UNIT II
CONCEPTUAL DATABASE DESIGN
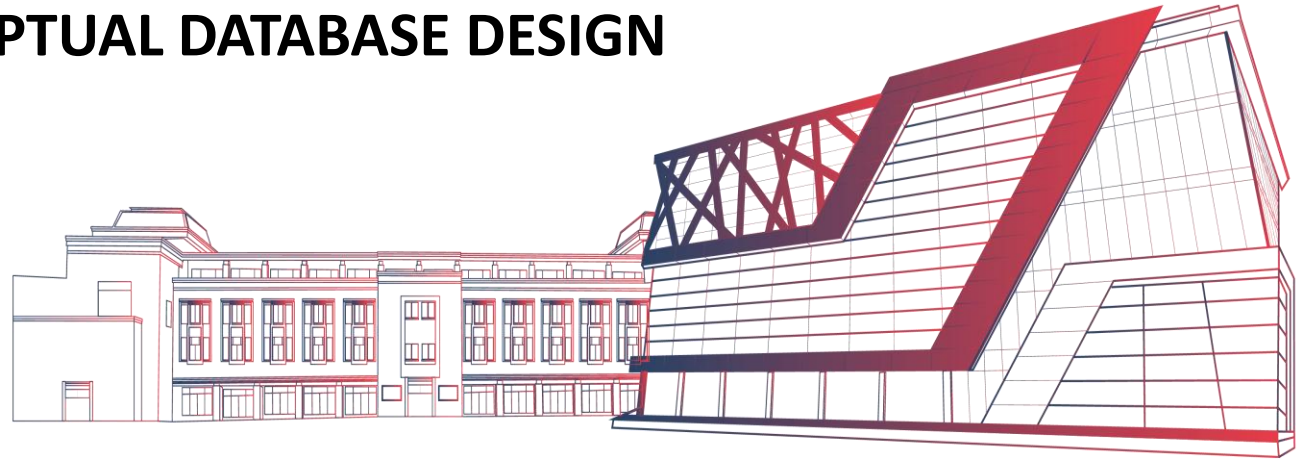
Database Design

Motivation - Why   Model?

Model → **Understand/ Comprehend** → **Control**

Analysis & Conceptualization

Presentation
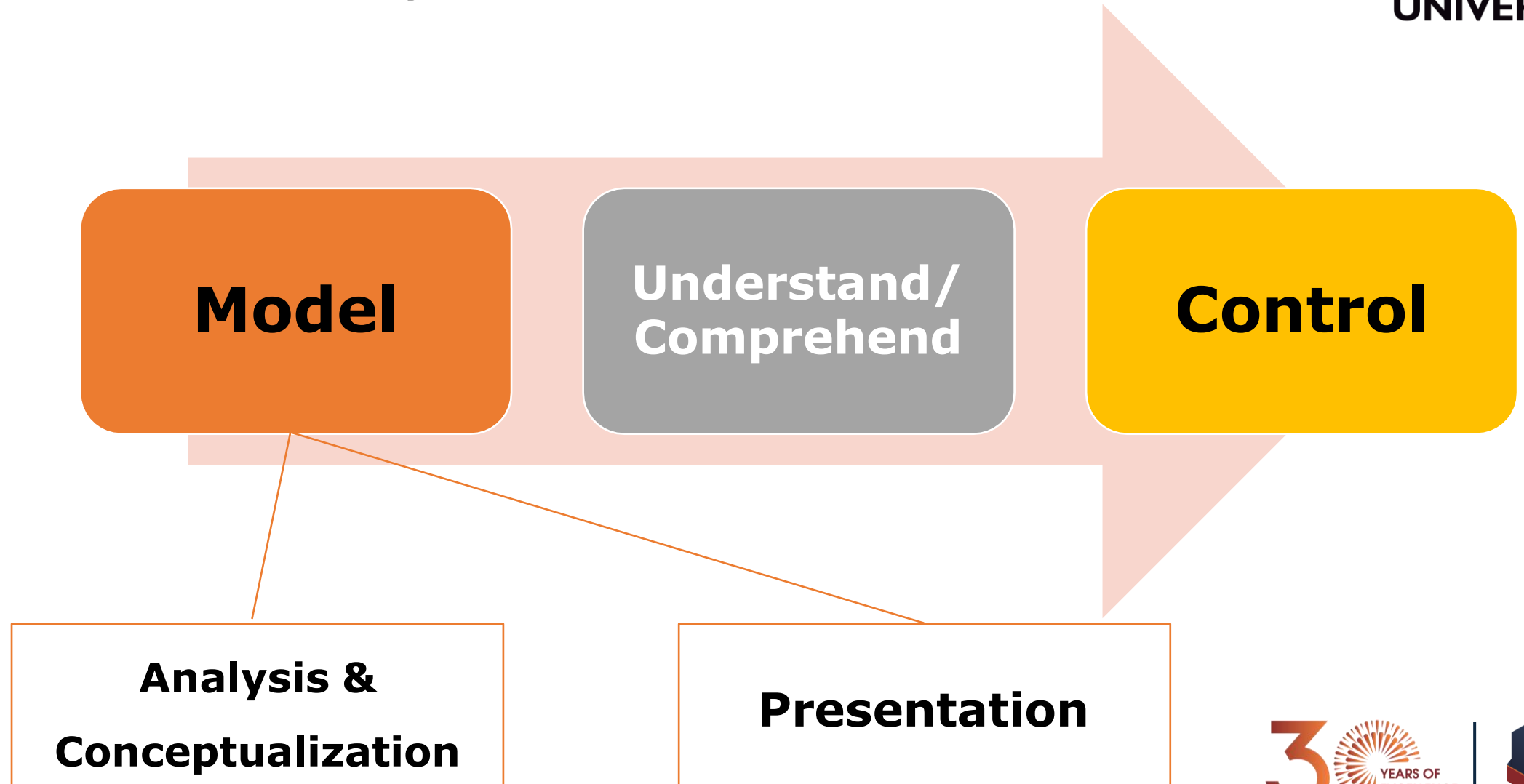
Why Design & Organize?

- **DATA**

Unorganized form
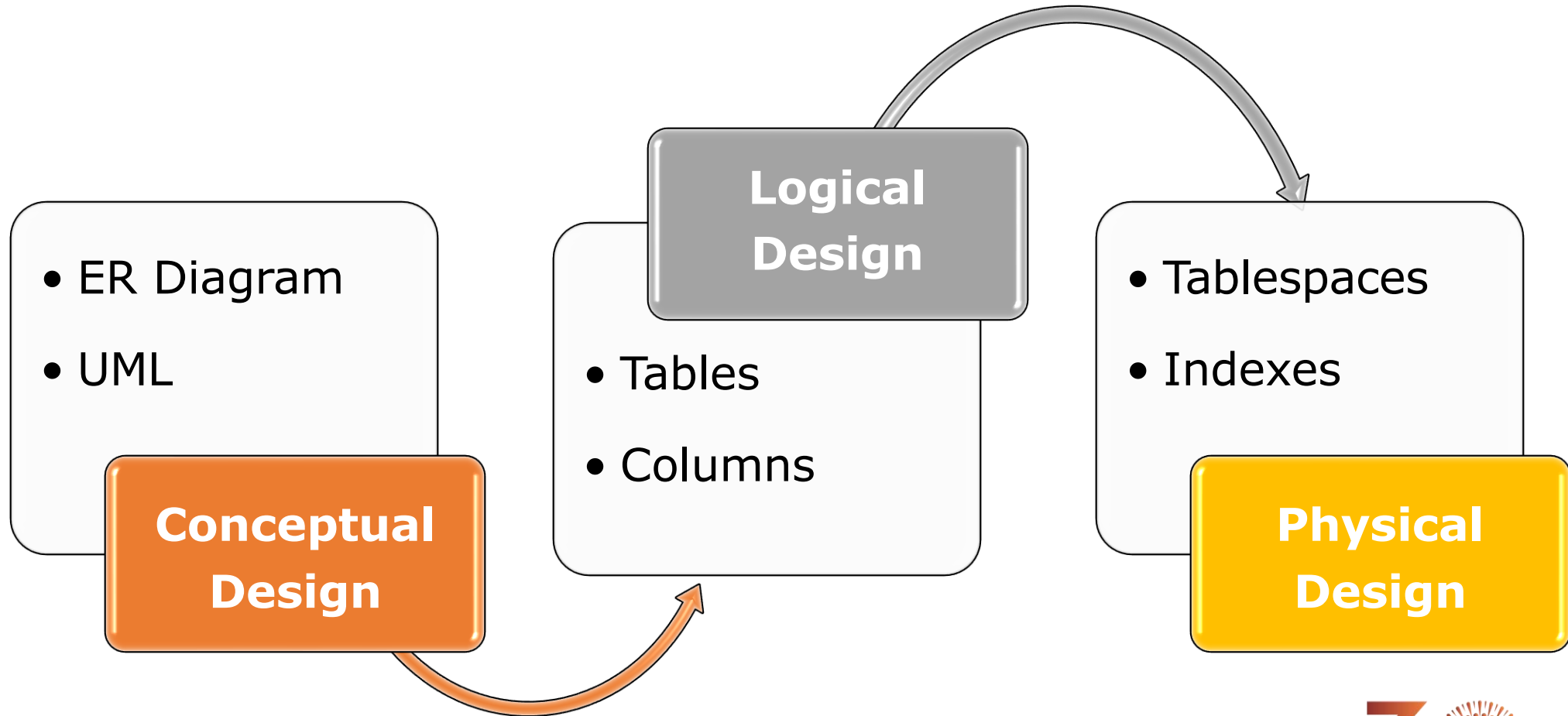
Eg. student's Score

- **INFORMATION**

processed, structured and

organized data

Eg. class average which can be

calculated from data.

Phases of Database Design

- ER Diagram
- UML

Conceptual Design

Logical Design

- Tables
- Columns

- Tablespaces
- Indexes

Physical Design

Why ER Diagrams?

- Giving you image of how the tables should connect.

- What fields are going to be on each table.

- The tables connection, if many-to many, one-to-many.

"ER diagrams are easy for non-technical people to understand, and thus are typically used by database designers before the schema ever exists"

Example COMPANY Database

- The company is organized into DEPARTMENTs. Each department has a name, number and an employee who *manages* the department. We keep track of the start date of the department manager.

- Each department *controls* a number of PROJECTs. Each project has a name, number and is located at a single location.

Example COMPANY Database (Cont.)

- We store each EMPLOYEE's social security number, address, salary, sex, and birthdate. Each employee *works for* one department but may *work on* several projects. We keep track of the number of hours per week that an employee currently works on each project. We also keep track of the *direct supervisor* of each employee.

- Each employee may *have* a number of DEPENDENTs. For each dependent, we keep track of their name, sex, birthdate, and relationship to employee.

Entity

- An **entity** is something that exists by itself.

- *Entity:* Real-world object distinguishable from other objects.

- An entity is described using a set of *attributes*.
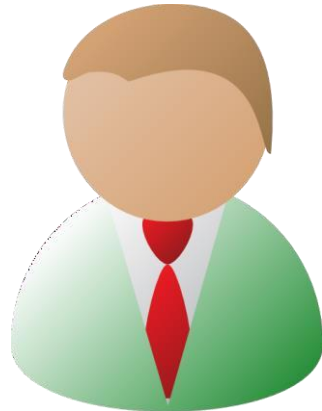
EMPLOYEE   **PROJECT**

# ER Diagram Symbols and Notations

Examples of Entities

- **Person: EMPLOYEE, STUDENT, PATIENT**

- **Place: STORE, WAREHOUSE**

- **Object: MACHINE, PRODUCT, CAR**

- **Event: SALE,REGISTRATION, RENEWAL**

- **Concept: ACCOUNT, COURSE**

Entity Set

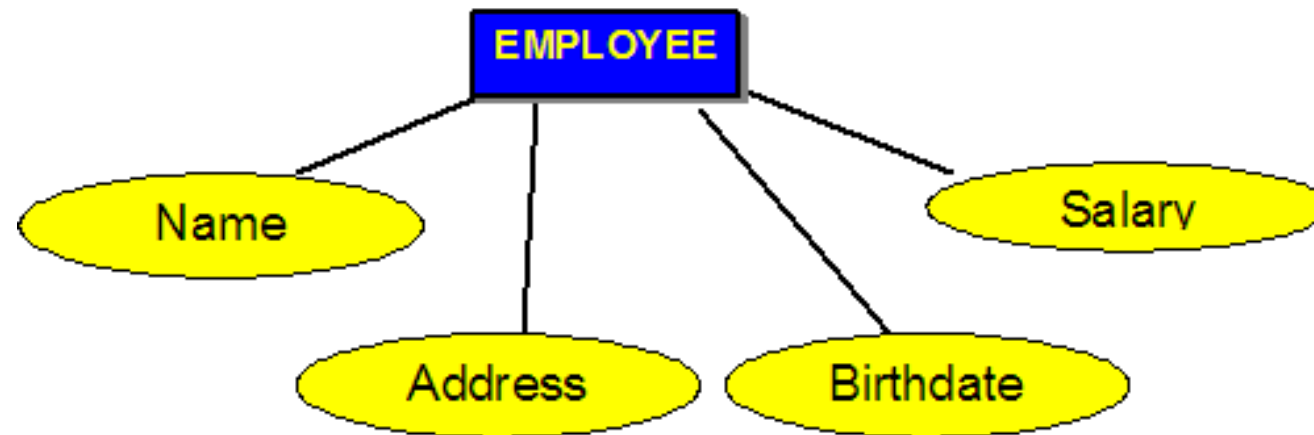- ***Entity Set:*** A collection of similar entities.

  Eg. all employees

- All entities in an entity set have the same set of attributes.

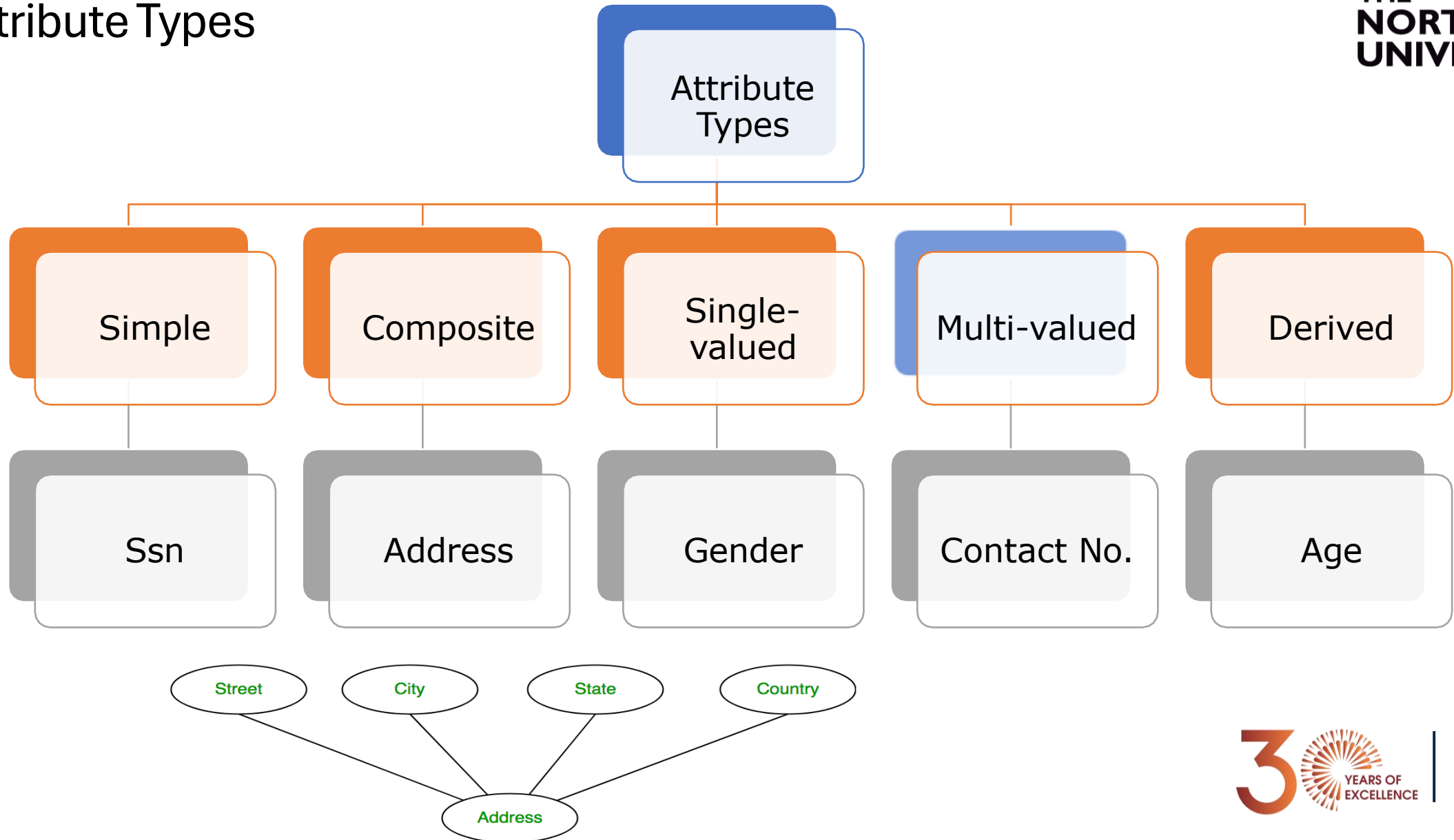- Each entity set has a *key*.

- Each attribute has a *domain*.
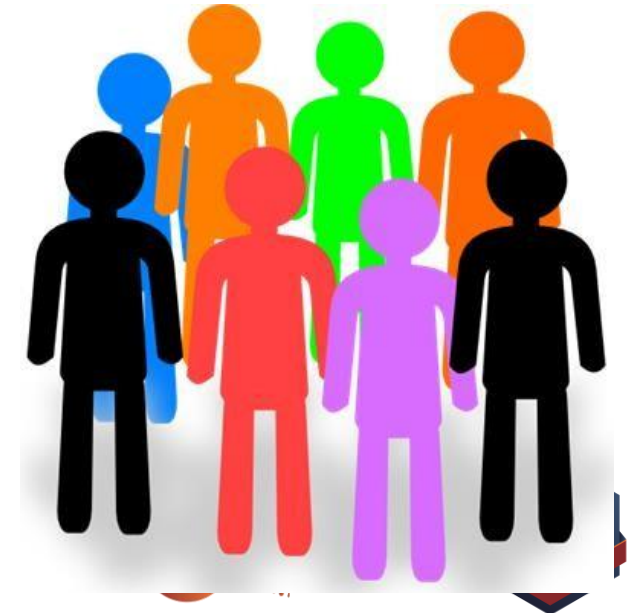
Attributes

○ Attributes are properties used to describe an entity.

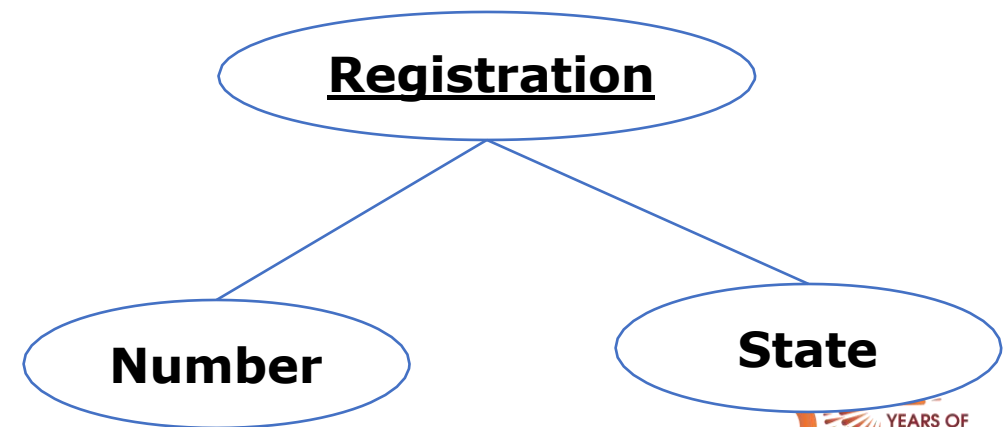○ Example: EMPLOYEE entity may have a Name, SSN, Address, Sex, BirthDate

Attribute Types
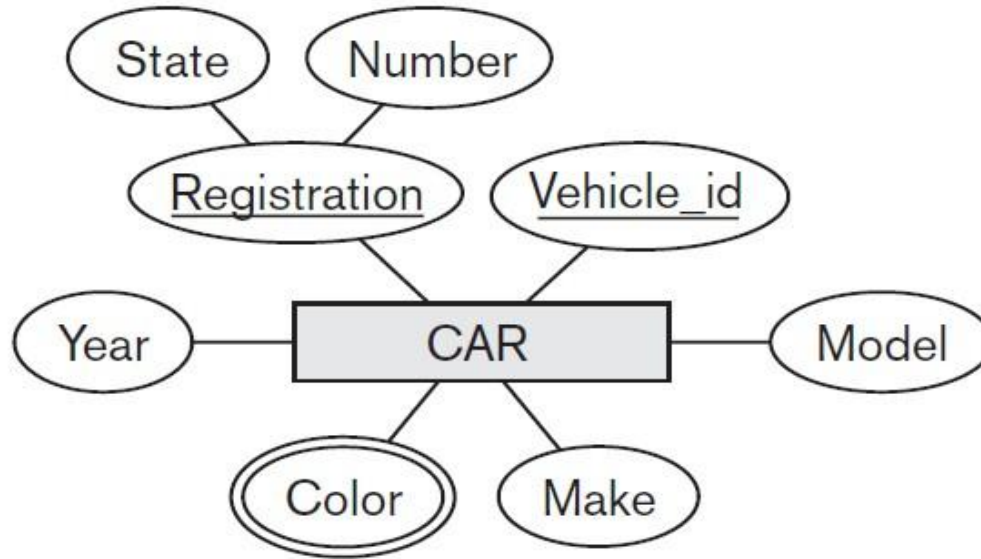
Entity Types and Key Attributes

- An attribute of an entity type for which each entity must have a unique value is called a **key attribute** of the entity type.

```
        Ssn
```

- A key attribute may **be composite**.

```
              Registration
             /            \
        Number            State
```

Key Attributes (Cont.)

An entity type may have more than one key.

CAR
Registration (Number, State), Vehicle_id, Make, Model, Year, {Color}
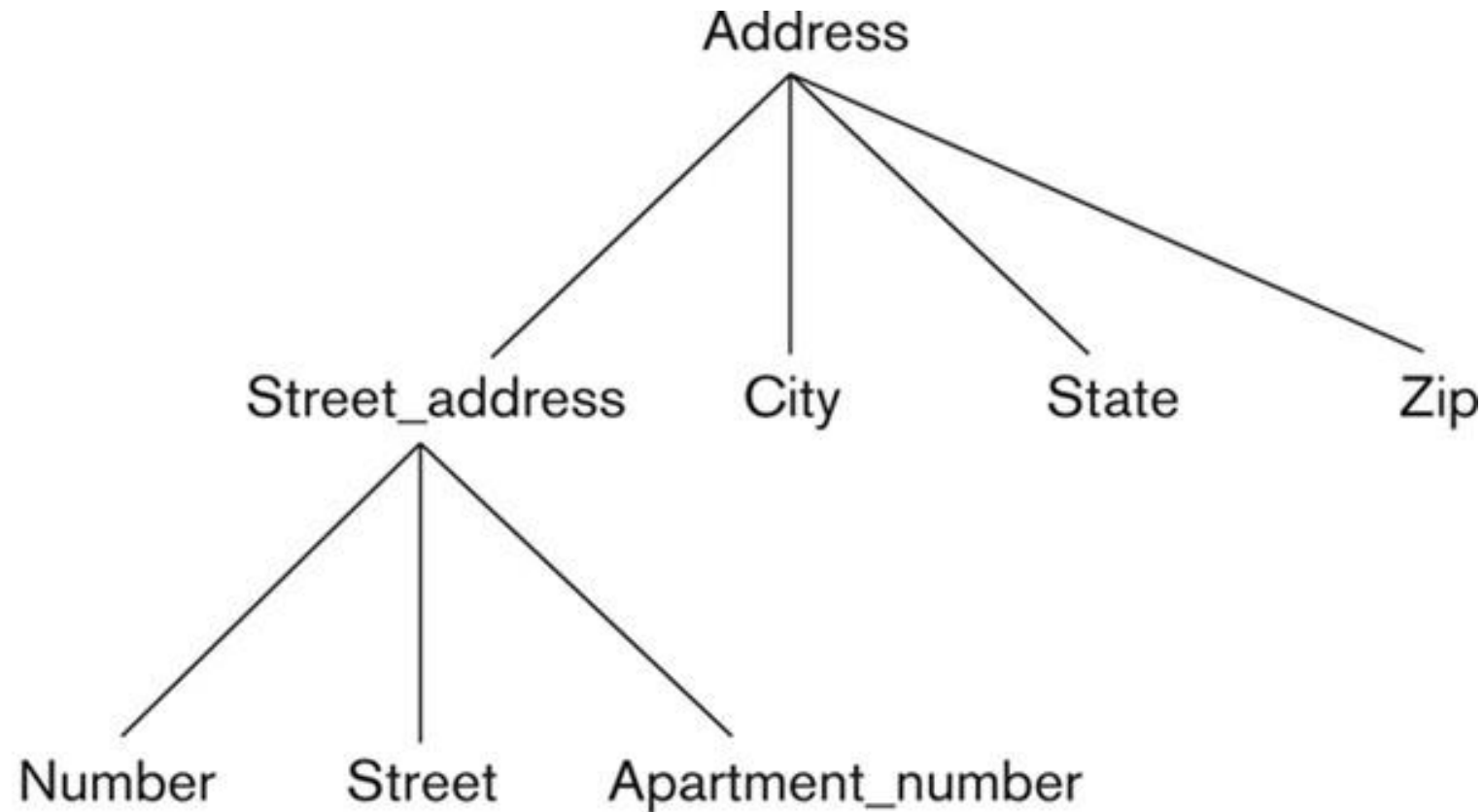
CAR₁
((ABC 123, TEXAS), TK629, Ford Mustang, convertible, 2004 {red, black})

CAR₂
((ABC 123, NEW YORK), WP9872, Nissan Maxima, 4-door, 2005, {blue})
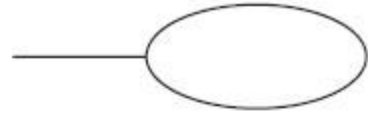
CAR₃
((VSY 720, TEXAS), TD729, Chrysler LeBaron, 4-door, 2002, {white, blue})

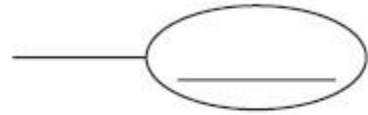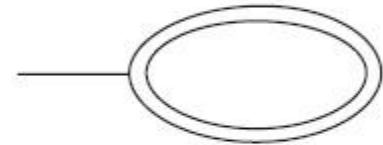# Nested Composite Attribute

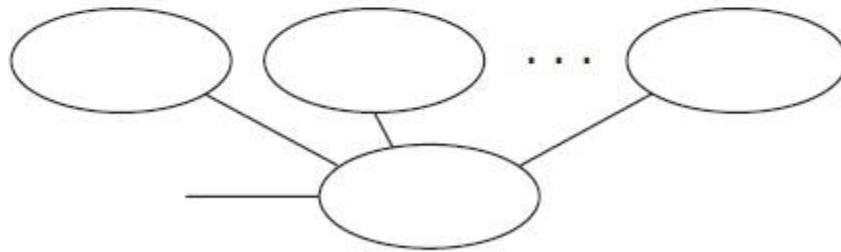# Types of Attributes - Notation

Attribute

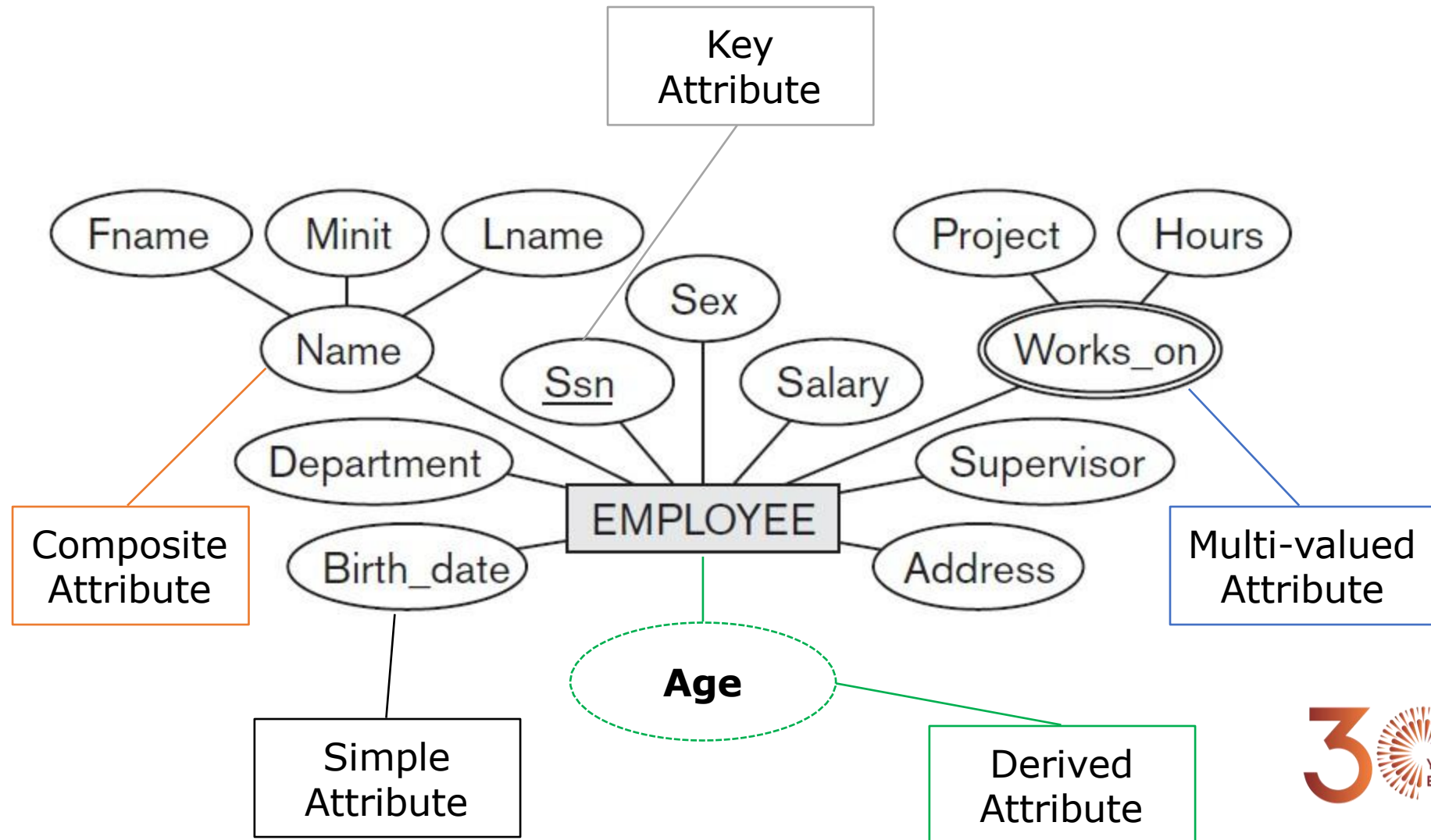Key Attribute

Multivalued Attribute

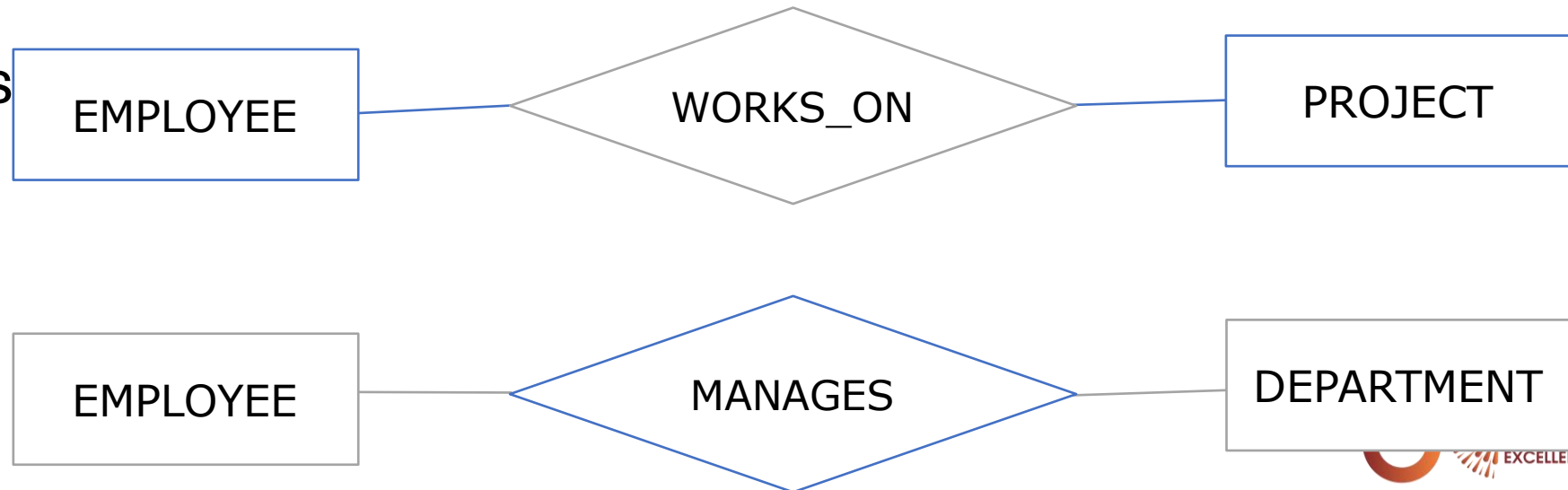Composite Attribute

Derived Attribute
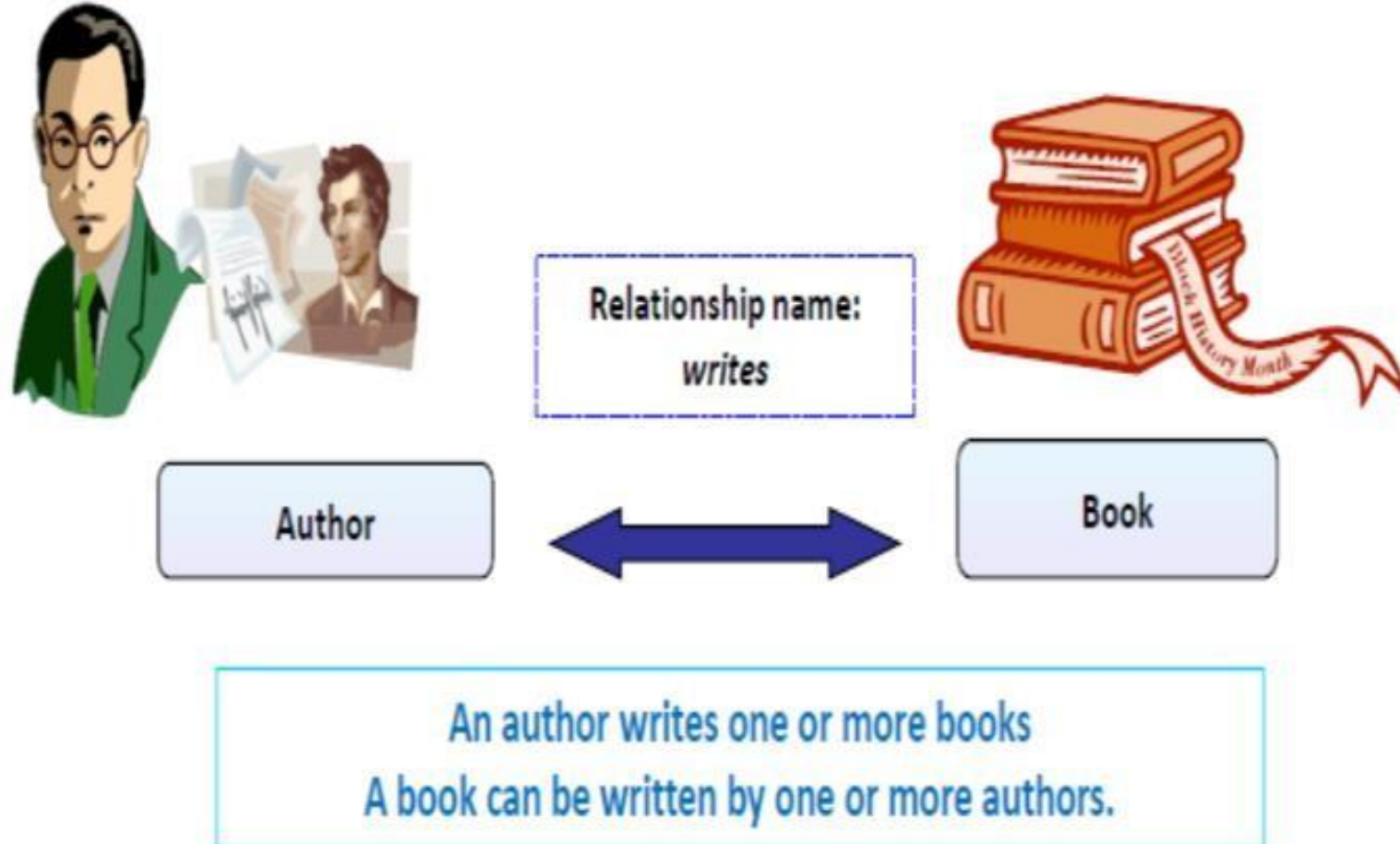
Example – Different Attributes

Relationship

- A relationship relates two or more distinct entities with a specific meaning.

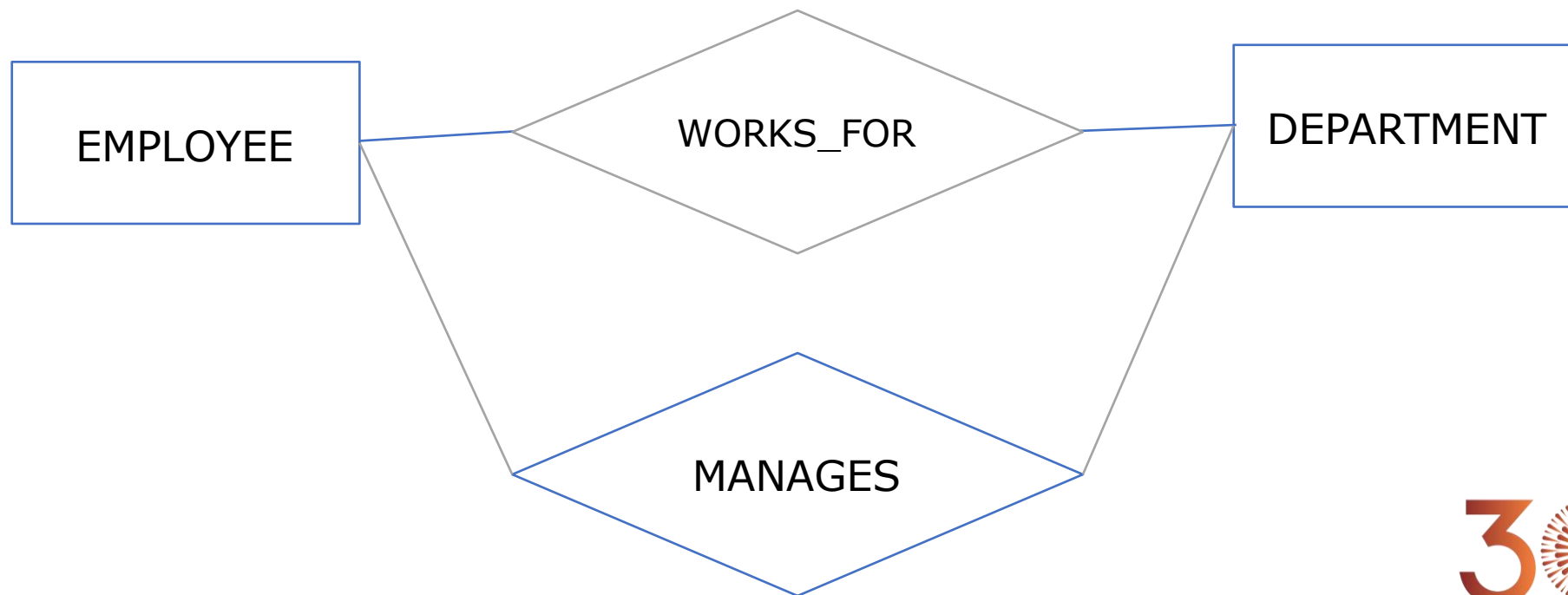- Relationships of the same type are grouped or typed into a relations

Relationship Example

Relationship name:
writes

Author

Book

An author writes one or more books
A book can be written by one or more authors.

Relationships and Relationship Types

More than one relationship type can exist with the same participating entity types.
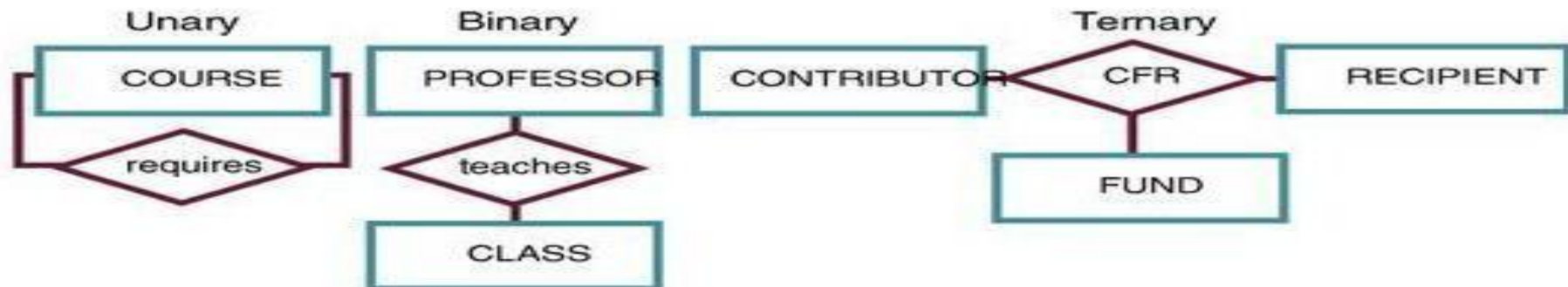
Degree of Relationship

Degree

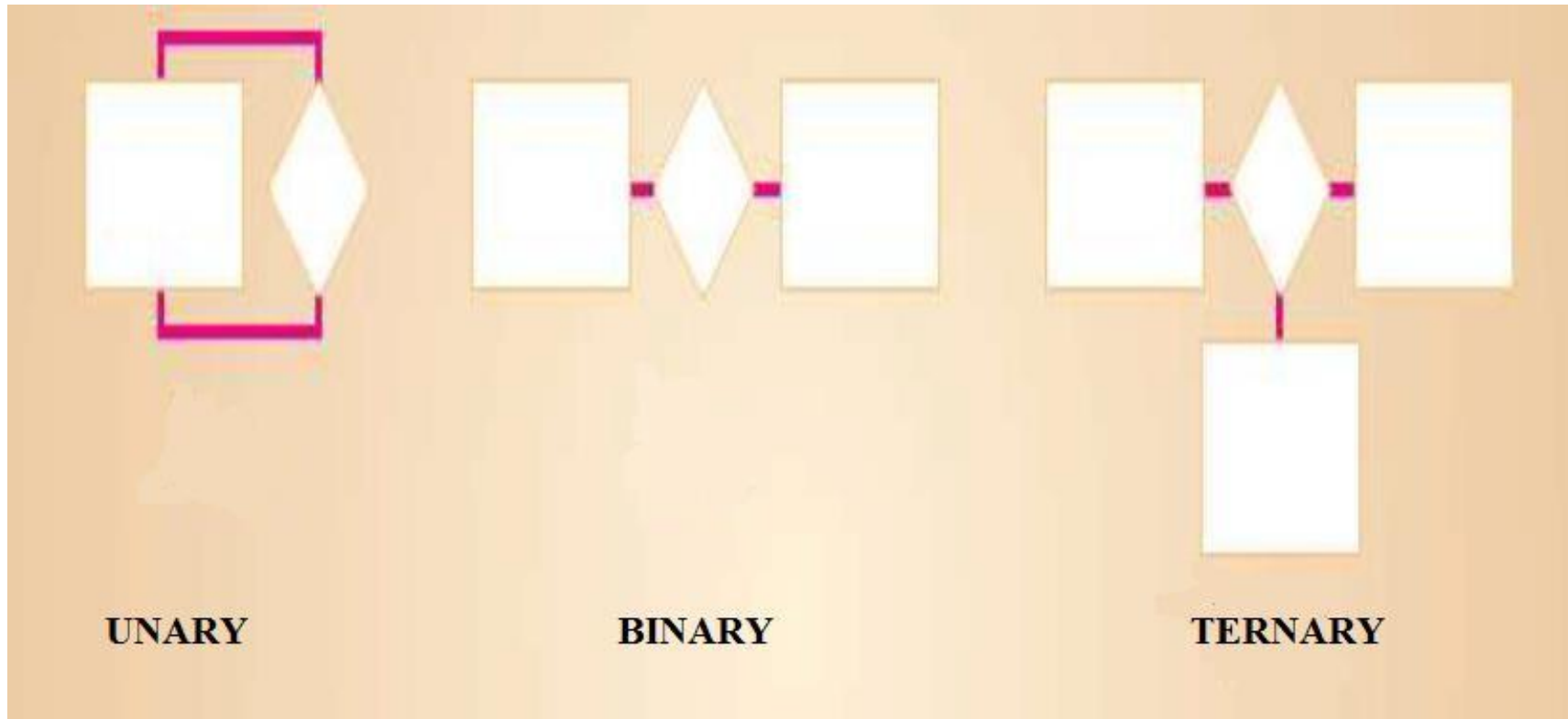(number of entity types that participate in a relationship)

Unary	Binary	Ternary

Degree of Relationship

UNARY   BINARY   TERNARY

Example

Entity Name

Entity
Person,place,object,event
or concept about which
data is to be maintained
Example: Car, Student

Relation

**Verb
Phrase**
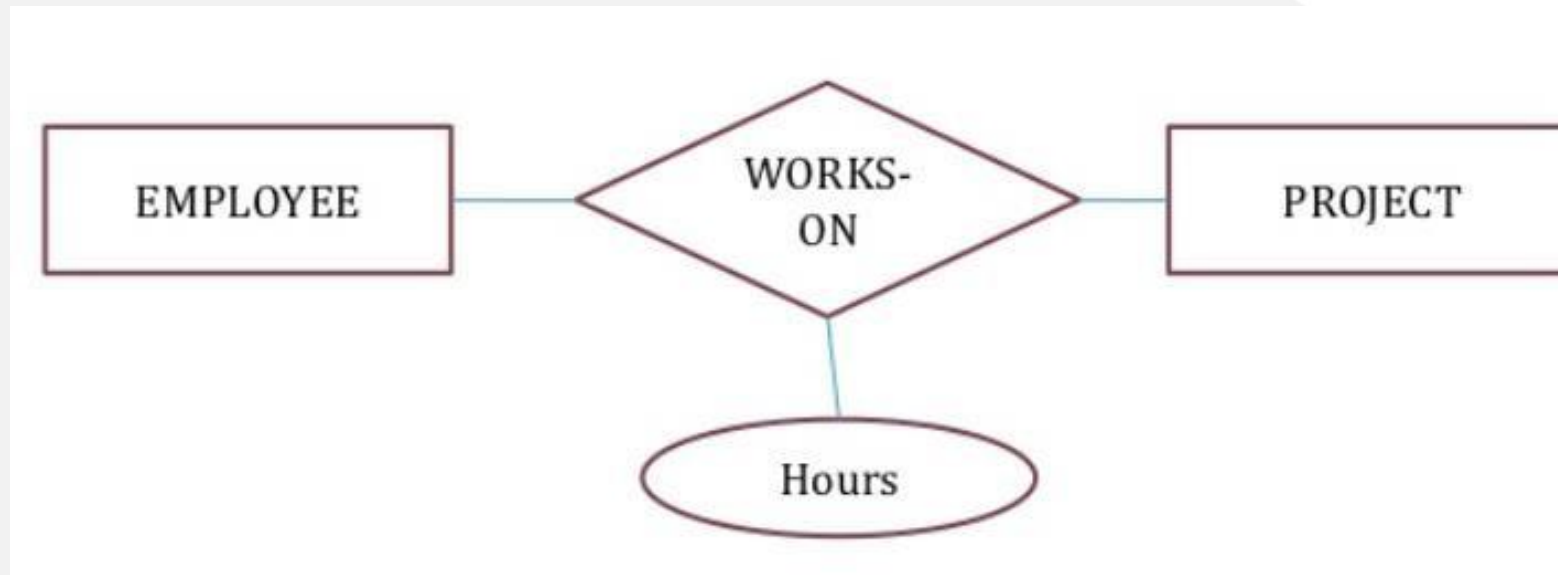
Association between the instances of one or
more entity types
Example: Blue Car Belongs to Student Jack

Jack

**Attribute
Name**

Attribute
Property or characteristic of
an entity
Example: Color of car Entity
Name of Student Entity

Attributes of Relationship Types

A relationship type can have attributes; for example, HoursPerWeek of WORKS_ON; its value for each relationship instance describes the number of hours per week that an EMPLOYEE works on a PROJECT.

Thanks!!