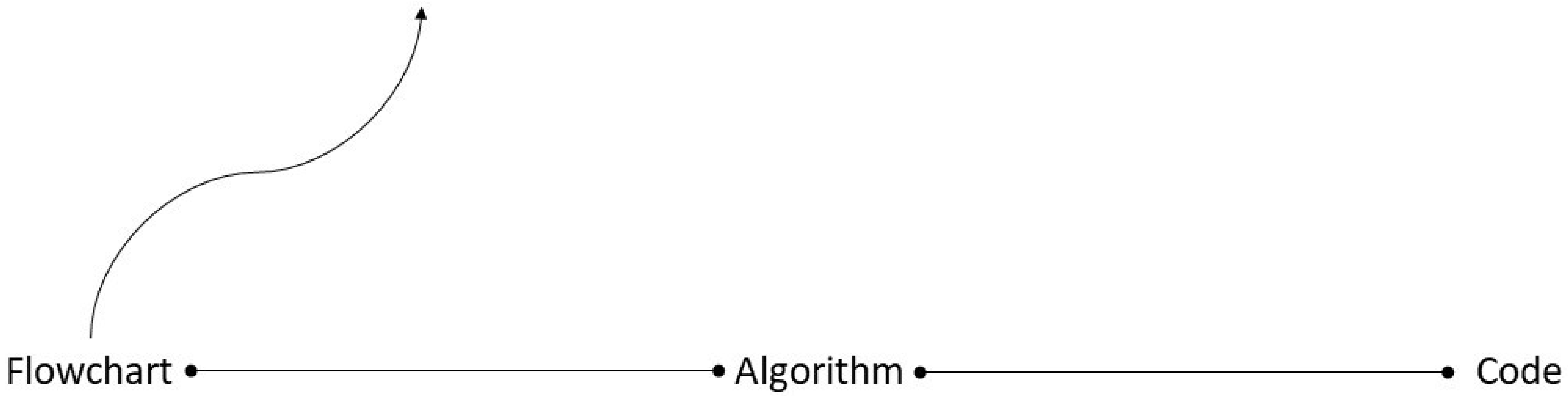
ER Model – Quick Recap

Why **E**ntity – **R**elationship Model



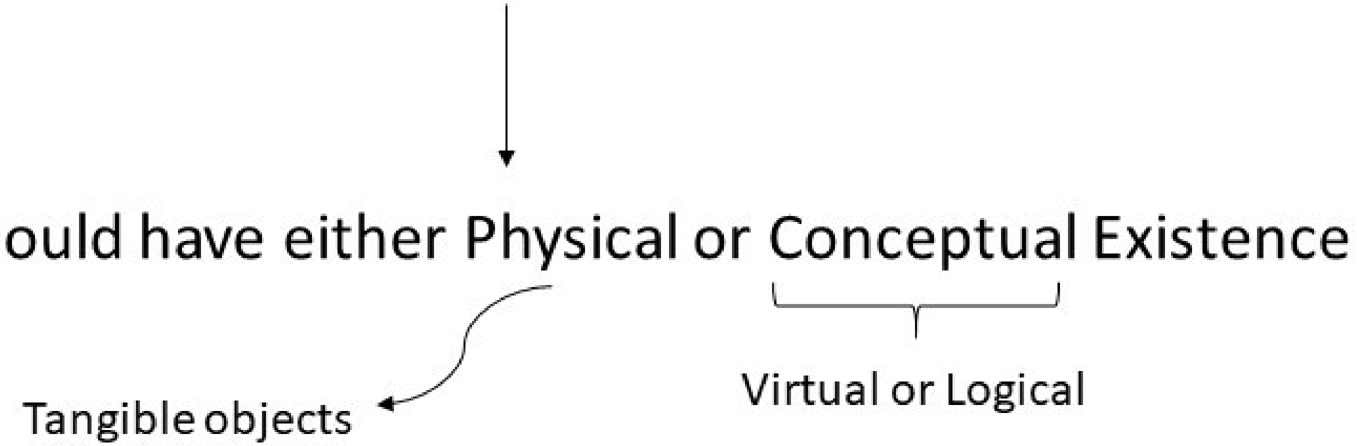
Flowchart

Algorithm

Code

What is an Entity ?

My Definition: ‘Anything’ about which you would like to store information.



Should have either Physical or Conceptual Existence

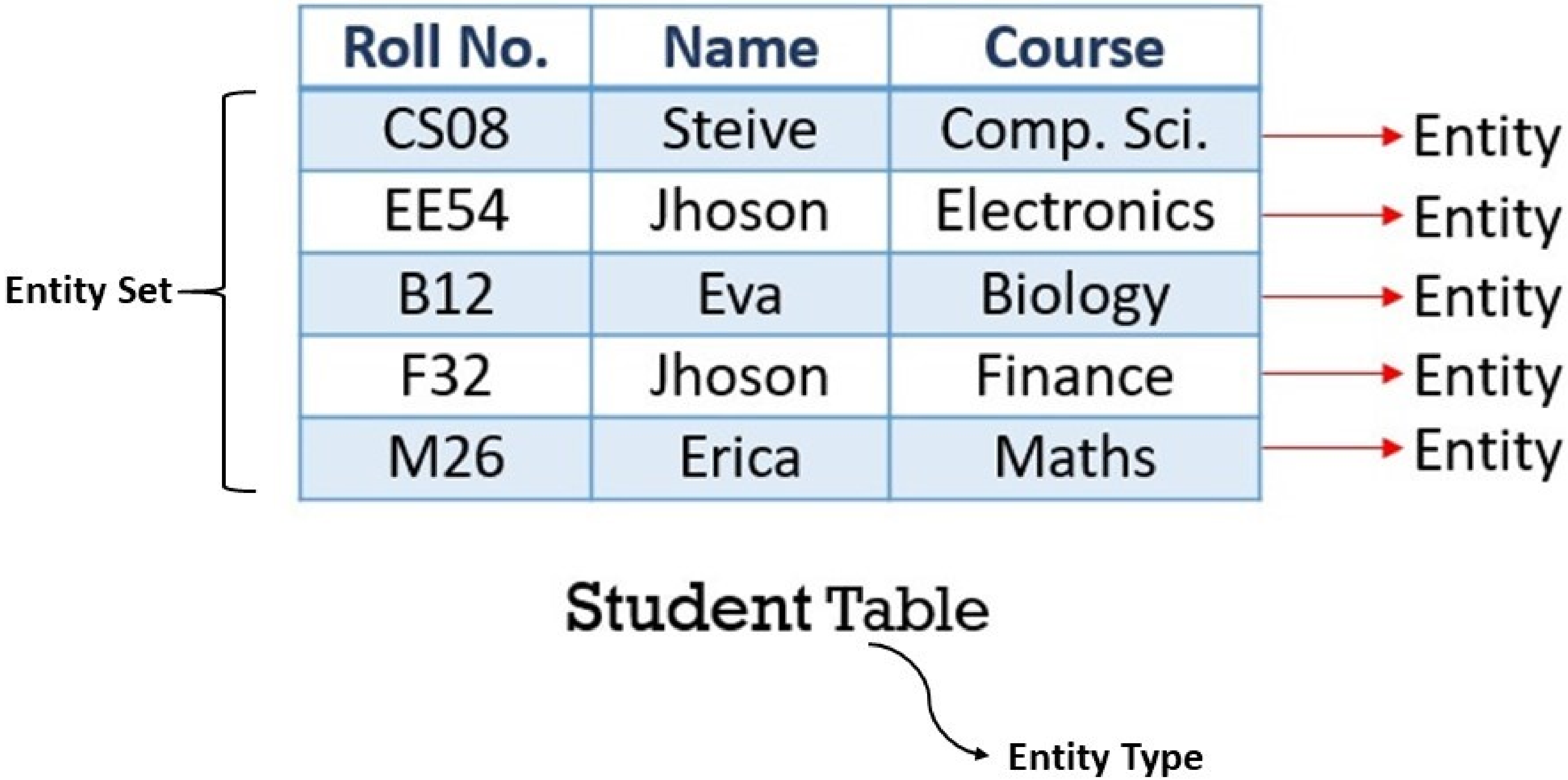
Tangible objects

Virtual or Logical

A Set of **distinguishable** items/objects

A Quick Recap:

Entity vs Entity Set Vs Entity Type



Roll No.	Name	Course
CS08	Steive	Comp. Sci.
EE54	Jhoson	Electronics
B12	Eva	Biology
F32	Jhoson	Finance
M26	Erica	Maths

Student Table

Each entity in this entity set is of type STUDENT

What is an Attribute ?

These are **Features/Properties** which helps to characterize or distinguish an Entity

It is a piece of Information which distinguishes **each row** in a table.

In simple words, Attributes are the name of the Columns

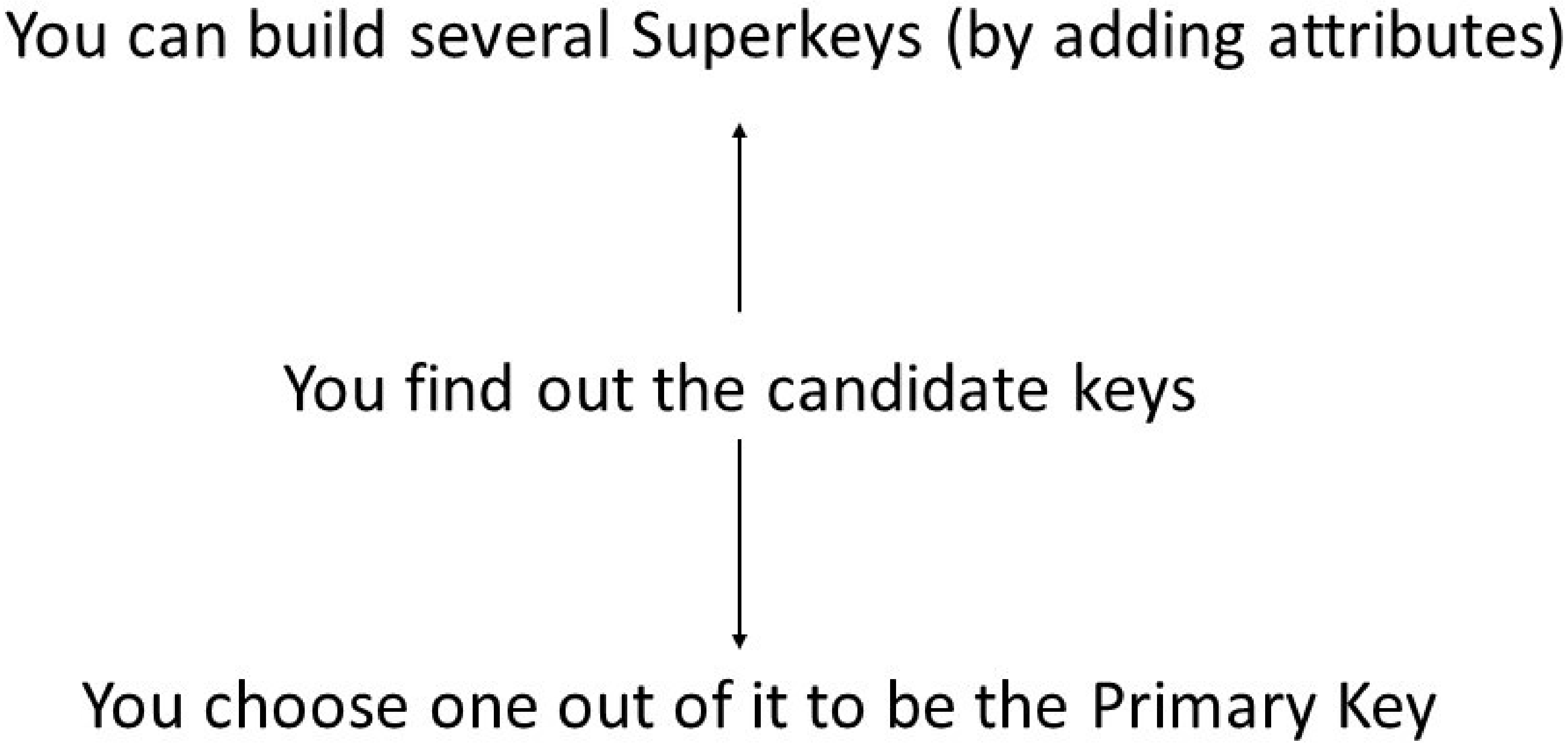
Domain of an Attribute

The set of possible values an attribute of an Entity can take.

Phone_Num – Any 10 Digit number.
Name – String of max length 250
Email – String matching the format: *<username>@<domain>.<extension>*

Gender – Enum: {‘Male’, ‘Female’, ‘Other’}
Date_of_Birth – Date in the format *YYYY-MM-DD*
Salary – Decimal value with up to 2 decimal places, greater than 0.

A Quick Recap:

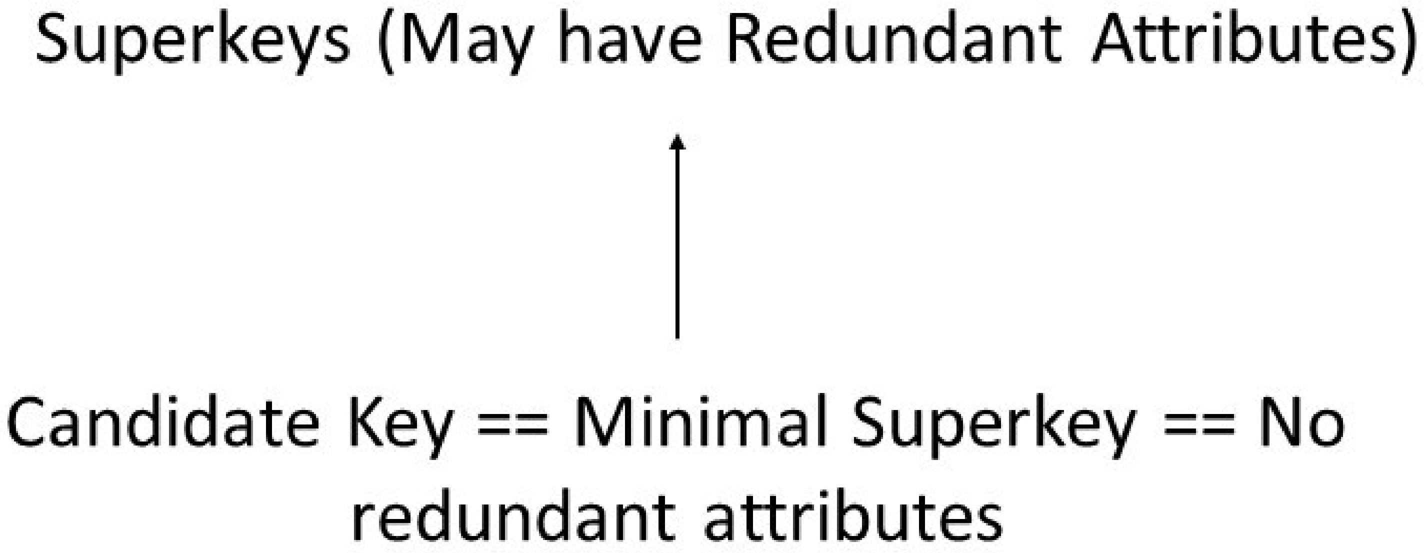


You can build several Superkeys (by adding attributes)

You find out the candidate keys

You choose one out of it to be the Primary Key

A Quick Recap:



Superkeys (May have Redundant Attributes)

Candidate Key == Minimal Superkey == No redundant attributes

A Quick Recap:

If you have a **COMPOSITE** Candidate Key

↓

Any Subset of attributes of a composite candidate key, cannot be a key by itself.

Super key vs Candidate Key

Superkey: A set of one or more attributes that can uniquely identify a row in a table.

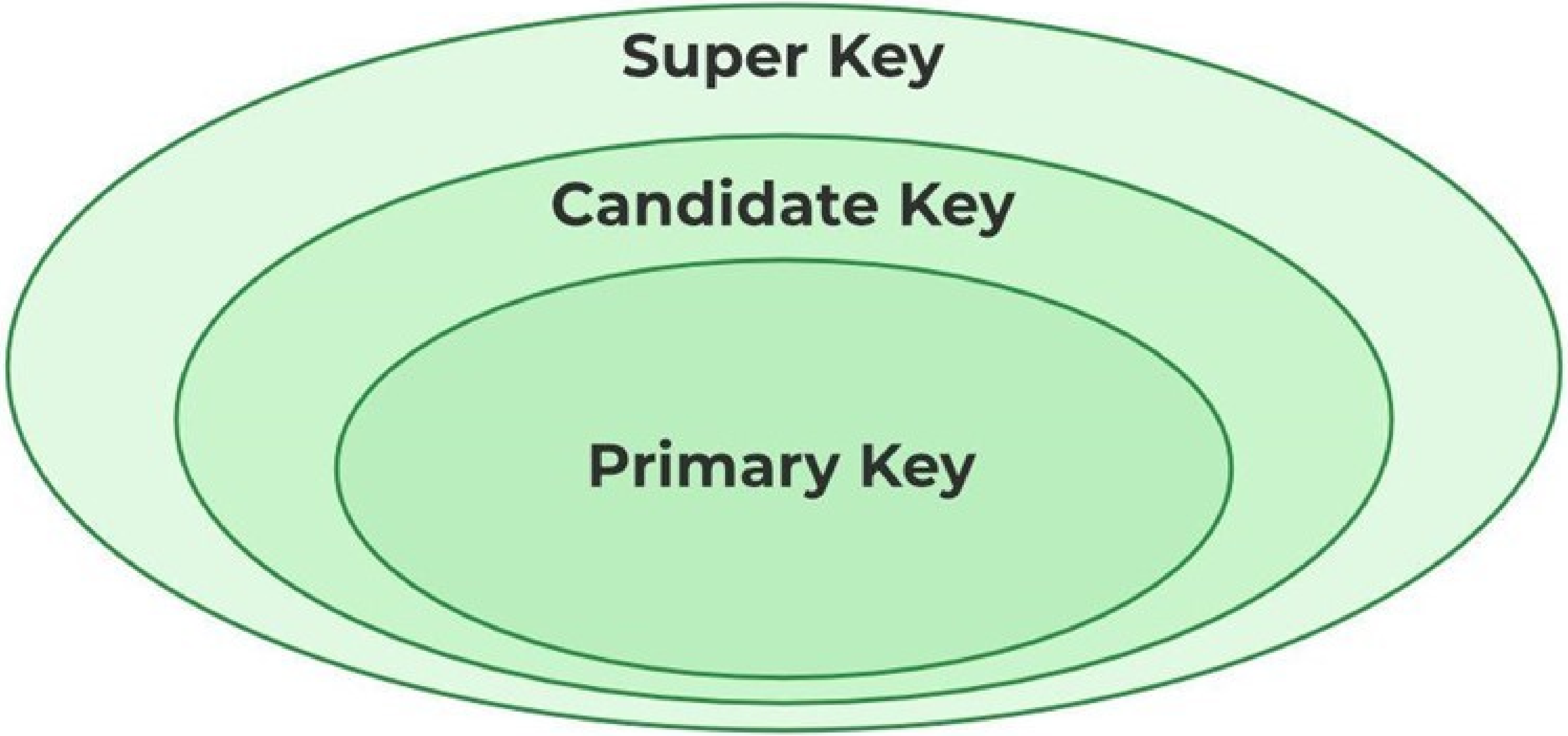
Candidate Key: A minimal superkey, (it has no redundant attributes)

EXAMPLE:
Students(Roll_no, Name, Email)

Superkeys: {Roll_no},
{Email}
{Roll_no, Name},
{Roll_no, Email},
{Email, Name},
{Roll_no, Name, Email}

Candidatekeys: {Roll_no},
{Email},

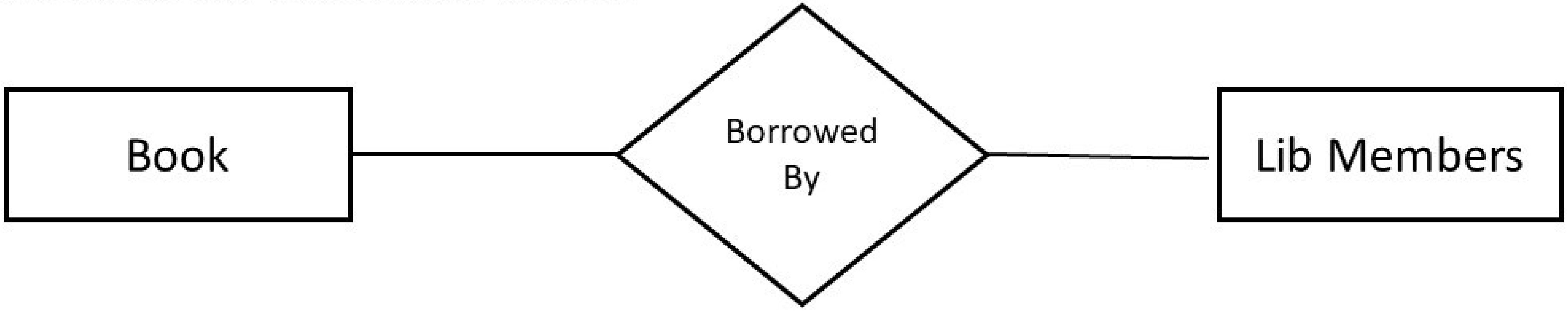
Keys In DBMS



What is a Relationship ?

It is an association / Mapping between the entities

Entities by themselves requires information to be stored on their behalf. Additionally oftentimes, there is also a need to maintain information about the associations between them.



Borrowed by, is a relationship between the participating entities Book and Members

Relationships

A relationship is a subset of a cartesian product

Cartesian Product: Lists out all possible associations / combinations

But only a subset of them will be true in reality.

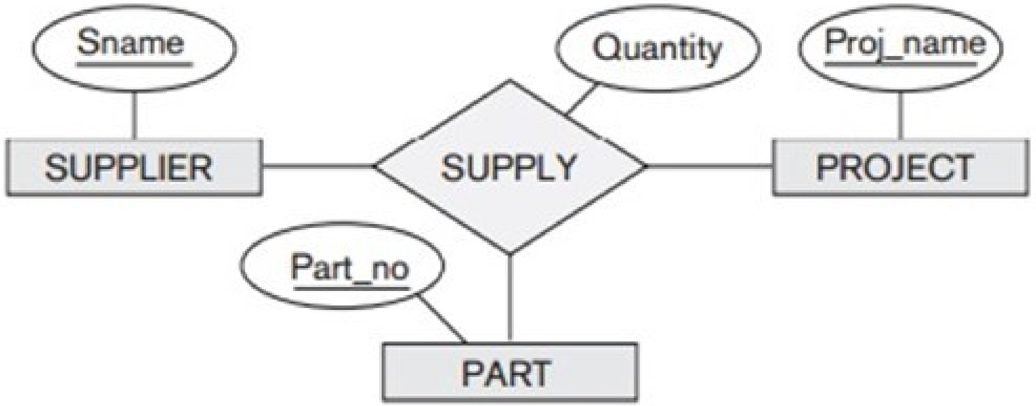
ISBN	Name	Auth
1234	Promised Neverland	Kaiu Shirai
5678	Ponniyin Selvan	Kalki

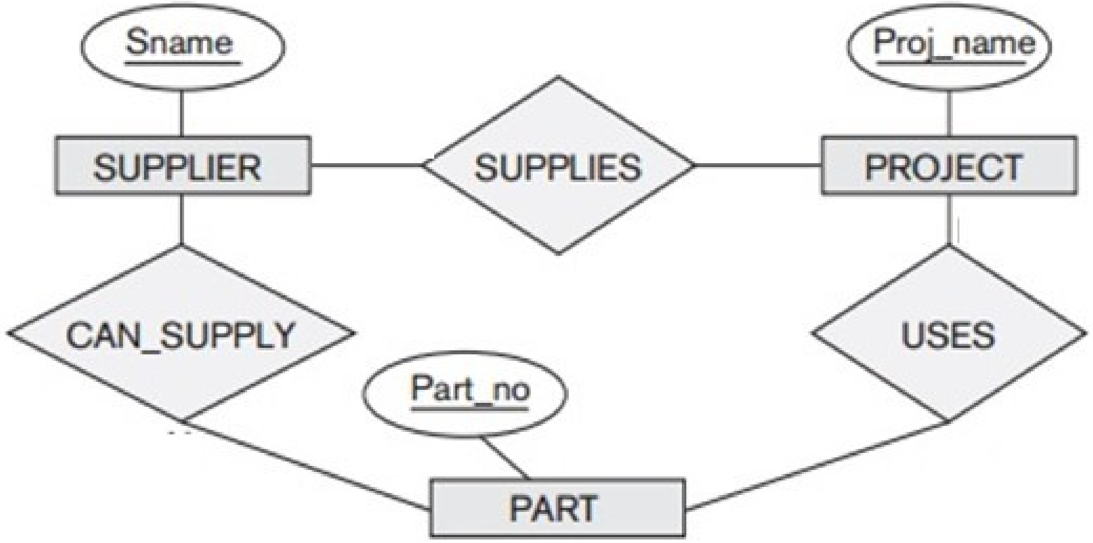
Id	Name	Dept
s1	Ram	CS
s2	Shyam	AI

Cross Product – Shows all possible associations / combinations

ISBN	Name	Auth	Id	Name	Dept
1234	Promised Neverland	Kaiu Shirai	s1	Ram	CS
1234	Promised Neverland	Kaiu Shirai	s2	Shyam	AI
5678	Ponniyin Selvan	Kalki	s1	Ram	CS
5678	Ponniyin Selvan	Kalki	s2	Shyam	AI

Ternary vs Three Binary Relationships





Ternary Relationship

Are they Equivalent

Binary Relationships

Ternary:

Supplier
Bajaj
TVS

Part
Spark Plug
Carburettor

Project
P1
P2

Supplier	Part	Project
Bajaj	Spark Plug	P1
TVS	Carburettor	P1
TVS	**Spark Plug**	**P1** **P2**

→ Allowed ?

Three Binary

Supplier
Bajaj
TVS

Part
Spark Plug
Carburettor

Project
P1
P2

Supplier	Project
Bajaj	P1
TVS	P1, P2

Supplier	Part
Bajaj	S_Plug
TVS	S_Plug

Part	Project
S_Plug	P1,P2
Carburettor	P1

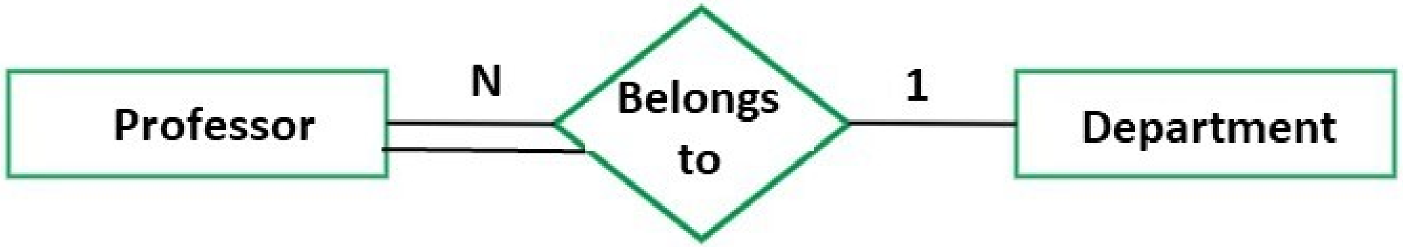
Cardinality Ratio

Often used to describe “Constraints” on a Binary Relationship

Consider ***borrowed_by*** relationship:
A book can be borrowed only by one person at a time.
But one person can borrow multiple books at a time.

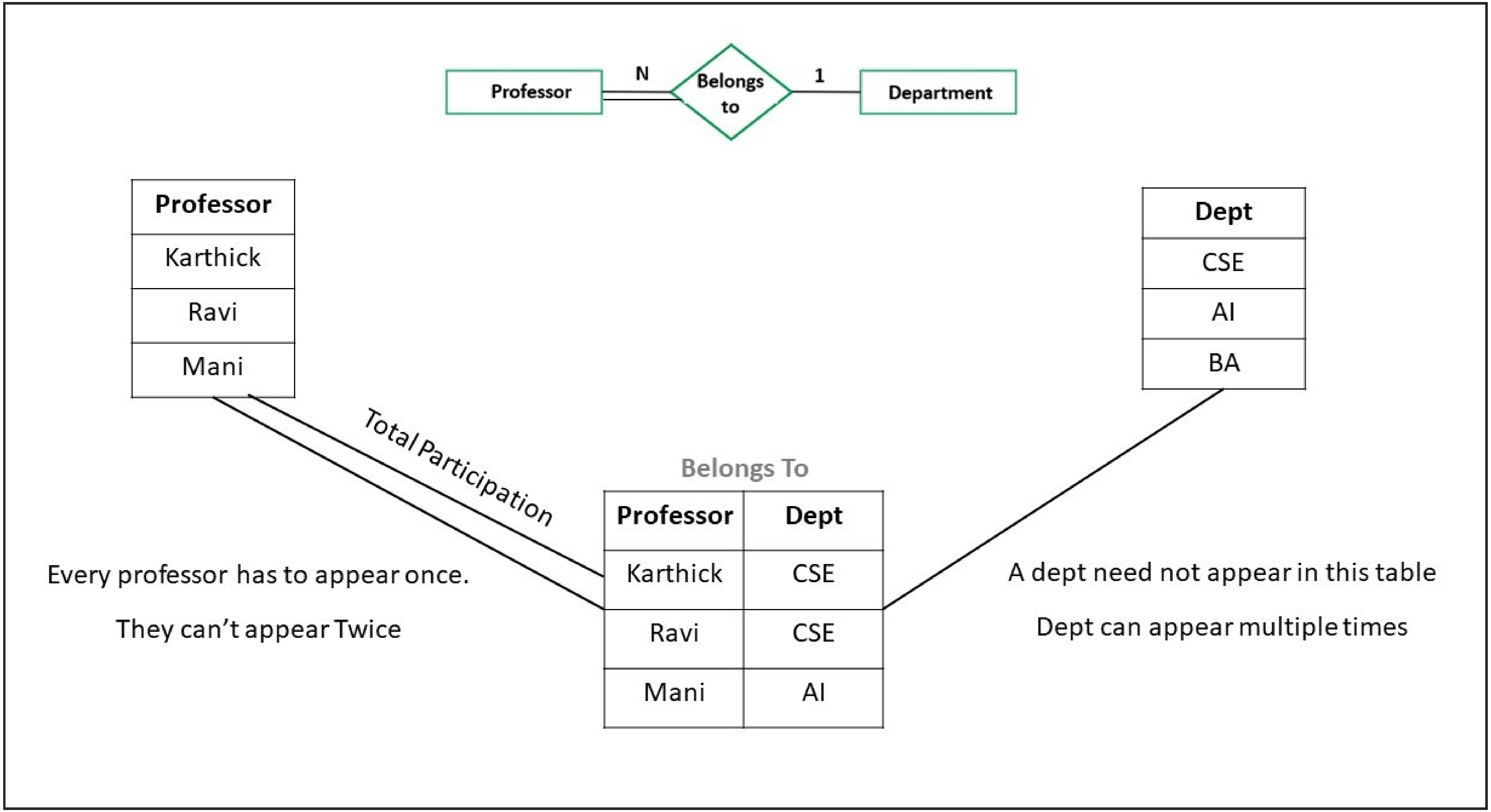
C.Ratio helps to capture such kind of constraints

Cardinality Ratio & Participation Constraint:



Many professors can belong to 1 department.

1 Department can have many professors



Professor
Karthick
Ravi
Mani

Dept
CSE
AI
BA

Belongs To

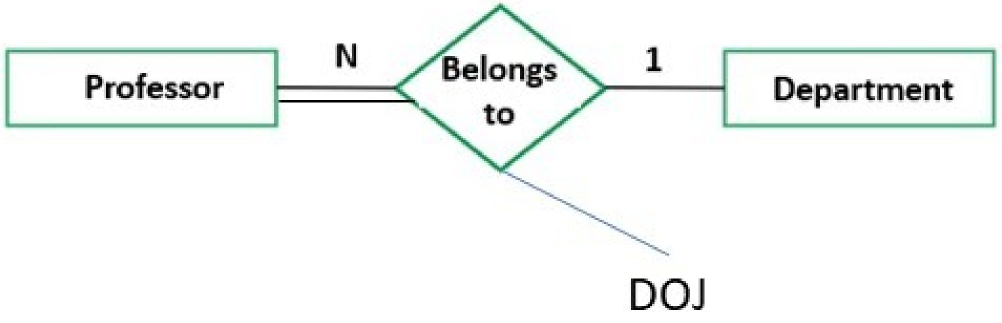
Professor	Dept
Karthick	CSE
Ravi	CSE
Mani	AI

Every professor has to appear once.

They can't appear Twice

A dept need not appear in this table

Dept can appear multiple times



Professor
Karthick
Ravi
Mani

Dept
CSE
AI
BA

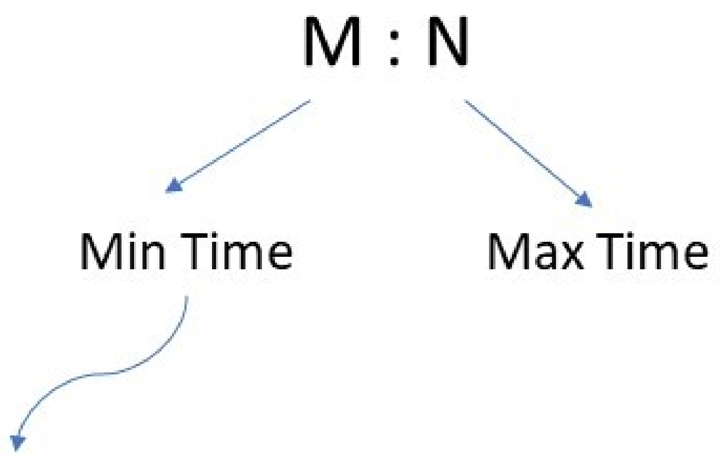
Belongs To

Professor	Dept	DOJ
Karthick	CSE	2021
Ravi	CSE	2022
Mani	AI	2023

Where can I Shift DOJ ?

Shift to the Many Side

Min – Max Notation



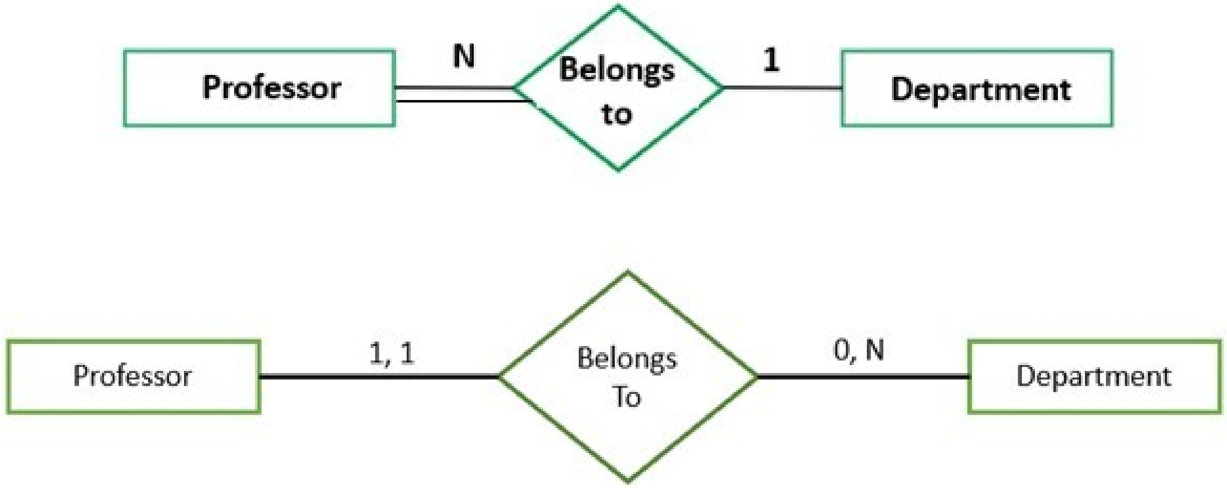
M : N

Min Time

Max Time

0 → Partial Participation

>1 → Total Participation



Professor
Karthick
Ravi
Mani

Dept
CSE
AI
BA

Belongs To

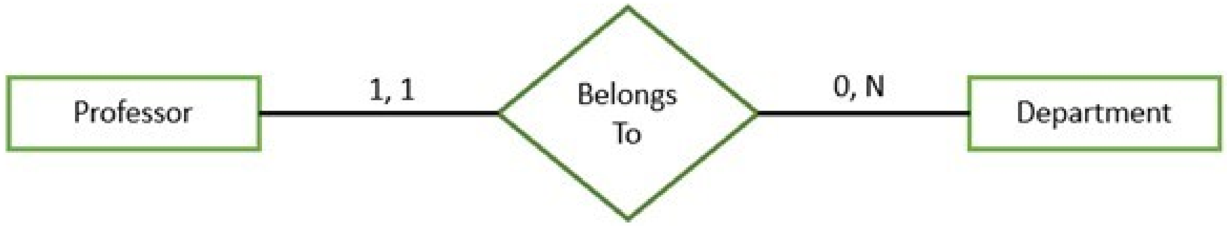
Professor	Dept
Karthick	CSE
Ravi	CSE
Mani	AI

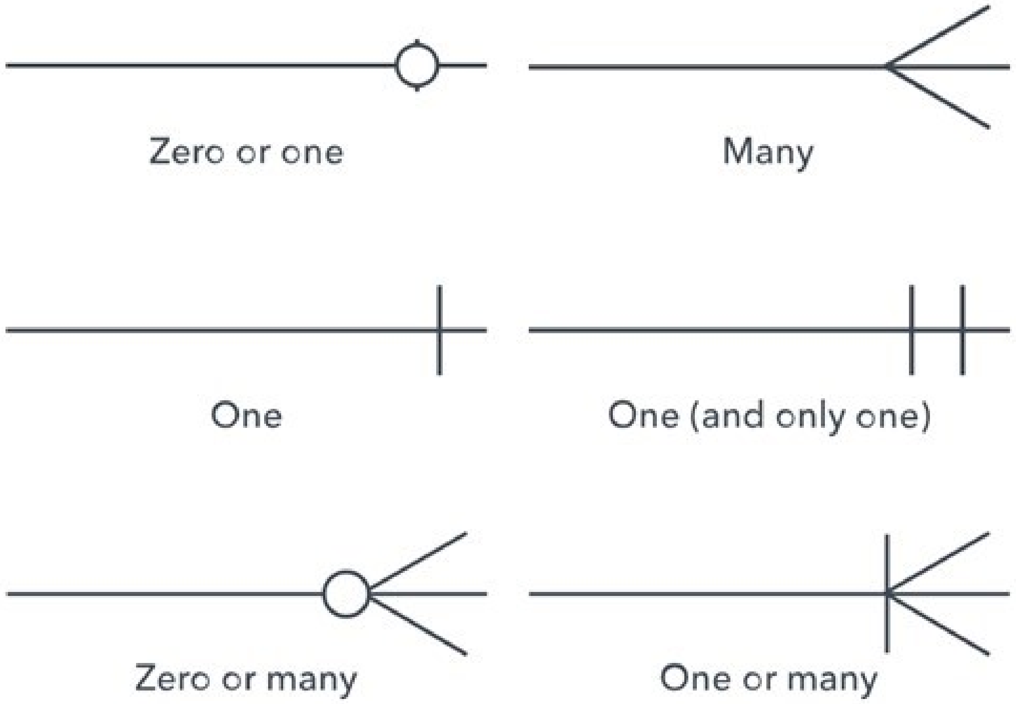
Every professor has to appear once.

They can't appear Twice
(Only At most once)

A dept need not appear in this table

Dept can appear multiple times


Professor
1, 1
Belongs To
0, N
Department

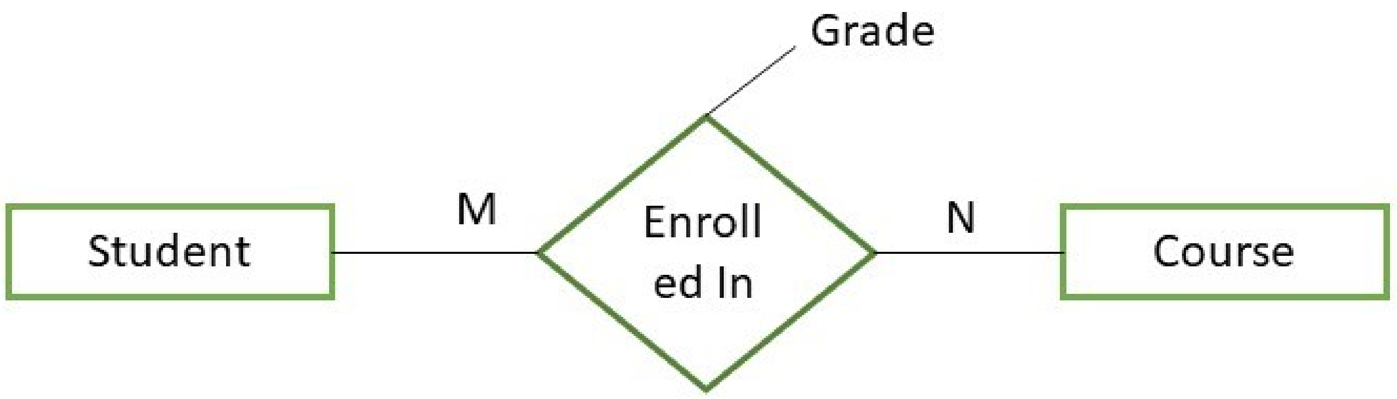

Zero or one
Many
One
One (and only one)
Zero or many
One or many

Attributes Shifting - Guidelines

If it is a **1 to Many** Relationship - Shift to the Many side.

If it is a **1 to 1** Relationship - Shift to any side. (Total Participating side preferred)

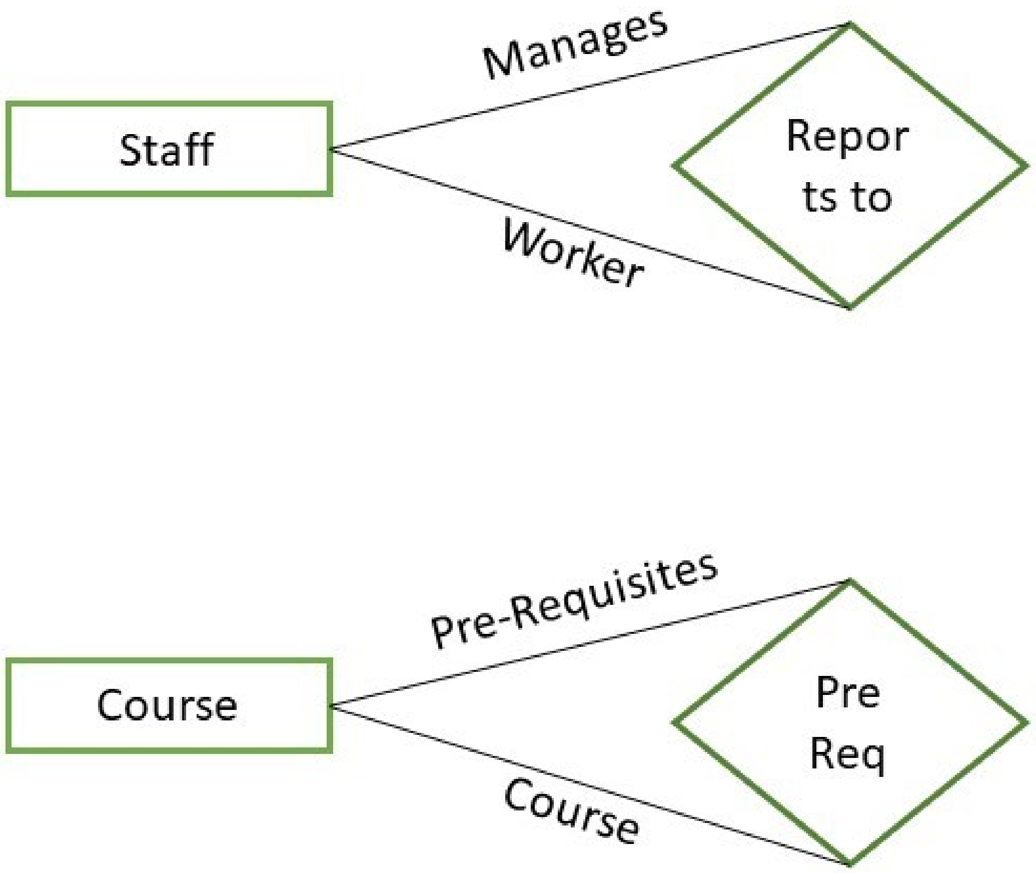
If it is **Many to Many** Relationship - Cant be shifted.



Special Cases

ENTITY → Attributes → Relationships → Cardinality → **Special Cases**

Recursive Relationships



Weak Entity

An entity set whose members “**Owe**” their existence to some other Entity.

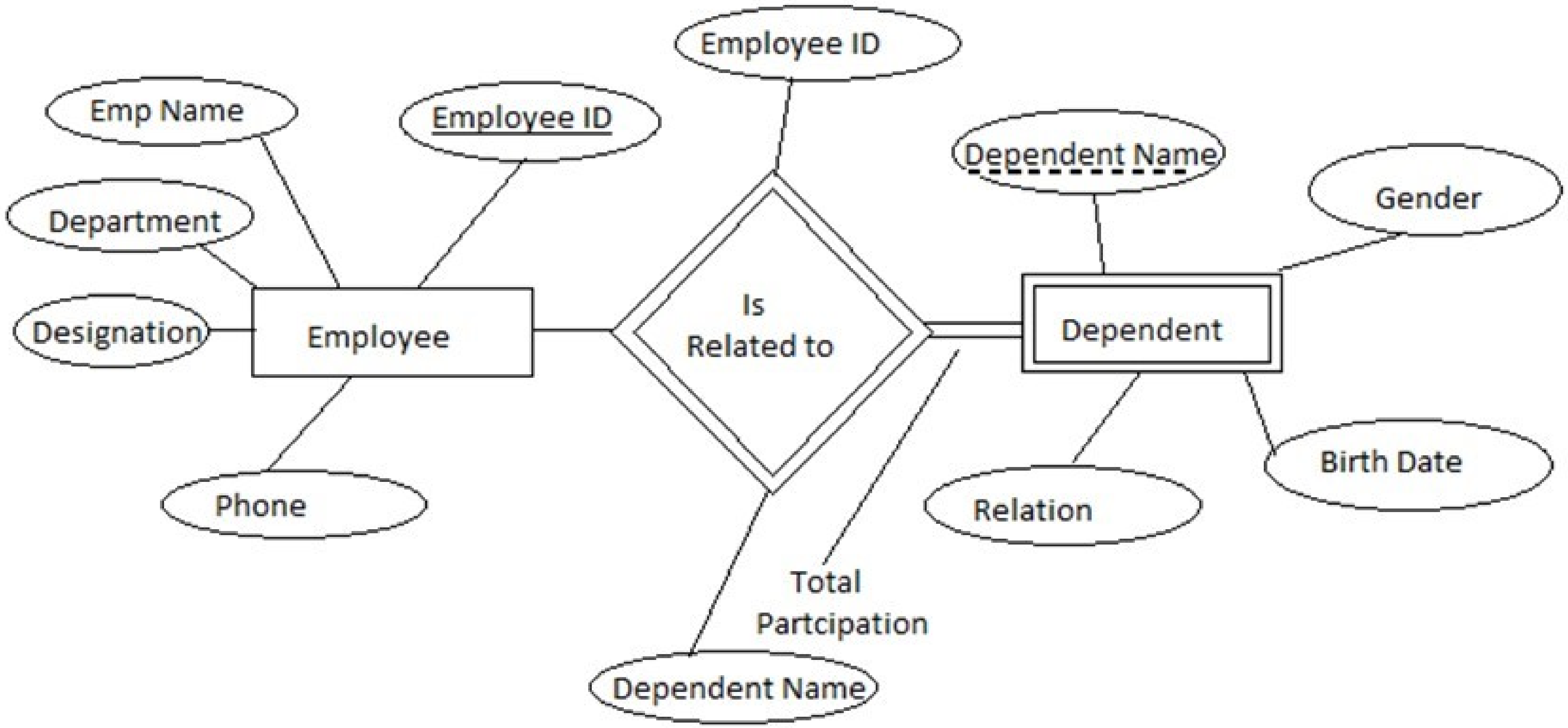
Strong / Owner Entity

They cannot exist Independently. (Not enough attributes to distinguish them **Uniquely**)

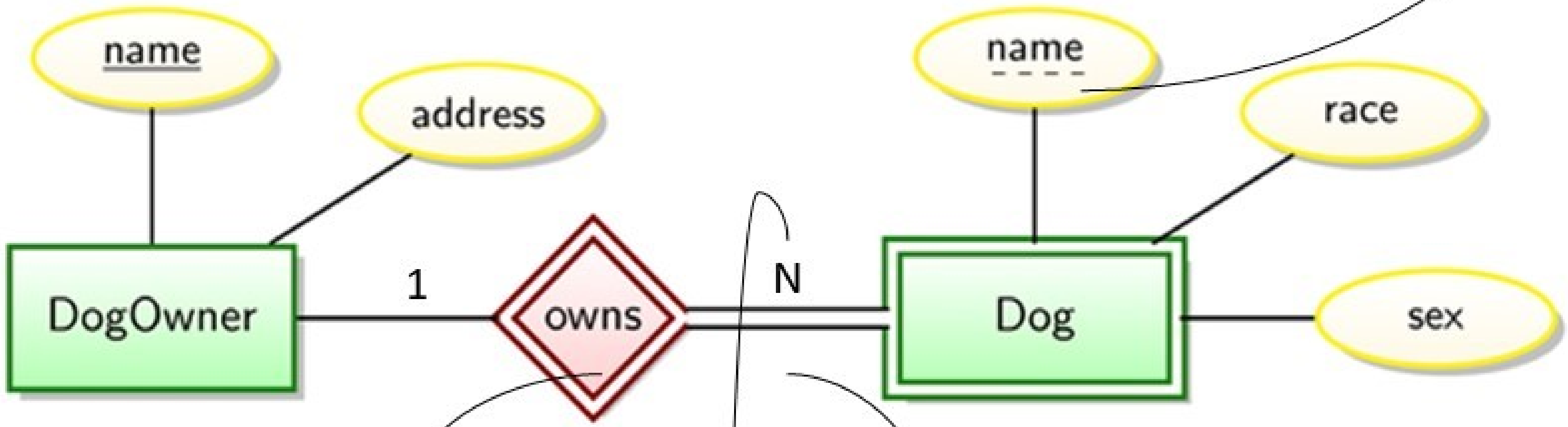
No key, Only Partial Key

They are **Existential Dependent** – To exist they must depend on some other entity

Weak Entity - Examples



Weak Entity - Terminologies



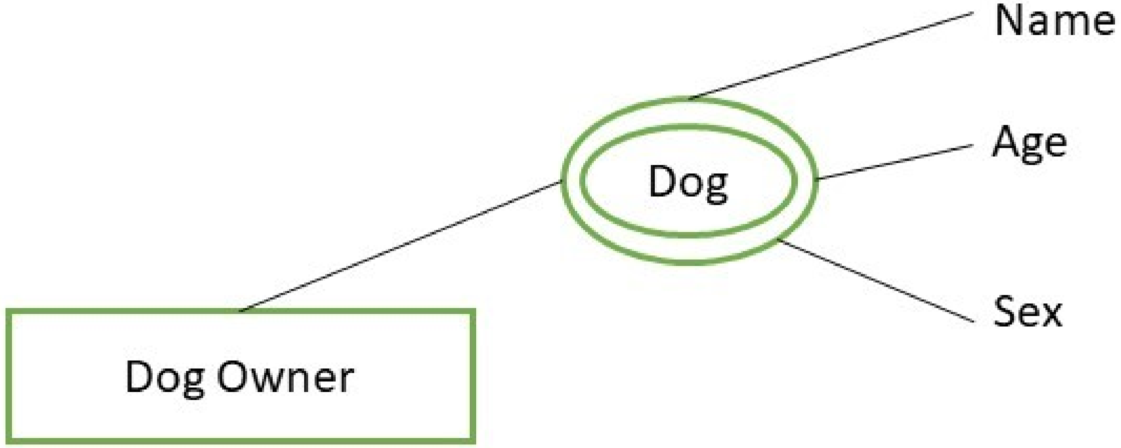
Known as Partial Key or Discriminator

Weak Entity should always participate totally

Called as **Identifying Relationship**
Double walled Rhombus

They are generally Many to One relationships

Weak Entity – As Composite Multi Valued Attribute



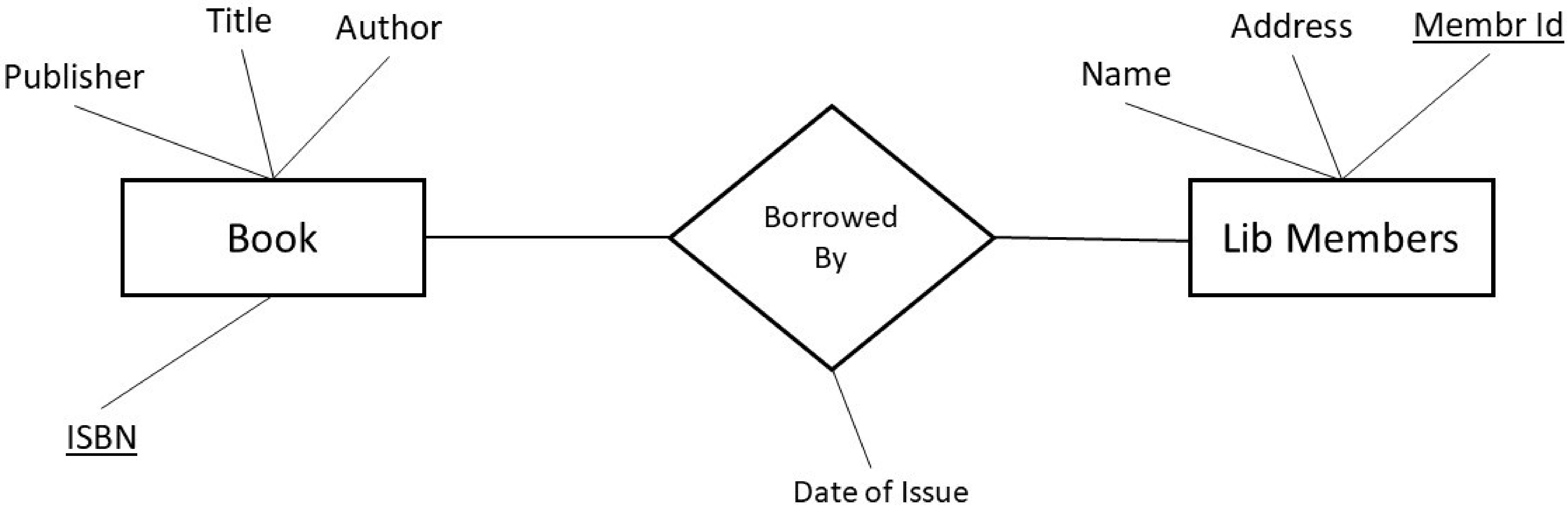
This can be done, when you are sure that the 'Dog' entity is not going to take part in a relationship with any other entity. In that case it is simple enough to be modelled as an attribute.

If a thing, even though not of independent existence, but participates on other relationships on its own
➔ Best captured as a weak entity

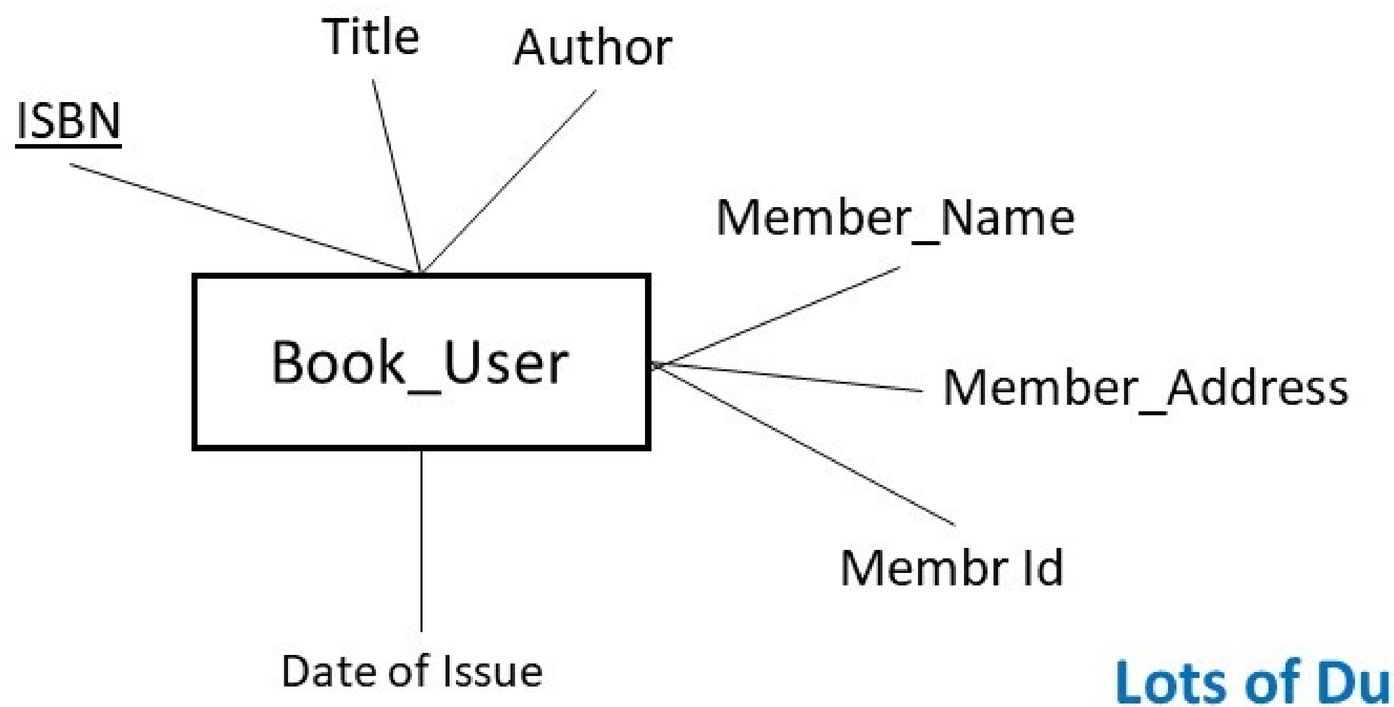
Some Nuances

To be, or Not to be… in a Relationship

Example


Title
Author
Publisher
Book
ISBN
Borrowed By
Date of Issue
Address
Membr Id
Name
Lib Members

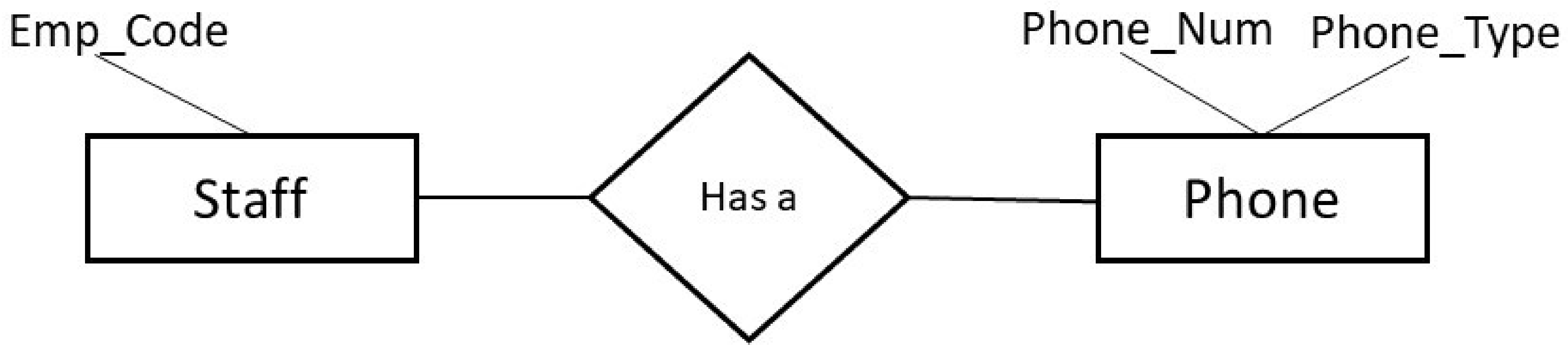
Example

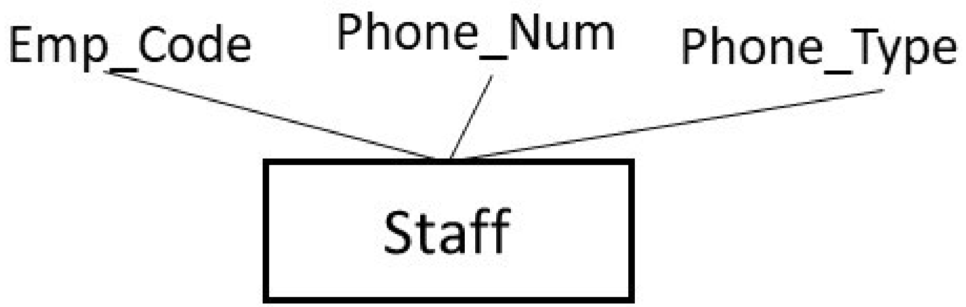


Lots of Duplication
Inefficient
Missing Values for Some Attributes

CRITERIA: For a given entity all of its attribute values should be defined

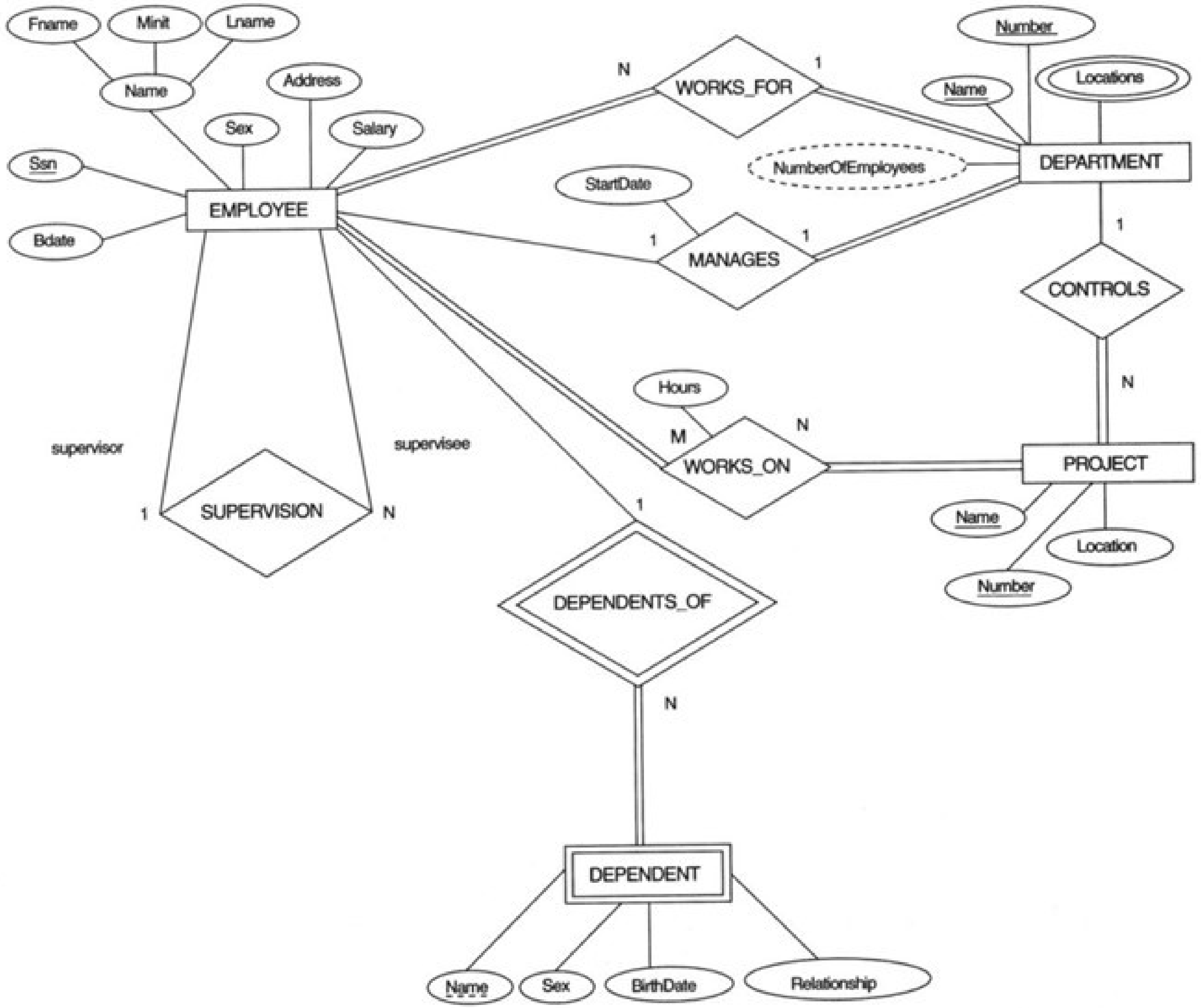
Example



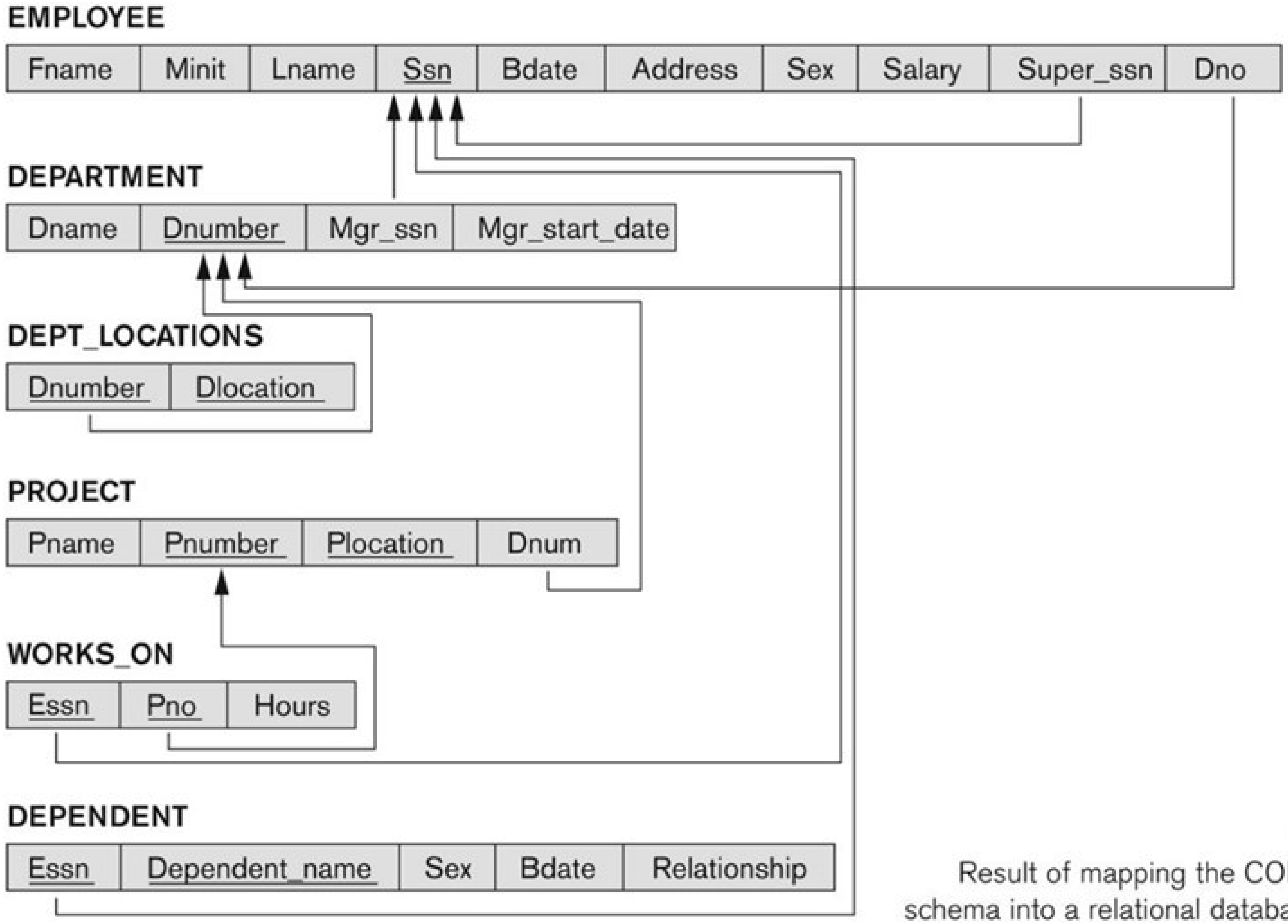


Good Approach: If all staff has a phone, and all phone is associated with a staff.
Bad Approach: Say if an office phone is general & No staff is associated to it ➔ Go for Relationships

You should be able to build such ER diagrams



Relational Model - Next



EMPLOYEE

Fname Minit Lname Ssn Bdate Address Sex Salary Super_ssn Dno

DEPARTMENT

Dname Dnumber Mgr_ssn Mgr_start_date

DEPT_LOCATIONS

Dnumber Dlocation

PROJECT

Pname Pnumber Plocation Dnum

WORKS_ON

Essn Pno Hours

DEPENDENT

Essn Dependent_name Sex Bdate Relationship

Figure 7.2
Result of mapping the COMPANY ER schema into a relational database schema.