Entity-Relationship Modelling
DBT Module

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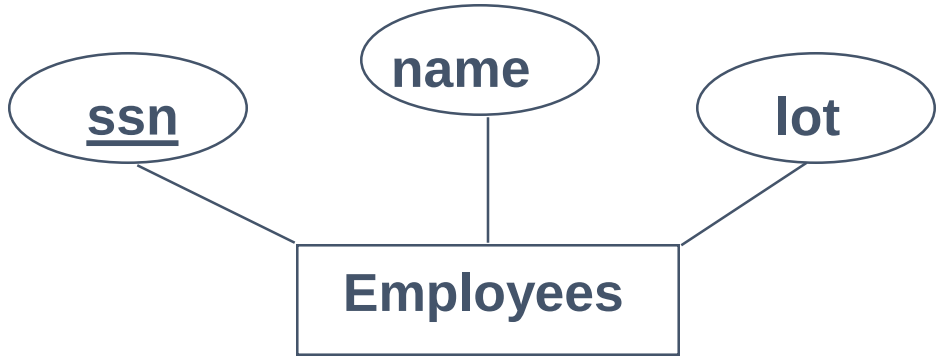
Session Outline

- Data Models
- Entity-Relationship(ER) modelling
- ER diagrams
- Components of ER diagram
- Examples

History of ER models

- It was proposed by Peter Chen in 1971 to create a uniform convention which can be used for relational database.

ER Model Basics



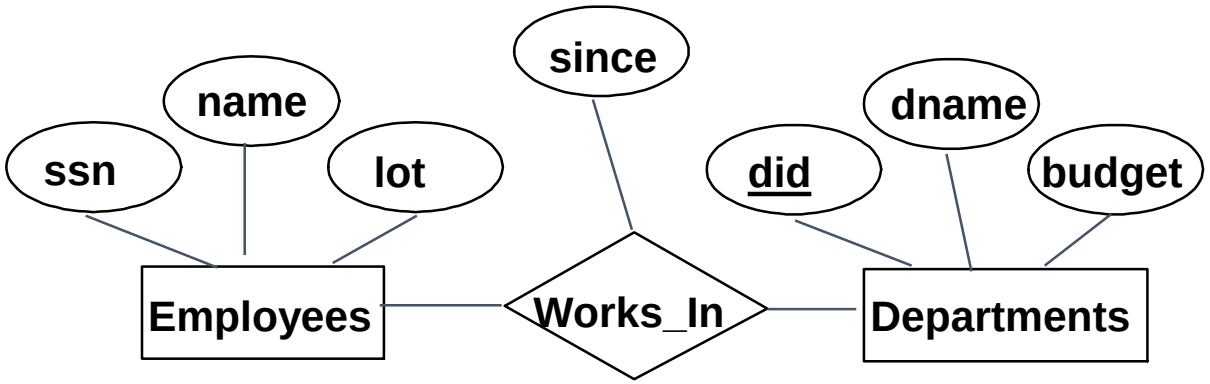
- *Entity:* Real-world object distinguishable from other objects. An entity is described using a set of *attributes*. Each attribute has a *domain*.

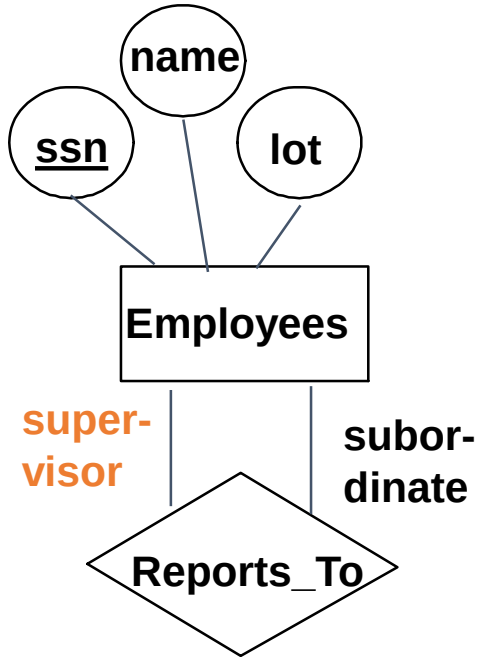
- *Entity Set*: A collection of similar entities. E.g., all employees.
  - All entities in an entity set have the same set of attributes. (Until we consider ISA hierarchies, anyway!)
  - Each entity set has a *key*.

Keys

- Minimal set of attributes which uniquely identify an instance of a entity
- Many candidate keys choose one to be a primary keys
- SSN vs Name … key must be unique

ER Model Basics (Contd.)

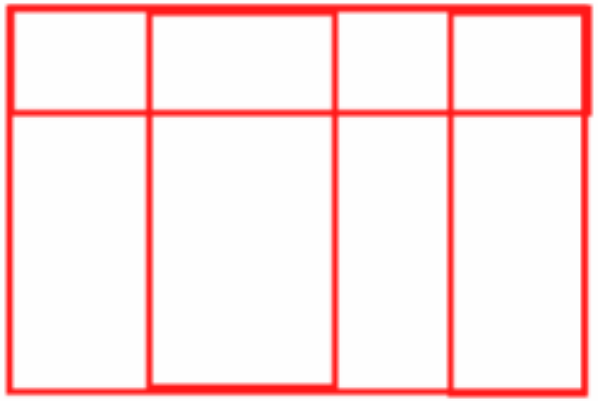


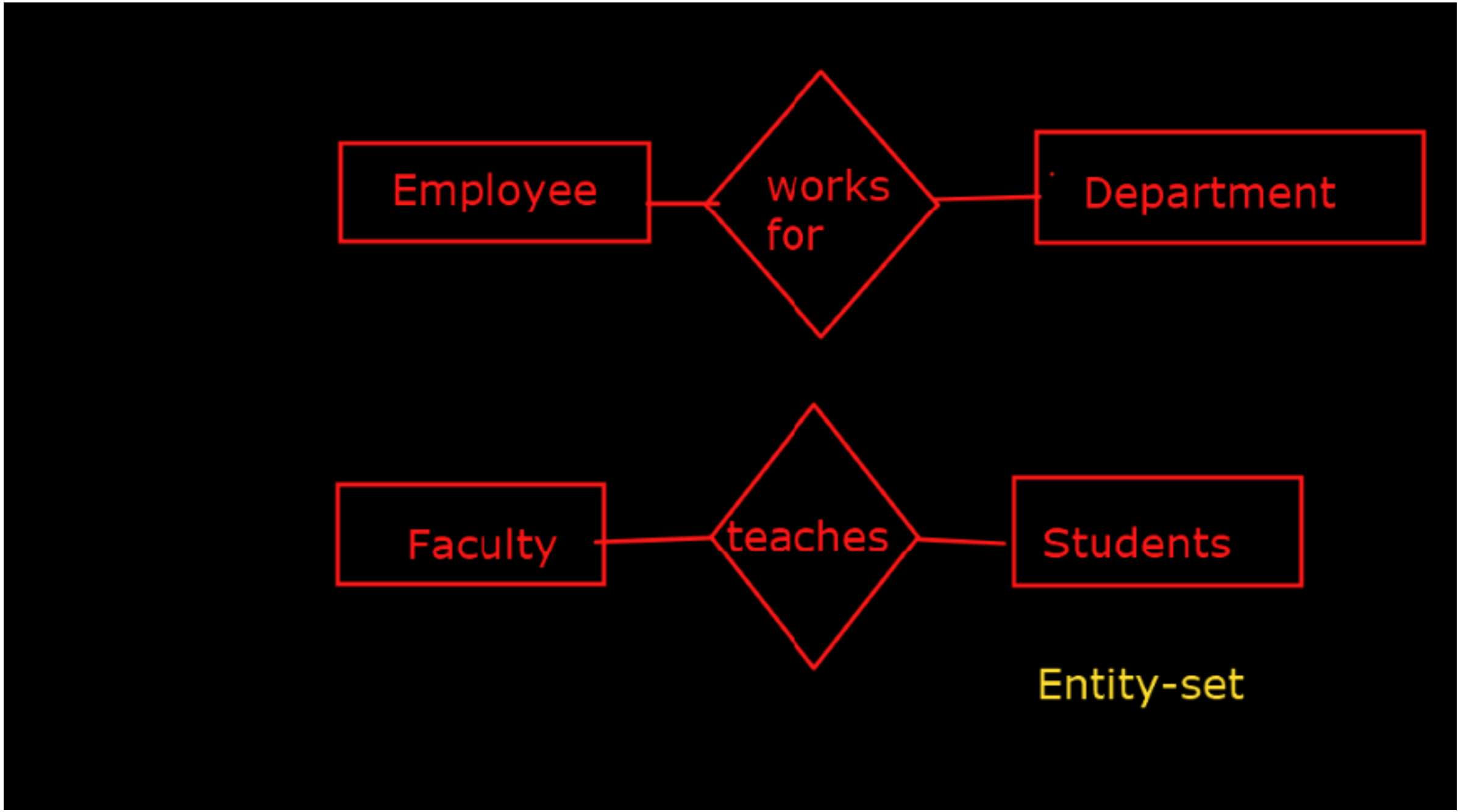


- *Relationship*: Association among two or more entities. E.g., Attishoo works in Pharmacy department.

- *Relationship Set*: Collection of similar relationships.
  - An n-ary relationship set R relates n entity sets E1 ... En; each relationship in R involves entities e1 E1, ..., en En
  - Same entity set could participate in different relationship sets, or in different "roles" in same set.

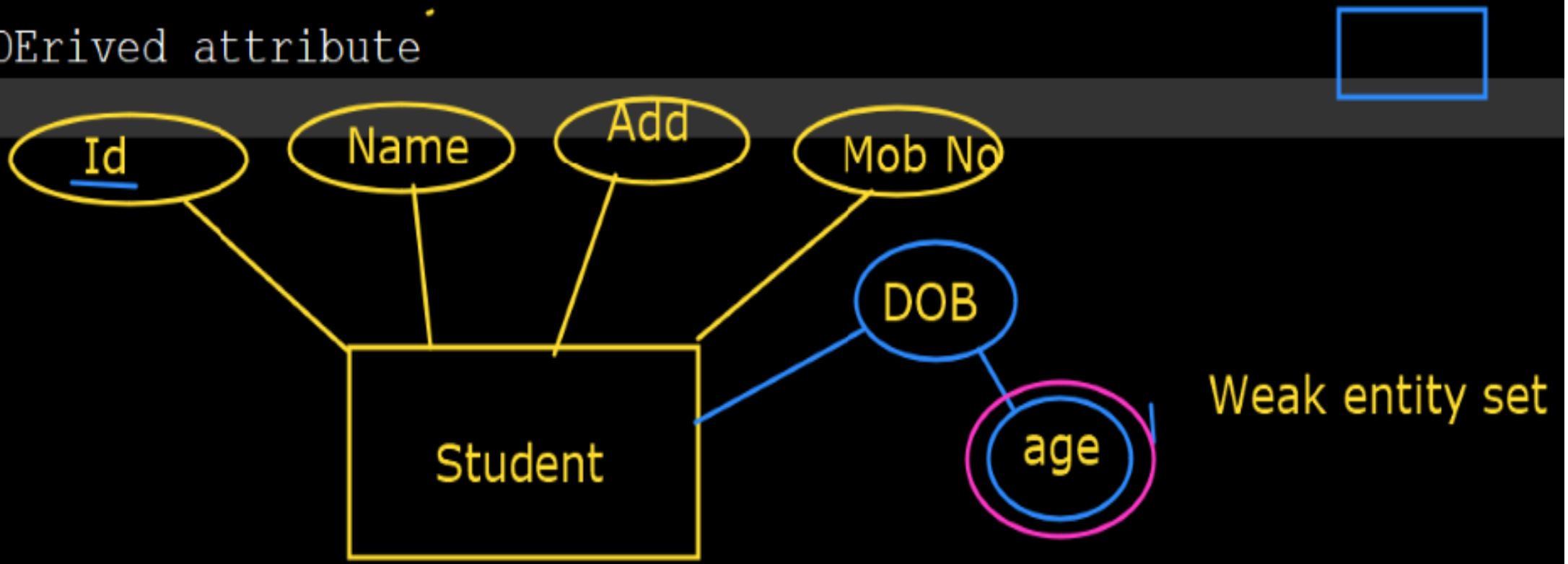
Components of a ER Diagram




Employee
works for
Department
Faculty
teaches
Students
Entity-set

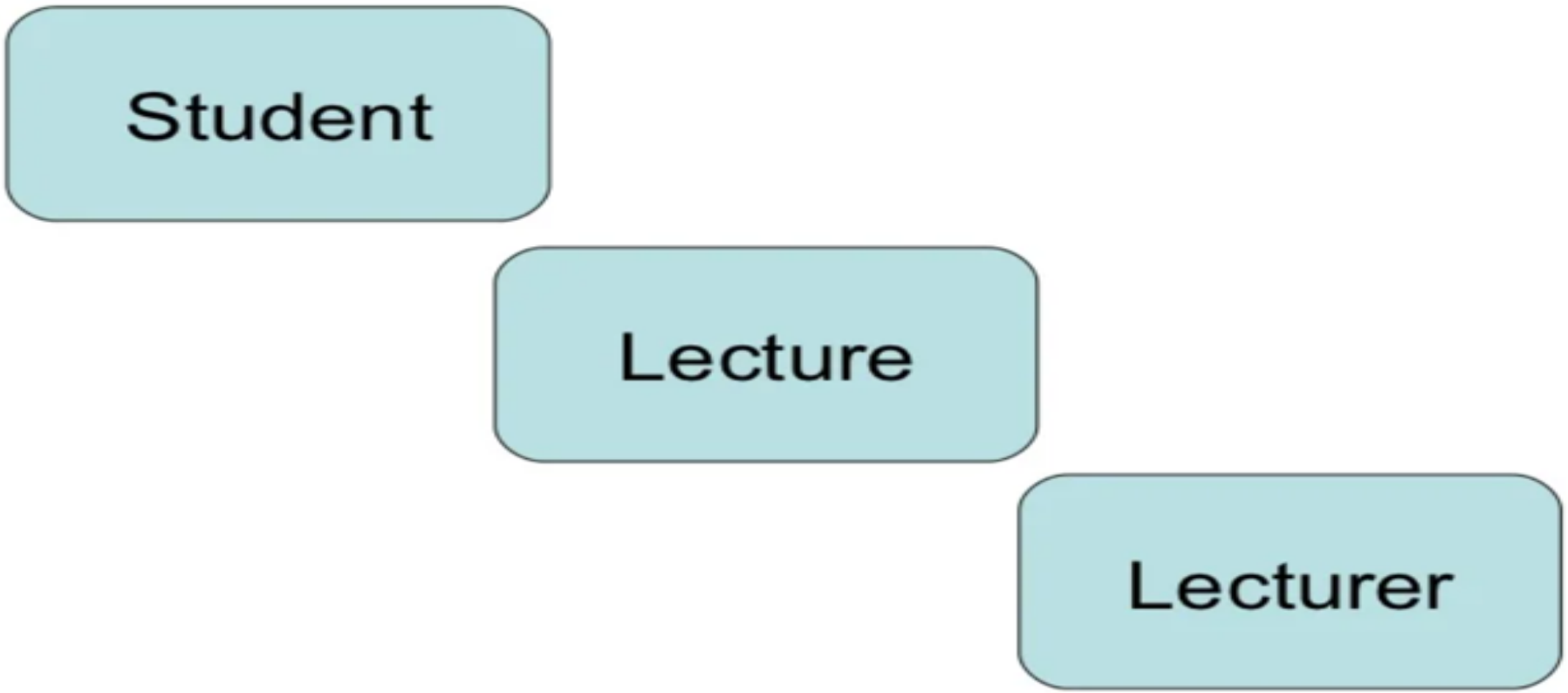
3. Multivalues attribute

4. DErived attribute



E-R Diagram

In E-R modelling we use a box to represent entity-types:



Following are the main components and its symbols in ER Diagrams:

- **Rectangles**: This Entity Relationship Diagram symbol represents entity types
- **Ellipses** : Symbol represent attributes
- **Diamonds**: This symbol represents relationship types
- **Lines**: It links attributes to entity types and entity types with other relationship types
- **Primary key**: attributes are underlined
- **Double Ellipses**: Represent multi-valued attributes
-

ER Diagram Symbols

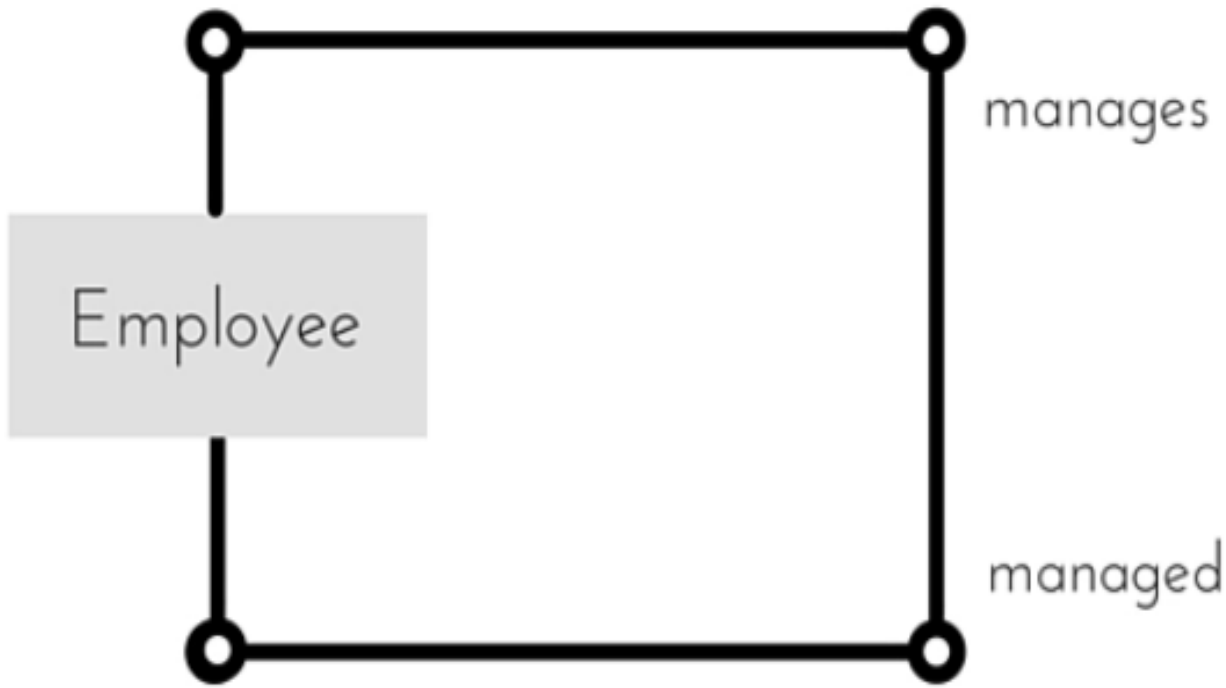

Entity Name


Attribute
Name


Relation
Verb
Phrase

ER Diagram: Recursive Relationship

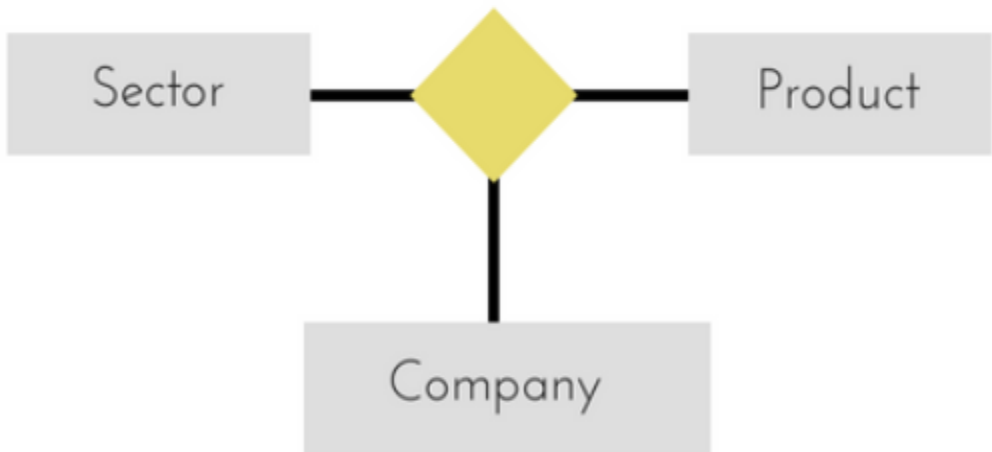
When an Entity is related with itself it is known as **Recursive** Relationship.



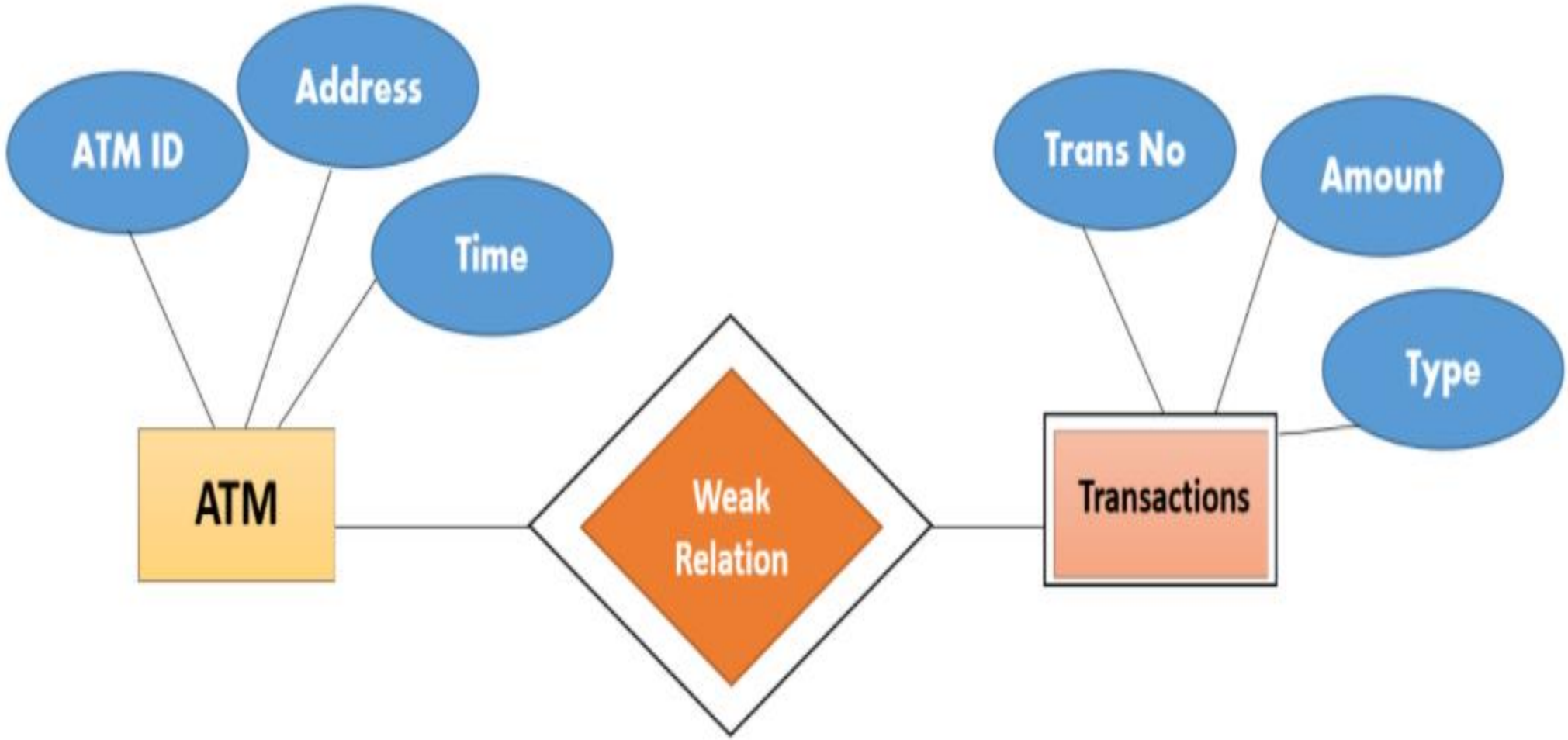
ER Diagram: Ternary Relationship

Relationship of degree three is called Ternary relationship.

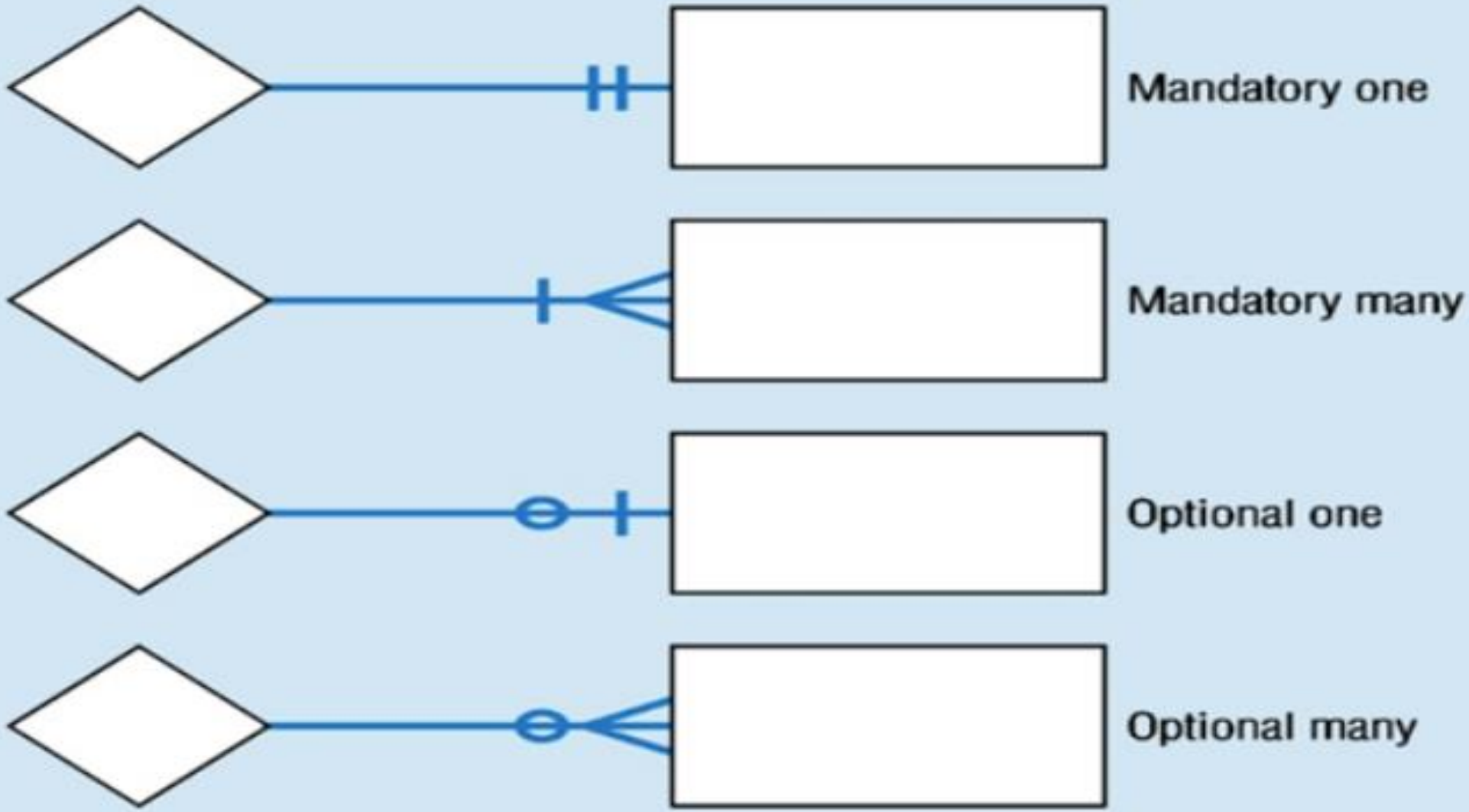
A Ternary relationship involves three entities. In such relationships we always consider two entites together and then look upon the third.



- The above relationship involves 3 entities.
- Company operates in Sector, producing some Products.


ATM ID
Address
Time
Trans No
Amount
Type
ATM
Weak Relation
Transactions

Relationship cardinality



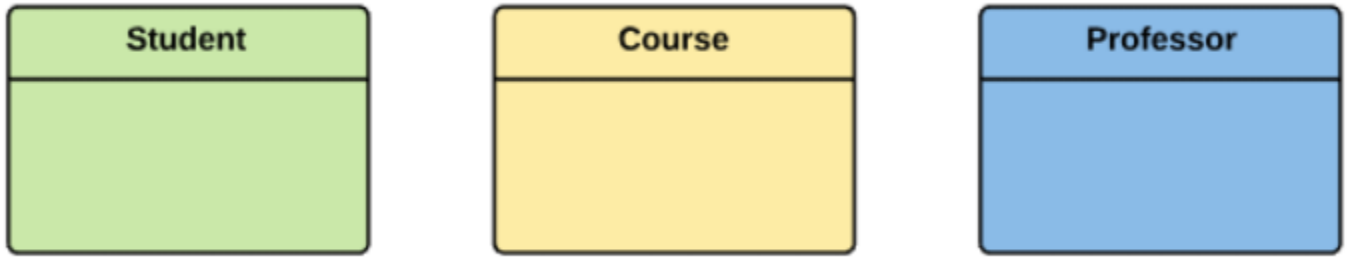
How to Create an Entity Relationship Diagram (ERD)

- Example:
- In a university, a Student enrolls in Courses.
- A student must be assigned to at least one or more Courses.
- Each course is taught by a single Professor.
- To maintain instruction quality, a Professor can deliver only one course

Steps to Create an ER Diagram

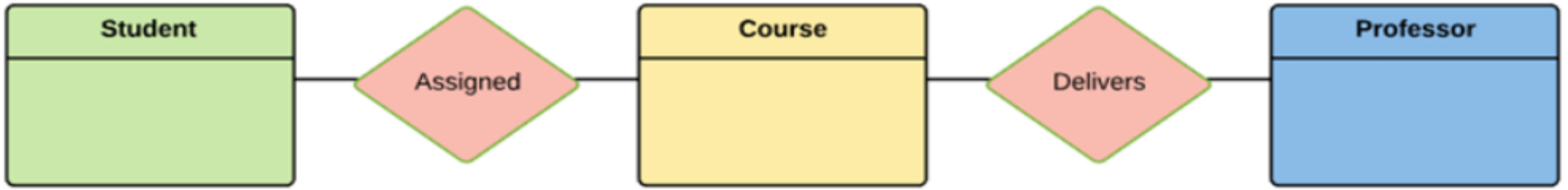
Step 1) Entity Identification

- We have three entities
- Student
- Course
- Professor
-



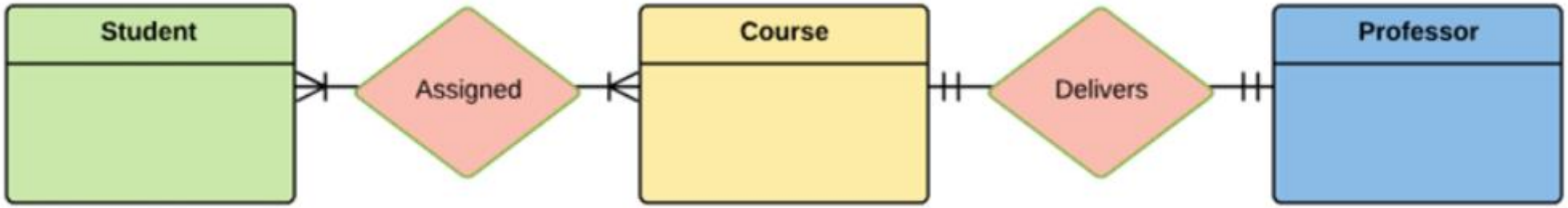
Step 2) Relationship Identification

- We have the following two relationships
- The student is **assigned** a course
- Professor **delivers** a course



Step 3) Cardinality Identification

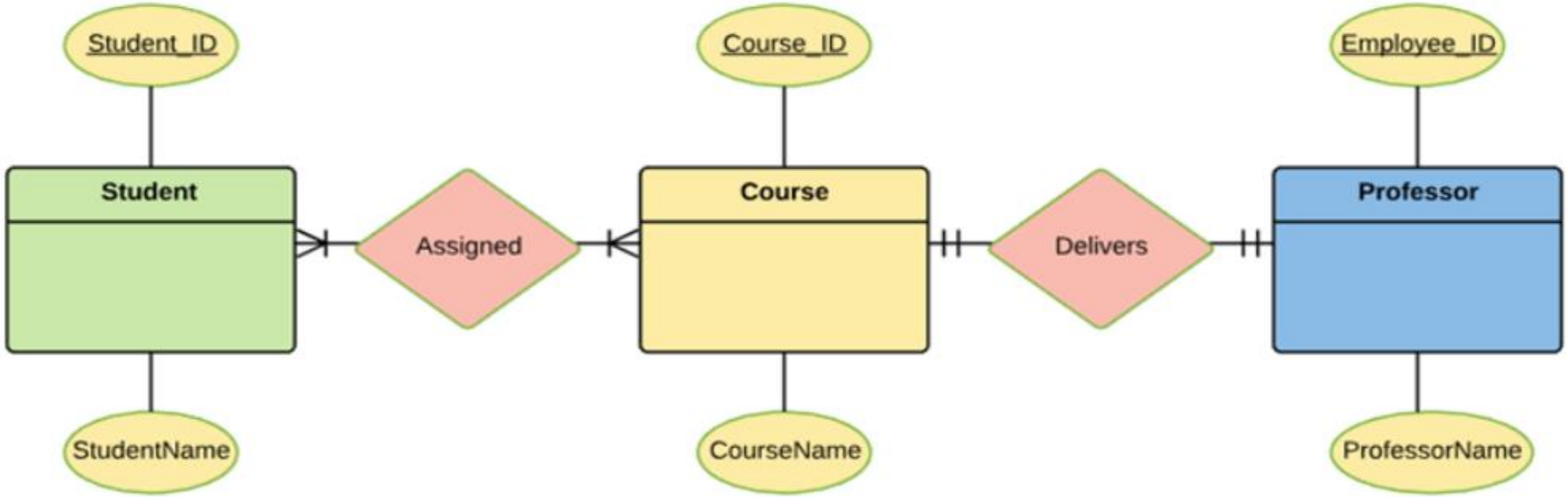
- For them problem statement we know that,
- A student can be assigned **multiple** courses
- A Professor can deliver only **one** course



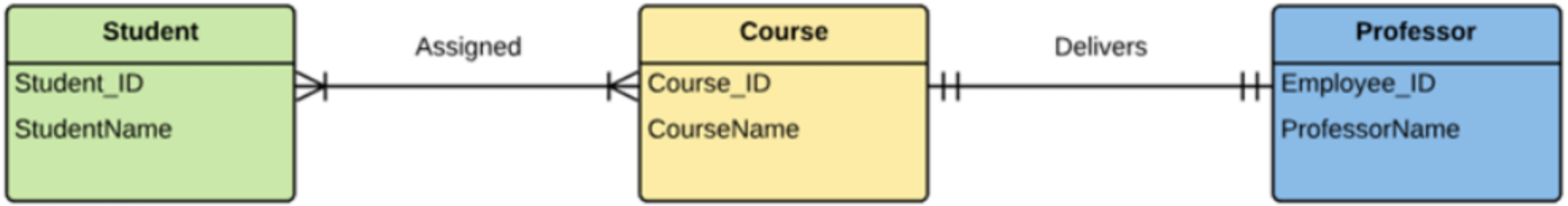
Step 4) Identify Attributes

Once the mapping is done, identify the primary Keys. If a unique key is not readily available, create one.

Entity	Primary Key	Attribute
Student	Student_ID	StudentName
Professor	Employee_ID	ProfessorName
Course	Course_ID	CourseName

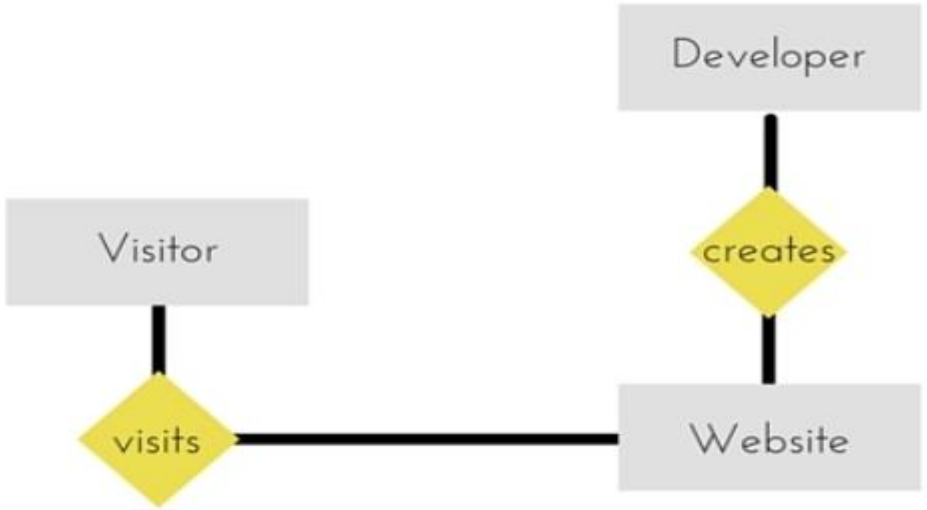


Step 5) Create the ERD Diagram



Example 2

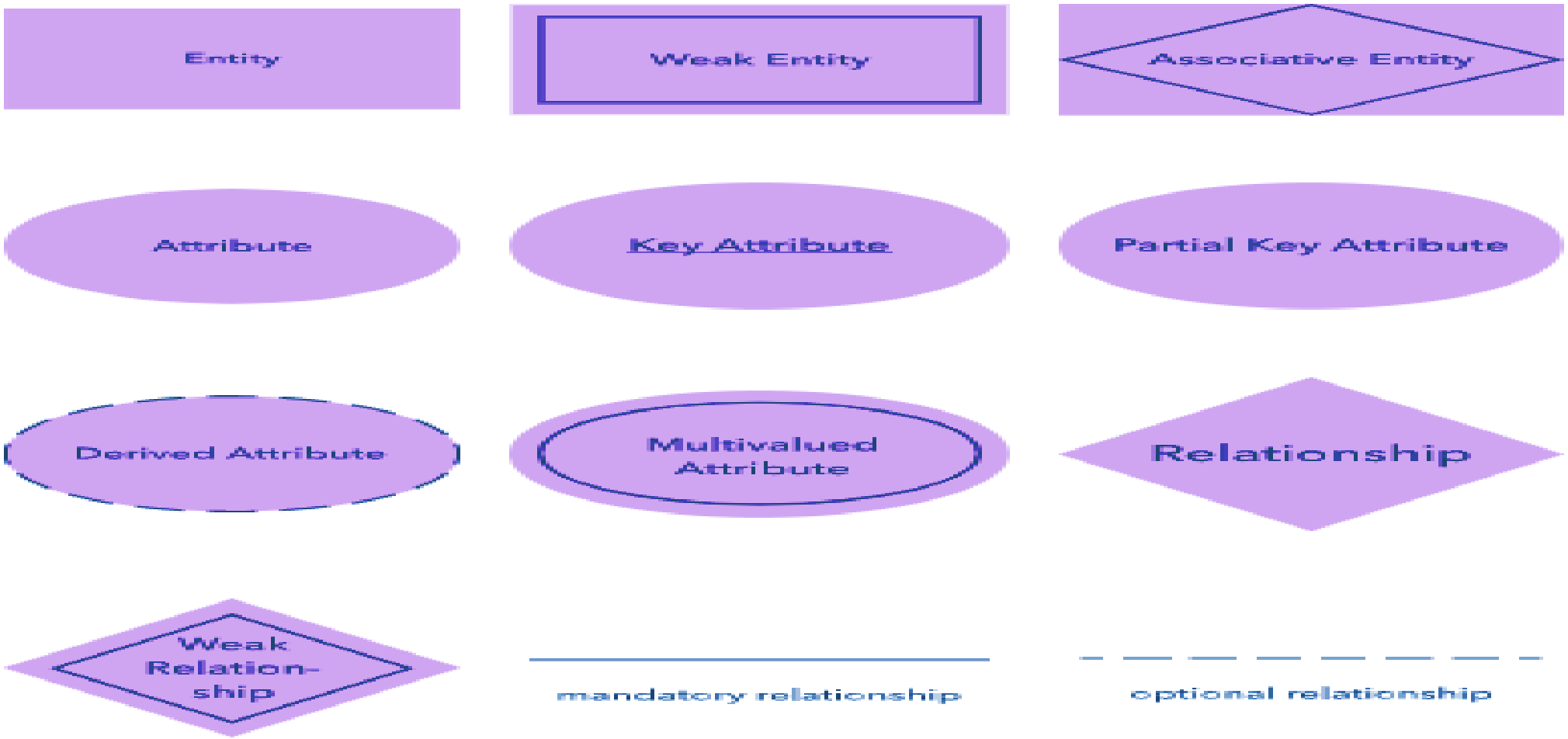
- For example, in the below diagram, anyone can see and understand what the diagram wants to convey: *Developer develops a website, whereas a Visitor visits a website*.

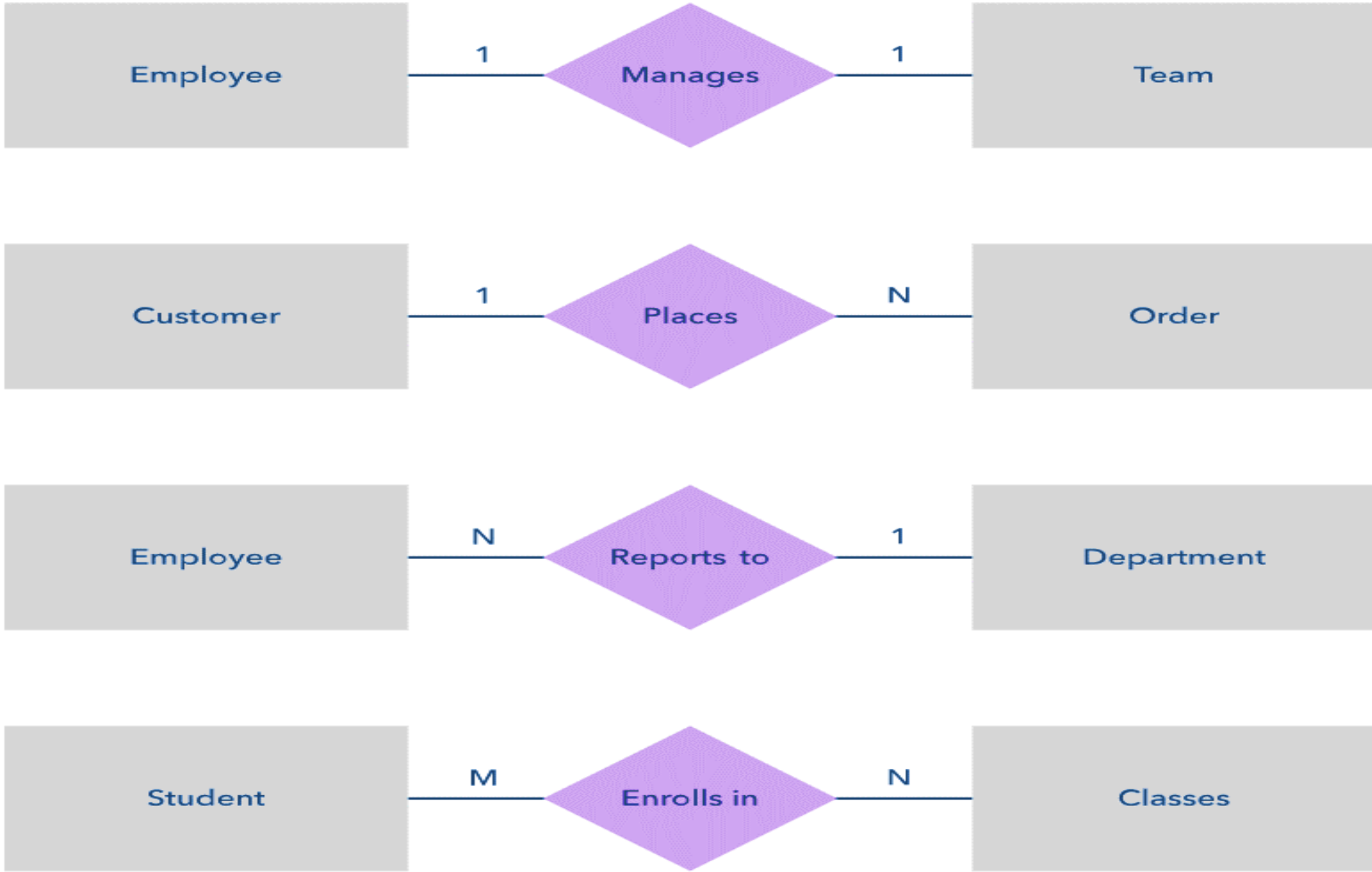


ERD symbols and notations

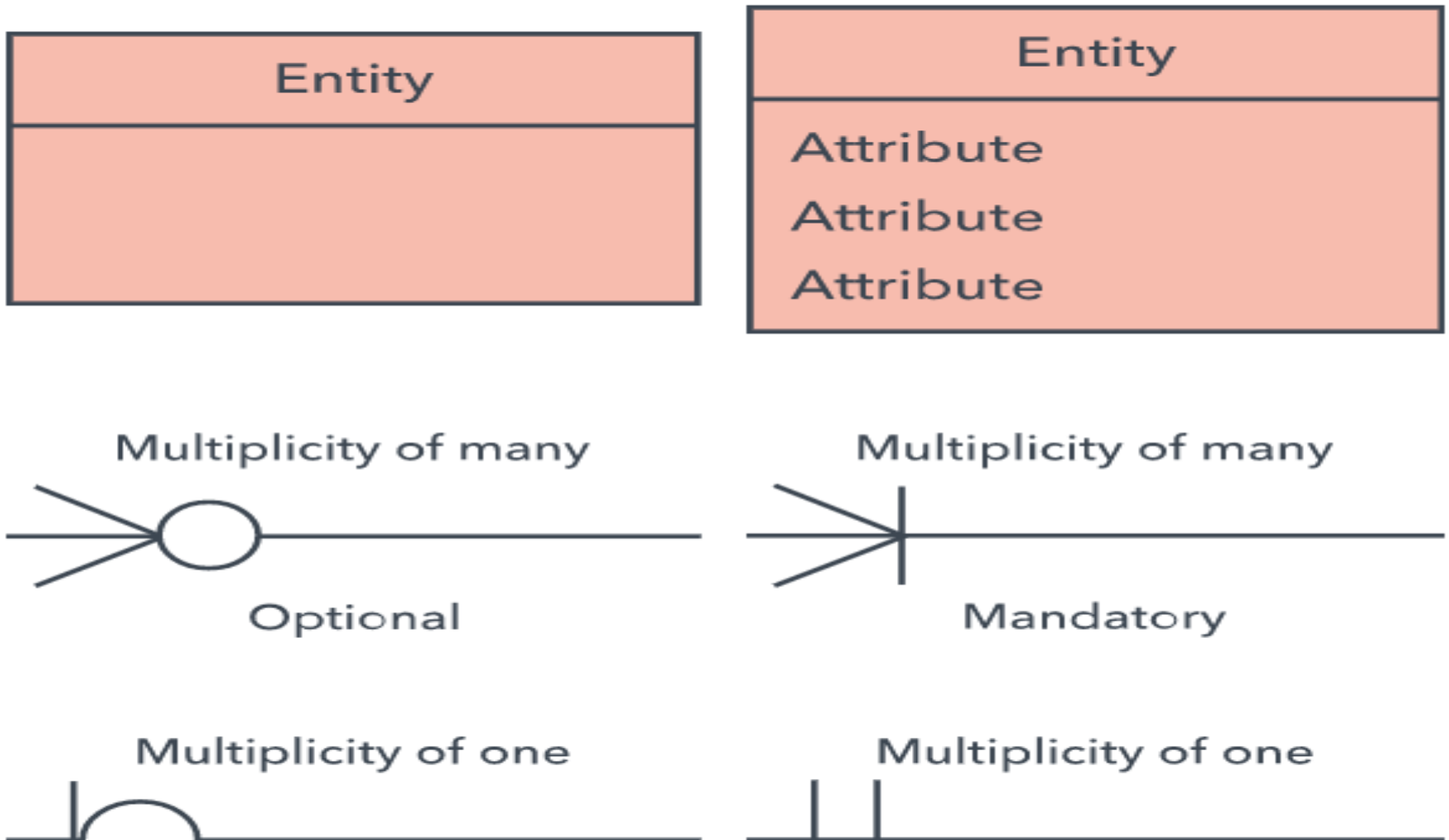
There are several notation systems, which are similar but vary in a few specifics.

Chen notation style




Employee
1
Manages
1
Team
Customer
1
Places
N
Order
Employee
N
Reports to
1
Department
Student
M
Enrolls in
N
Classes

Crow's Foot/Martin/Information Engineering style



Bachman style

One to One

One to Many

Examples

Following are examples of ERD diagrams made in each system.

Bachman

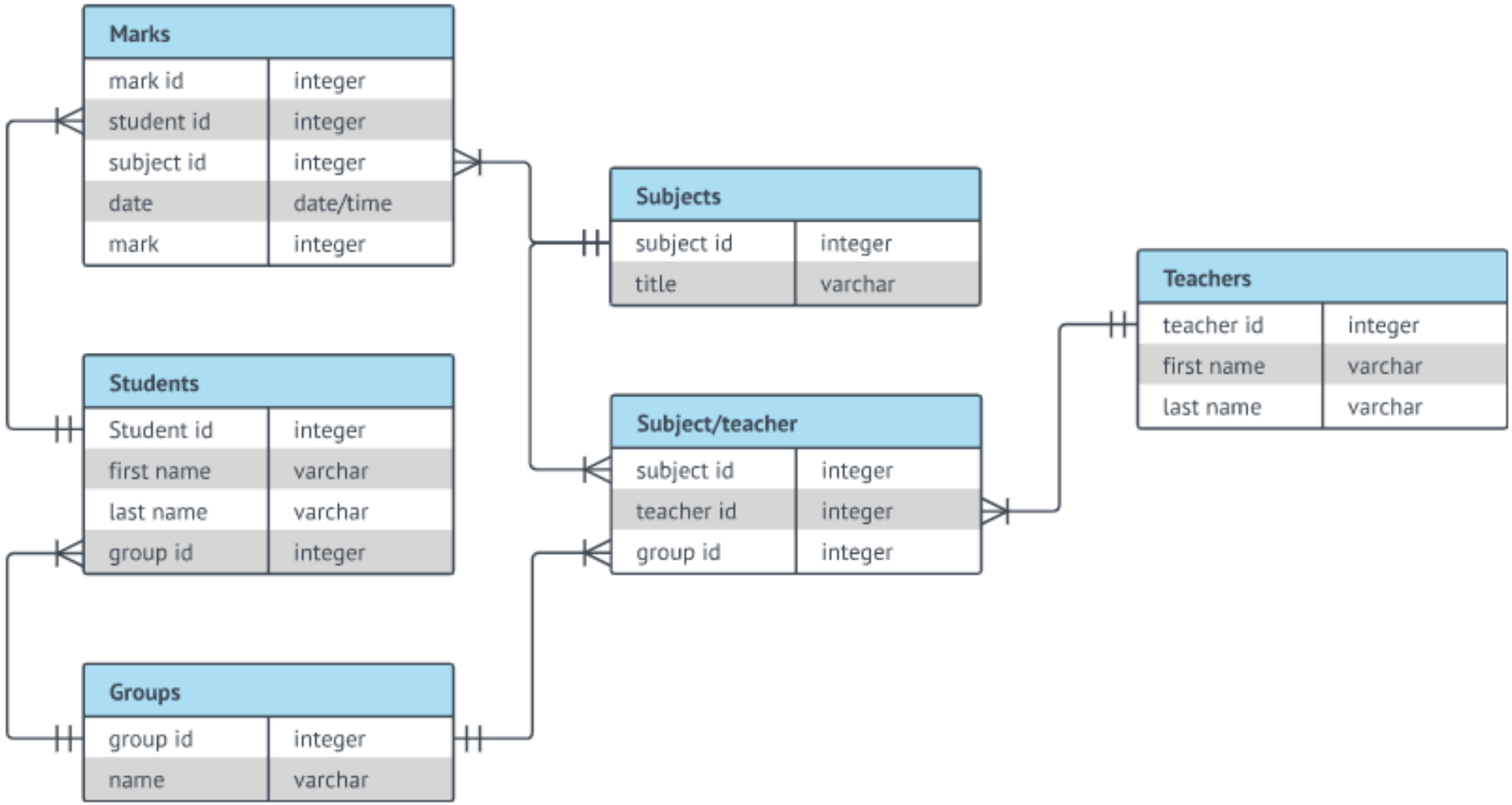
IDEF1X

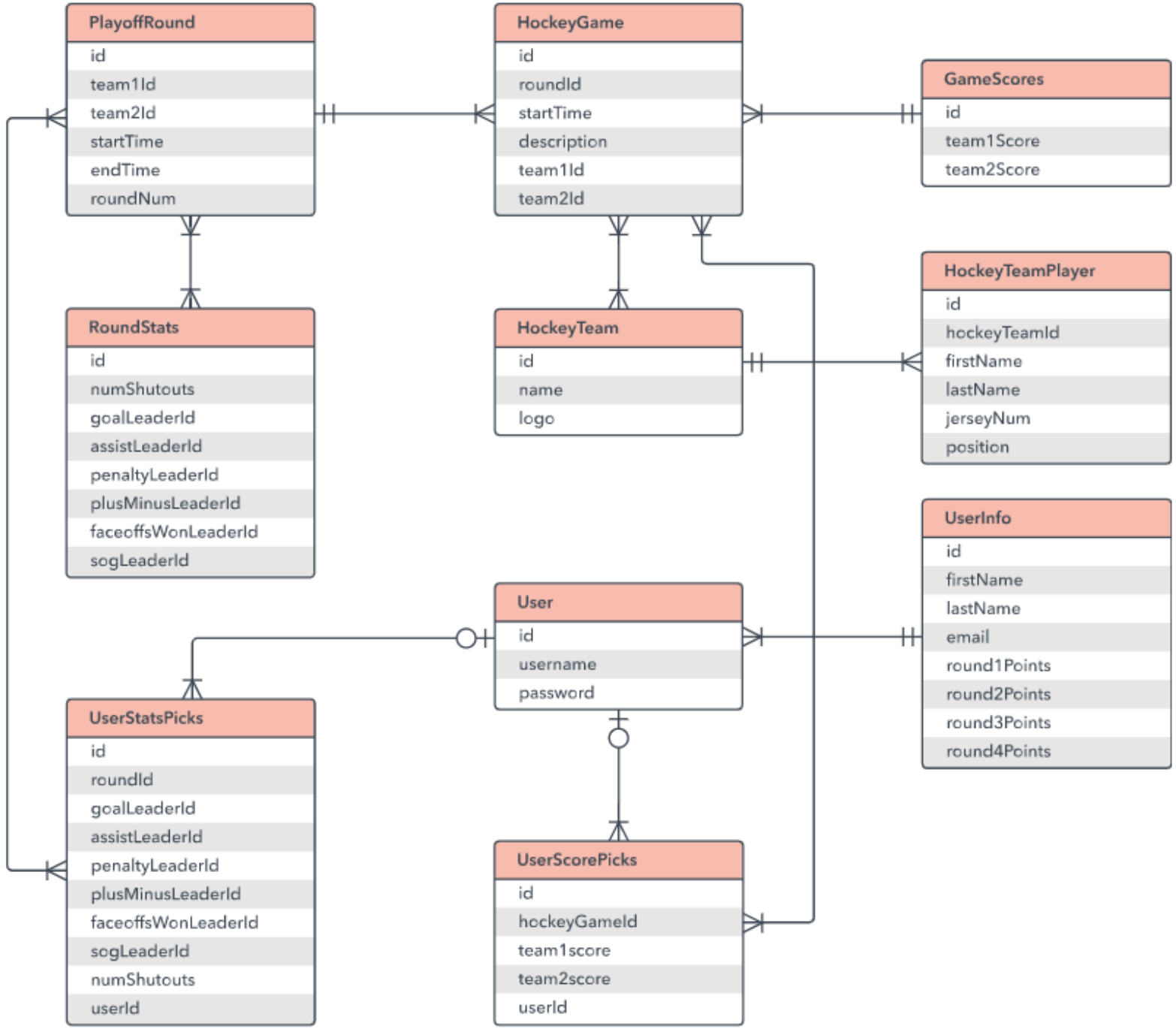
Crow's Foot

Barker's

Chen

Min-Max/ISO


Marks
mark id
integer
student id
integer
subject id
integer
date
date/time
mark
integer
Subjects
subject id
integer
title
varchar
Teachers
teacher id
integer
first name
varchar
last name
varchar
Students
Student id
integer
first name
varchar
last name
varchar
group id
integer
Subject/teacher
subject id
integer
teacher id
integer
group id
integer
Groups
group id
integer
name
varchar


PlayoffRound
id
team1Id
team2Id
startTime
endTime
roundNum
HockeyGame
id
roundId
startTime
description
team1Id
team2Id
GameScores
id
team1Score
team2Score
RoundStats
id
numShutouts
goalLeaderId
assistLeaderId
penaltyLeaderId
plusMinusLeaderId
faceoffsWonLeaderId
sogLeaderId
HockeyTeam
id
name
logo
HockeyTeamPlayer
id
hockeyTeamId
firstName
lastName
jerseyNum
position
UserInfo
id
firstName
lastName
email
round1Points
round2Points
round3Points
round4Points
User
id
username
password
UserStatsPicks
id
roundId
goalLeaderId
assistLeaderId
penaltyLeaderId
plusMinusLeaderId
faceoffsWonLeaderId
sogLeaderId
numShutouts
userId
UserScorePicks
id
hockeyGameId
team1score
team2score
userId

Tools to create an Entity Relationship Diagram (ERD)

- Trevor.io
  - **Link:** Trevor.io/create-an-er-diagram-online
- Lucidchart
  - **Link:** Lucidchart.com/pages/examples/er-diagram-tool
- Creately
  - **Link:** Creately.com/lp/er-diagram-tool-online/
- DBDiagram
  - **Link:** dbdiagram.io/home
- ERDPlus
  - **Link:** Erdplus.com
- DrawSQL
  - **Link:** Drawsql.app
- QuickDBD
  - **Link:** Quickdatabasediagrams.com