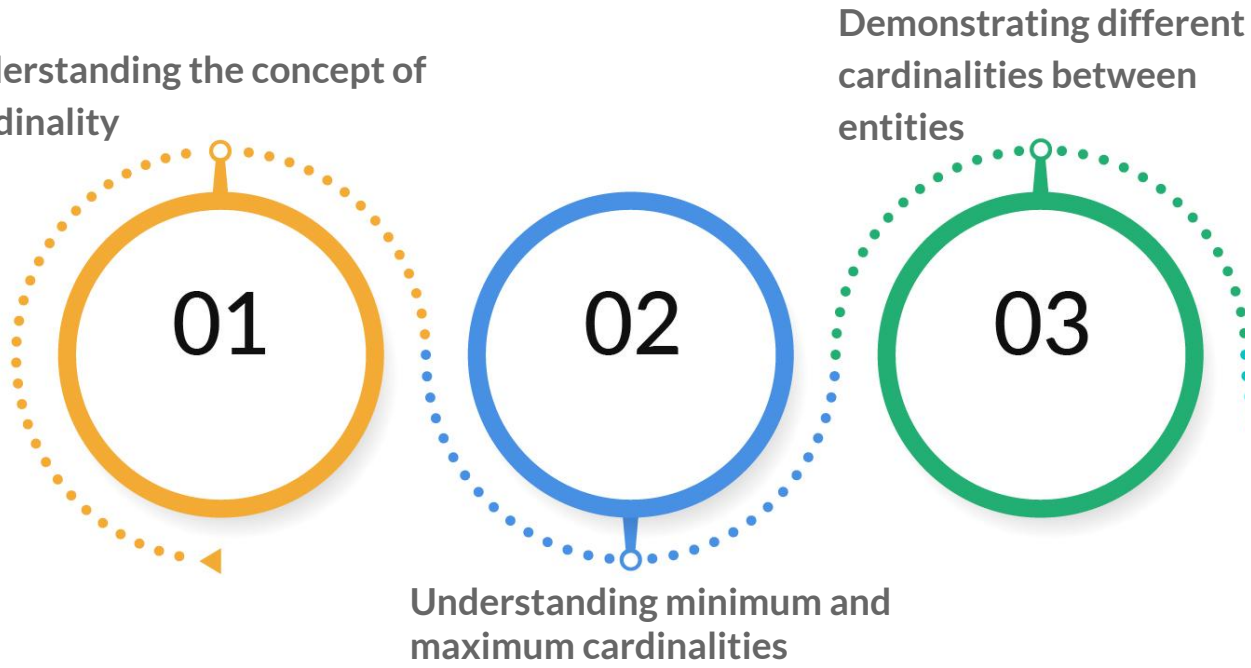
01 When the maximum participation from each entity is one, the relation is one-to-one.

02 When the maximum participation from one of the entities is N, the relation is one-to-many.

03 When the maximum participation from both the entities is N, the relation is many-to-many.

Segment 6 | Cardinality in an E-R Model

In This Segment



Minimum Cardinality

Optional Participation (CAN)

01 A Team can participate in a relation with the Project entity. A team may or may not handle any project. The minimum cardinality of team is 0.

02 A Project can participate in a relation with the Team entity. A project may or may not be handled by any team. The minimum cardinality of project is 0.

Mandatory Participation (MUST)

01 A Team must participate in a relation with the Project entity. A team must handle at least one project. The minimum cardinality of team is 1.

02 A Project must participate in a relation with the Team entity. A project must be handled by at least one team. The minimum cardinality of project is 1.

Maximum Cardinality

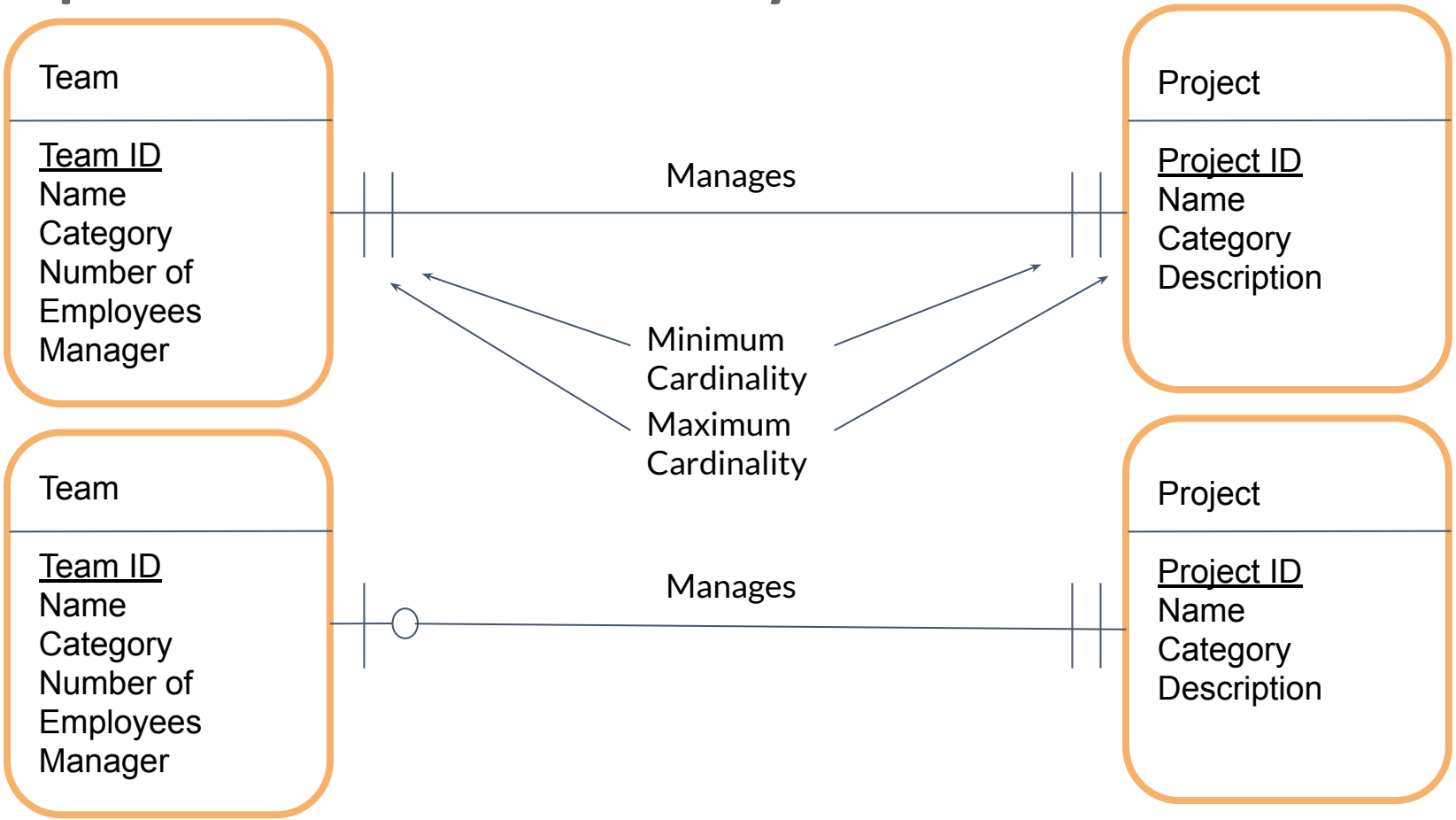
Maximum cardinality is the degree of relation between two entities.

If the relation between the team and project entities is many-to-many, then the maximum cardinality of team is N and that of the project entity is N as well.

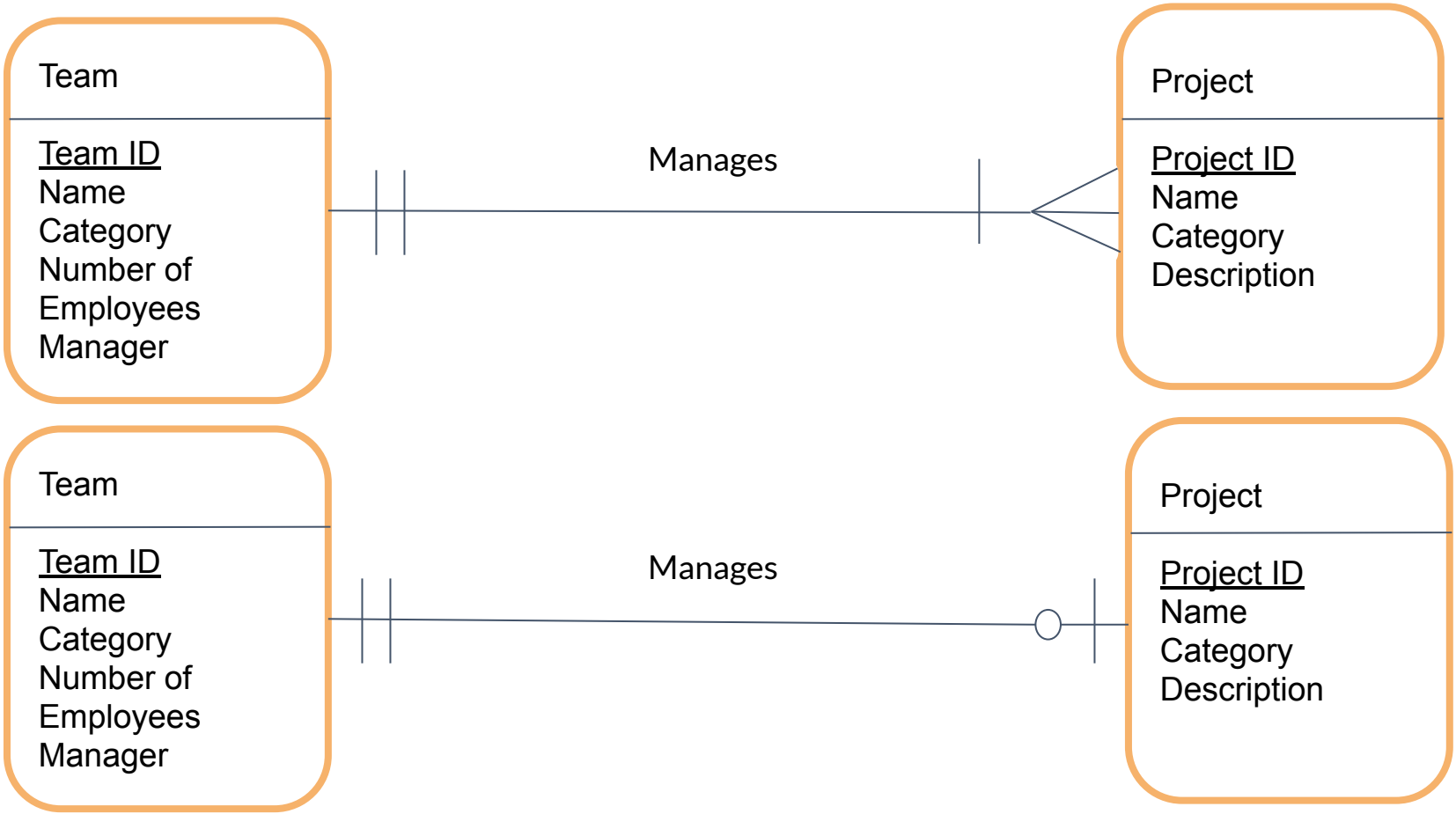
If the relation between the team and project entities is one-to-one, then the maximum cardinality of both entities is 1.

If the relation between the team and project entities is one-to-many, then the maximum cardinality of team is 1, whereas that of the project entity is N.

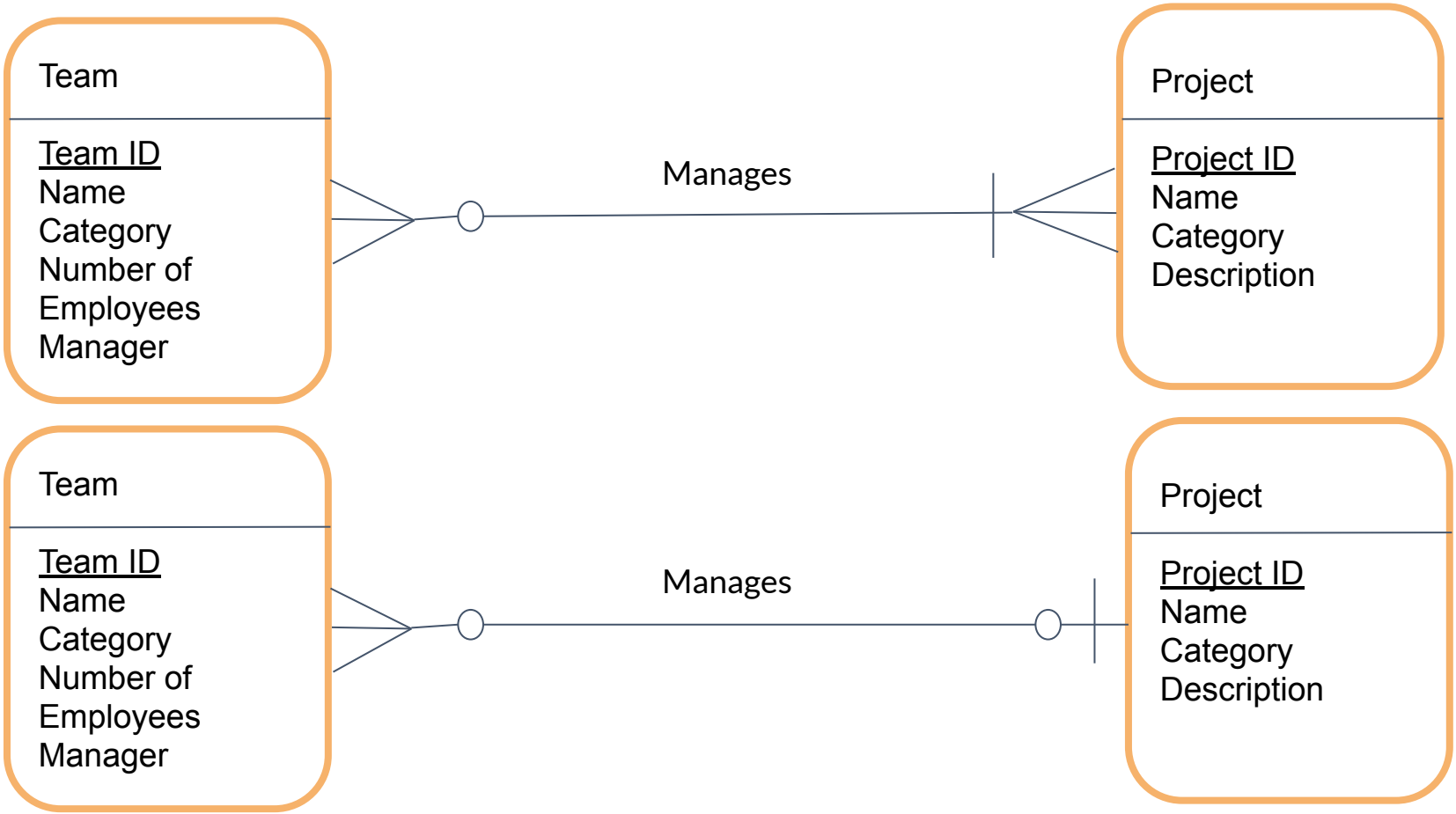
Representation of Cardinality



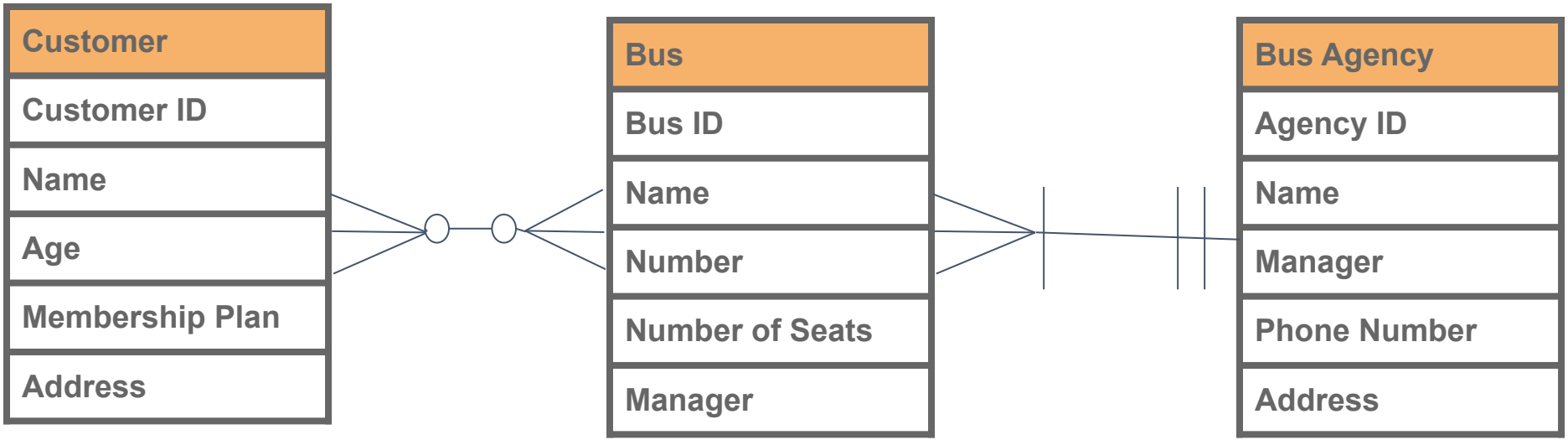
Representation of Cardinality



Representation of Cardinality



Representation of Cardinality for Bus Ticket Booking



Summary

01 Minimum cardinality defines whether the entity participation in a relation is mandatory or optional.

02 Maximum cardinality defines the degree of relation between two entities.

03 For a one-to-many relation, the entity on the One side has a maximum cardinality of 1, whereas the entity on the Many side has a maximum cardinality of N.

Session Summary

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

02 **Entities** are those business concepts about which a company collects data.

03 **Attributes** are the properties of entities. They define what data must be known for each entity.

04 A Unary relation or recursive relation relates one row of an entity to another.

05 A Binary relation connects two different entities.

06 A Ternary relation connects three different entities.

07 Minimum cardinality defines whether participation of an entity in a relation is optional or mandatory.

08 If the maximum cardinality of both the entities in a relation is 1, then **the degree of relation is one-to-one**.

09 If the maximum cardinality of both the entities in a relation is N, then **the degree of relation is many-to-many**.

10 If the maximum cardinality of one entity is 1, whereas that of the other entity is N, then **the degree of relation is one-to-many**.

Thank You